

COURSE BOOK

UNDER GRADUATE PROGRAMMES

2019-20



G. H. RAISONI COLLEGE OF ENGINEERING, NAGPUR

(An Autonomous Institution affiliated to RTM Nagpur University, Nagpur)

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G H RAISONI COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur)

Accredited by NAAC with 'A+' Grade

CRPF Gate No. 3, Hingna Road, Digdoh Hills, Nagpur – 440 016. (INDIA)

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COURSE-BOOK-2019-20

UNDER GRADUATE PROGRAMMES

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Engineering

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■ NAGPUR ■ PUNE ■ JALGAON ■ AMRAVATI ■ AHMEDNAGAR ■ CHHINDWARA



RAISONI
GROUP OF INSTITUTIONS

B.TECH. FIRST YEAR SCHEME (FOR CIVIL ENGINEERING)

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Teaching Mode
		Th	Tu	Pr	Total Hours		Theory			Practical	Total Marks	
							TAE	CAE	ESE	Cont		
SEMESTER-I												
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50	
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75	Classroom & Lab Teaching
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50	Classroom & Lab Teaching
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25	Classroom & Lab Teaching
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100	Lab Teaching
BECL104	Bio-System in Engineering	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BECL101 BECP101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75	Classroom & Lab Teaching
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25	W/S
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25	Classroom Teaching
TOTAL		9	4	16	29	21	80	120	175	225	600	

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Teaching Mode
		Th	Tu	Pr	Total Hours		Theory			Practical	Total Marks	
							TAE	CAE	ESE	Cont.		
SEMESTER-II												
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50	
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50	Lab Teaching
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75	Classroom & Lab Teaching
BCEL101 BCEP101	Engineering Mechanics	1	1	2	4	3	20	30	--	25	75	Classroom Teaching
BECP103	Embedded Programming	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50	Lab Teaching
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50	
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100	Lab Teaching
BHUP102	Ethics& Professional Competencies	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
TOTAL		4	5	26	35	22	60	90	100	350	600	

B.TECH.FIRST YEAR SCHEME (MECHANICAL ENGG)

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Teaching Mode
		Th	Tu	Pr	Total Hours		Theory			Practical	Total Marks	
							TAE	CAE	ESE	Cont.		
SEMESTER-I												
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50	
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75	Classroom & Lab Teaching
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50	Classroom & Lab Teaching
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25	Classroom & Lab Teaching
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100	Lab Teaching
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BECL101 BECF101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75	Classroom & Lab Teaching
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25	W/S
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25	Classroom Teaching
TOTAL		9	4	16	29	21	80	120	175	225	600	

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Teaching Mode
							Theory			Practical	Total Marks	
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.		
SEMESTER-II												
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50	
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50	Lab Teaching
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75	Classroom & Lab Teaching
BMEP101	Engineering Graphics	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BCEL101 BCEP101	Engineering Mechanics	1	-	2	3	2	10	15	--	25	50	Classroom Teaching
BECP103	Embedded Programming	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50	Lab Teaching
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50	
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100	Lab Teaching
BHUP102	Ethics & Professional Competencies	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
TOTAL		4	4	28	36	22	50	75	100	375	600	

B. TECH. FIRST YEAR SCHEME (ETC/ETRX/CSE/IT/EE)

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Teaching Mode
		Th	Tu	Pr	Total Hours		Theory			Practical	Total Marks	
							TAE	CAE	ESE	Cont.		
SEMESTER-I												
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50	
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75	Classroom & Lab Teaching
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50	Classroom & Lab Teaching
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25	Classroom & Lab Teaching
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100	Lab Teaching
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BECL101 BEC101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75	Classroom & Lab Teaching
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25	Classroom Teaching
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25	Classroom Teaching
TOTAL		9	4	16	29	21	80	120	175	225	600	

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Teaching Mode
		Th	Tu	Pr	Total Hours		Theory			Practical	Total Marks	
							TAE	CAE	ESE	Cont.		
SEMESTER-II												
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50	Classroom Teaching
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50	Classroom Teaching
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50	Lab Teaching
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75	Classroom Teaching
BECL102 BEC102	Analog Circuits	1	1	2	4	3	10	15	25	25	75	Classroom Teaching
BEC103	Embedded Programming	-	-	2	2	1	--	--	--	25	25	Lab Teaching
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50	Lab Teaching
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50	
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100	Lab Teaching
BHUP102	Ethics & Professional Competencies	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25	Classroom Teaching
TOTAL		4	5	26	35	22	50	75	125	350	600	

MATRICES

Course Objectives:

1. To introduce concepts of matrices in the field of Engineering.
2. To develop skills in student to solve engineering problems based on Matrices.

Course Outcomes:

1. Solve linear system equation using different methods for real time engineering problems in respective disciplines.
2. Determine the Eigen values and vectors of a matrix for various engineering problems in respective disciplines.
3. To formulate the problem and find solution by using knowledge of matrix.
4. To relate the problem and solve by using concept of matrix.

Contents:

Adjoint of Matrix, Inverse of matrix by adjoint method, Solution of simultaneous equations by adjoint method. Solving system of linear equations by Gauss elimination method, Jacobi's method. (6hrs)

Inverse of matrix by partitioning method. Rank of matrix, Consistency for system of linear equations, Linear dependence. Basis and Span of vectors

(6hrs)

Characteristics equation, Eigen values and its properties. Eigen vectors. Reduction to diagonal form, Determination of largest Eigen values and corresponding Eigen vector by Iteration method.

(6hrs)

Cayley Hamilton theorem (statement & verification). Sylvester's theorem, Association of matrices with linear differential equations of second order with a constant coefficients.

(6hrs)

Applications of matrices in Mesh analysis, Questions on matrices in GATE.

TERM WORK: Solving second order differential equations in MATLAB and its Simulink model, various applications of matrices,

TERM WORK: Solving matrix in MATLAB

TERM WORK: Prepare .m file in MATLAB to solve simultaneous equations by matrix method. (6hrs)

Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth ed.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2013, Forty Third ed.

Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd, 2007, Third.

3. Advanced Mathematics for Engineers and Scientists, Spiegel, M. R, McGraw-Hill, 2010, Second Ed.

DIFFERENTIAL & VECTOR CALCULUS

Course Objectives:

1. To introduce concepts of Differential Calculus & Vector Calculus in the field of Engineering.
2. To develop skills in students to solve applications based problems on Differential Calculus.

Course Outcomes: Student shall be able to

- 1 Apply concepts of differentiation in solving engineering problems.
- 2 Use applications of partial differentiation to solve various problems in engineering.
- 3 Apply the Knowledge of vector calculus to solve various problems in engineering.
- 4 Use vector integration in solving engineering problems.

Contents:

Differential Calculus: Review of limits, continuity, differentiability, Successive differentiation. Leibnitz's Theorem Taylor's series for one variable. Maclaurin series for one variable. Indeterminate forms, Applications of maxima and minima for function of one variable. (10hrs)

Partial Differentiation: Functions of several variables, First and higher order derivatives, Euler's theorem, Chain rules, Total differential coefficient. Jacobian, Properties of Jacobian, Maxima and minima of function of two variables, Lagrange's method of undetermined multipliers.

(12hrs)

Vector Calculus: Differentiation of vectors, Gradient of scalar point function, Directional derivatives, Divergence and Curl of vector point function. Solenoidal motion & Irrotational motion.

Line integral, Surface integral, Volume integral, Statement of Gauss theorem, Greens theorem and Stokes theorem and its verification

Questions on Differential Calculus, Partial Differentiation & Vector Calculus in GATE. (8hrs)

Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth Ed.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2013, Forty Third ed.
3. Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers, Alpha Science International, Ltd, 2007, Third Ed.

4. Advanced Mathematics for Engineers and Scientists, Spiegel, M. R, McGraw-Hill, 2010, Second Ed.

AC-DC CIRCUITS

Course Objectives:

1. To Study Different types of Circuit Elements
2. To Study Basic Circuits Laws.
3. To Study Basic Concepts of A.C. Circuits

Course Outcome:

1. Understand relationship between different electrical parameters
2. Understand magnetic aspects of electric current
3. Students will develop an ability to analyze D.C.Circuits of different configurations.
4. Students will develop an ability to analyze A.C.Circuits of different configurations.
5. Students will develop an ability to analyze Resonance Circuits.

Contents:

Unit-I D.C. Circuits

Circuits Elements(R, L, C), Kirchhoffs Laws, Superposition principle & Theorem, Norton's theorem, Thevenins theorem Voltage source, (definition, characteristics of practical source, equivalent current source) Star-Delta transformation.
(8hrs)

Unit-II:-Magnetic circuits

Flux, mmf, reluctance, analogous electric circuits, simple calculations for composite magnetic circuits.

(7hrs)

Unit III A. C. Circuits

Periodic functions, average & rms values, Steady state behaviours with sinusoidal excitation, phasor representation, reactance and impedance, Series and Parallel A.C. circuits, resonance, power in A. C. circuits, power factor, Principle of generation of single phase & Three phase voltages. Power in balanced three phase A.C. systems.
(10hrs)

Books:

1. B. L. Theraja, Textbook of Electrical Engineering Vol. I & II, Twenty Second Edition, S. Chand & Co., 1997
2. D.C. Kulkshreshtha, Basic Electrical Engineering, McGraw 2012.
3. Naidu, Kamakshaia, Introduction to Electrical Engineering, Third Edition, Tata McGraw Hill, 2000

4. H. Cotton, Basic Electrical Engineering, Seventh Edition, C B S, 2005
5. S G Tarnekar, P K Kharbanda, S B Bodkhe, S D Naik, Laboratory courses in Electrical Engg., Second Edition, S. Chand & Co., 2010.

AC & DC MACHINE

Course Objectives:

1. To prepare the students to understand basic fundamentals of Electrical Circuits.
2. To make the students aware about basic principles of operations of electrical machines under the influence of magnetic field.

Course Outcomes: Students should

1. Understand Concepts of energy transfer through magnetic coupling
2. Understand working principle of transformer.
3. Understand Concepts of D.C machines
4. Understand Operation of A.C machines

Unit I : Single Phase Transformers.

Introduction, Basic principle, construction of phasor diagram for transformer under no load condition, Transformer on load, EMF equation Phasor diagrams, Equivalent circuit, Losses, Efficiency, Regulation, Open-circuit & short-circuit test.
(10hrs)

Unit II : D. C. Machines.

Introduction, construction, EMF and Torque equation, classification, self-excitation of D.C. shunt generators, EMF, voltage, current relations in generator and motor, Characteristics, starting and speed control of d. c. motors.
(10hrs)

Unit III : Introduction to AC Motors.

Three phase Induction motor Construction, and principle of rotating field, synchronous speed, Rotor current, torque and slip, Principle of Single phase Capacitor Start motor.
(10hrs)

Books:

1. D.C. Kulkshreshtha, Basic Electrical Engineering, McGraw 2012.
2. Textbook of Electrical Engineering Vol. I & II, B.L.Theraja, S. Chand & Co., 1997 Twenty Second Edition,
3. Naidu, Kamakshaia, Introduction to Electrical Engineering, Third Edition, Tata McGraw Hill, 2000
4. Basic Electrical Engineering, H. Cotton, C B S, 2005, Seventh Edition
5. Laboratory courses in Electrical Engg., S G Tarnekar, P K Kharbanda, S B Bodkhe, S D Naik, S. Chand & Co., 2010S, econd Edition
6. Kothari, Nagrath, Electric Machines Tata McGraw Hill, 2006, Third Edition

ENERGY SOURCES & AUDIT

Course Objectives:

1. To Study the various types of electrical sources
2. To study the comparisons of various sources.
3. To study the non-Conventional electrical sources

Course Outcome:

1. To understand present scenario of energy & its importance
2. To Learn Conventional energy sources & Non conventional Energy sources
3. To Understand concept of Energy Management
4. To apply knowledge of energy audit to industry
5. To understand importance of safety components

Contents:

Unit 1 Energy Sources

Current Energy Scenario, Conventional Energy Sources , Types of conventional energy sources, importance & drawbacks of Conventional Energy Sources, Alternatives to conventional energy sources. Non-Conventional Energy Sources, Types of non-conventional energy sources, importance & drawbacks of Non-Conventional Energy Sources, Comparison with conventional energy sources & its application. (4hrs)

Unit 2 Energy Management & Audit

Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, energy audit instruments. (4hrs)

Unit 3: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, types of Earthing systems. Power factor improvement. (6hrs)

Books:

1. Non-Conventional Energy Resources, B H Khan Tata McGraw-Hill Education, 01-Jan-2006
2. Non-conventional Energy Sources, G. D. Rai, Khanna Publisher
3. Handbook of Energy Audit, Sonal Desai
4. Energy Management, Audit & Conservation by Barun Kumar De,

PROGRAMMING FOR PROBLEM SOLVING

Course Objectives:

1. This Course introduces basic idea of how to solve given problem.
2. Focuses of paradigms of programming language.
3. Aims at learning python as programming language.

Course Outcomes:

1. Analyze and understand the behavior of fundamental programming constructs.
2. Develop and Analyze Algorithms for solving problems.
3. Demonstrate the knowledge of various concepts of Python Language.
4. Develop solutions using functions & recursion
5. Demonstrate knowledge of Dictionaries.
6. Demonstrate knowledge of advanced concepts of python programming

Contents:

ALGORITHMIC PROBLEM SOLVING:

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). (7hrs)

DATA, EXPRESSIONS, STATEMENTS:

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. (10hrs)

CONTROL FLOW, FUNCTIONS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if, if-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices. (10hrs)

DICTIONARIES: Operations and methods; advanced list processing – list comprehension. (4hrs)

Object Oriented Programming: Classes and objects-inheritance-polymorphism (10hrs)

Exception Handling & File Handling: Overview of exception classes and types: try, except. Finally, File processing: reading and Writing files. Recent Trends in Python (4hrs)

Books:

1. Python Programming using Problem Solving Approach by Reema Thereja, Oxford Publication.
2. Python Programming: An Introduction to Computer Science 2nd Edition by John Zelle
3. Python Programming for the Absolute Beginner, 3rd Edition by Nicheal Dawson.

DATA STRUCTURES

Course Objectives:

1. This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
2. It also aimed at developing skill to implement methods to solve specific problems using basic data structures.
3. The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.

Course Outcomes:

1. Identify essential data structures and understand when it is appropriate to use.
2. Explain use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated.
3. Apply linear data structures to solve various real world computing problems using programming language.
4. Analyze standard algorithms for searching and sorting.

Contents:

Database Management System: Database Concepts –Introduction, Data, Information, Metadata, Components of Database Management system, SQL select statement, Operators, Data Types, Single Row Function, Aggregating Data, Using Group Function, Data Manipulation Statement, Data Definition Statement, Constraints. (7hrs)

Arrays & Pointers: Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Multidimensional Arrays, Pointers; Pointer Arrays, Dynamic Memory Management. (7hrs)

Linked List : Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation; Insertion into a Linked List, Deletion from a Linked List, Circularly Linked Lists, Two-Way Lists (or Doubly Linked Lists). (8hrs)

Stacks, Queue and Recursion : Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Application of Stacks, Recursion, Queues as ADT, Types of Queues (Circular Queues, Dequeues), and Applications of Queues. **Sorting and Searching** Introduction: Sorting; Bubble Sort, Insertion Sort, Selection Sort, Searching; Linear Search, Binary Search. (8hrs)

Books:

1. Ivan Bayross, 'SQL, PL/SQL The programming language of Oracle
2. Data Structures with C, Seymour Lipschutz, Schaums Outlines, Tata McGraw Hill
3. Horowitz E. & Sahani S., 'Fundamentals of Computer Algorithms', Galgotia Publications Ltd
4. S. Sahani, Data Structures in C.
5. D. Samantha, Classic Data Structures, PHI Publications.

DATA ANALYTICS

Course Objective:

1. This course helps to understand data and usage of data in solving real time problems.
2. It introduces general idea of database management systems.
3. It also explains the fundamental concepts of big data analytics and data visualization.

Course Outcomes:

1. Understand data and usage of data in data analytics.
2. Apply data analytics techniques for visualization through Excel.
3. Analyze and design multidimensional data models.
4. Visualize trends and discover insights of data.
5. Derive Entity- Relationship (E-R) model from specifications and transform it into relational model.

6. To design SQL queries to perform CRUD operations on database (Create, Retrieve, Update, and Delete)

2. <https://www.tableau.com/>
3. <https://www.smartdraw.com/uml-diagram/>
4. <http://www.nptel.ac.in/courses/106104135/>
[For Fundamentals of Database Systems]

Contents:

Unit 01: Introduction to Data Analytics

Introduction, MS Excel Basics (options: Create, Save Rename, Add, Delete), Editing data in Worksheet (options: Insert, Select, Delete, Copy & Paste, Find & Replace) Formatting Cells, Worksheets (operations: Add/Remove Columns & Rows, Hiding/Unhiding Columns & Rows, Merging Cells), Setting Colors.
(2hrs)

Unit 02: Manipulation of Excel Data

Working with Formula: Data Filtering, Sorting, Use of Range, Functions: SUM(), AVERAGE(), MAX() & MIN(), COUNT() & COUNTA(), IF(), Data Representation using Charts & Graphs, Creation of Pivot table, Create a Chart, Change Chart Type, Switch Row/Column, labels and legends, Print Area.
(6hrs)

Unit 03: Basics of DBMS

Introduction, Characteristics, Data models (Entity-Relationship Model, Relational Model, Network model), Relational algebra.
(2hrs)

Unit 04: Getting started with basic design templates

Multidimensional Models, Basic Design, Chart Generation, Dashboard Creation, Data Visualization.
(6hrs)

Unit 05: Basics of Open Source RDBMS

Introduction, Installation, MySQL Commands (Administrative Commands), Various Syntax of SQL, DDL and DML Commands.
(4hrs)

Books:

1. Microsoft Excel 2013 Step by Step by Curtis D. Frye; Microsoft Press 2013.
2. Database System Concepts, by Abraham Silberschatz, Professor, Henry F. Korth, and S. Sudarshan, 3RD Edition, Publisher: McGraw-Hill Education
3. Learning Tableau by Joshua N. Milligan, ISBN 139781784391164, PACKT Books - Packt Publishing

Urls:

1. <https://www.guru99.com/excel-tutorials.html>

ENGINEERING GRAPHICS

Course Objectives:

1. To familiarize with basic engineering graphics principles and standards of drafting.
2. To use various engineering drawing techniques to create drawing of machine parts.
3. To understand and read drawings and blue prints for industrial applications.

Course Outcomes: To

1. Define the various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient
2. Understand drawings of simple machine parts in first and third angle of projection systems
3. Apply the concept of projections of lines and planes along with traces.
4. Analyse solid geometry in different positions
5. Interpret sections and development of solids in different positions.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using drafting tools.

Contents:

Lettering, Dimensioning, Introduction to scale and curve: Use of various drawing instruments, lines, lettering and ISI standards for drafting. Simple geometrical construction. Definition of scale, Representative fraction, enlarging scale drawing, reducing scale drawing and full size drawing, dimensioning, Introduction to basic Engineering curves (conic sections)
(2hrs)

Theory of Projections: Theory, techniques, first and third angle projections, Projection of points. Projection of straight lines inclined to both reference planes.
(3hrs)

Projection of Planes: Plane inclined to both reference planes. Auxiliary planes and view: Auxiliary vertical plane and Auxiliary inclined plane.

(2hrs)

Projection of Solids: Projections of solids such as Prisms, pyramids, cone, cylinder with varying position of axes with ground line.

(2hrs)

Sections of solids: Section of solid such as Prisms, pyramids, cone, cylinder

(2hrs)

Development of solid surfaces: Development of surfaces for various regular solids.

(2hrs)

Orthographic Projection and Isometric projection: Conversion of pictorial view of solid to orthographic views and isometric view.

(2hrs)

Books:

1. Engineering Drawing, N.D.Bhatt, Panchal, Charotar Publishing House
2. Engineering Graphics, Venugopal K and Prabhu Raja V, New AGE International Publishers.
3. A text Book of Engineering Graphics using AUTO CAD, Sarkar, Rastogi and Kulkarni, Tata McGraw Hill

ENGINEERING MECHANICS

Course Objectives:

1. To describe and be able to predict the conditions of rest or motion of the bodies under the action of forces.
2. To understand the basic concepts of forces moments, couples in two dimensional force system & spatial force system.
3. To be able to analyze simple determinate structures like beam & trusses

Course Outcomes:

1. Apply the concept of two dimensional force systems for replacement into equivalent force system
2. Understand the basic concepts of free body diagrams for static equilibrium for two dimensional force systems
3. Demonstrate the basic concepts of forces, moments, and couples in spatial force system.
4. Apply the basic concepts of Moment of inertia & Virtual Work

Contents:

Fundamentals of Statics: Definition of mechanics, Body, Rigid Body, Scalar quantities, Vector quantities, Representation of vector, Fundamental Units, Derived Units, Particle, Mass, Weight, Fundamental principles of mechanics, Newton's law of universal gravitation.

Equivalent Force System (2-D): Concept of Force, Unit Newton force, System of force, Principle of transmissibility of force, Resolution and composition of coplanar force system, Resultant, Equilibrant, Law of parallelogram of force, Triangle law, Polygon law, Moment of force, Varignon's theorem, Couple and its properties, Reduction of system of forces into a force couple system. Numerical on equivalent force involving co-planer force systems acting on body, Numerical on reduction of system of forces into a force couple system. (5 hrs)

Equilibrium of Two Dimensional Force System:

Concept of equilibrium, Principles of equilibrium, Equations of Equilibrium, Lami's theorem, Numerical on equilibrium involving co-planer force systems acting on body. **Beam**, Simply Supported Beam, Overhanging Beam, Beam reaction, Types of load acting over beam i.e. Concentrated load, Uniformly distribute load (UDL), Uniformly varying load (UVL), Types of support i.e. Simple support, Hinge support, Roller Support, Numerical on reaction of beam subjected to combination of loads.

Analysis of Truss : Perfect Frame, Imperfect frame, Deficient frame, Redundant frame, Assumptions made in analysis of truss, Method of joints, & sections, Numerical on forces in the members of a truss

(10hrs)

Spatial Force System (Three Dimensional Force System):

Component of force in a space, Resultant spatial force system, Force multiplier, Cartesian form of representation of vector, Unit vector, Position vector, Displacement Vector, Scalar product or Dot product, Cross product, Length of common perpendicular between two non-intersecting vectors, Shortest distance, Moment of force about point, Moment of force about axis, Moment arm of force about point, Moment arm of force about axis, Resultant moment, Couple,

Friction: Definition of friction, Types of friction, Angle of repose Coulombs laws of dry friction, Analysis of rigid bodies on rough inclined surfaces.

(8hrs)

Properties of Areas: Centroid of plane areas, Moment of Inertia of composite lamina, Radius of

gyration, Second moment of area, Product of inertia, Parallel axis theorem, Perpendicular axis theorem, Polar moment of inertia, Moment of inertia & product of inertia about new axes, Principal moment of inertia and principal axis direction by analytical method only.

(7hrs)

Virtual Work: Virtual Displacement, Definition of virtual work, Principles of virtual work Virtual work method applied to beams & frames mechanisms.

Books:

1. K Vijaya Kumar Reddy & J Suresh Kumar, Singer's Engineering Mechanics , 3rd Edition, BS Publications, 2010
2. Beer F.P. and Johnston E.R., Vector Mechanics for Engineers: Statics and Dynamics, Tata McGraw-Hill, 9th edition 2012
3. Irving H. Shames, Engineering Mechanics: Static and Dynamics, Pearson Education, Asia Pvt Ltd, 4th edition 2009

ANALOG CIRCUIT

Course Objectives:

1. To familiarize with various electronic components and understand their properties.
2. To understand basic fundamentals of analog circuits.
3. To prepare for various engineering applications.

Course Outcome:

- 1 Use knowledge of diode for related application.
- 2 Demonstrate the knowledge of transistor and its application
- 3 Demonstrate the knowledge of oscillator
- 4 Use devices for designing of small electronics projects.

Contents:

PN Junction Diode: Review of PN junction, forward and reverse bias, VI Characteristics, Dynamic Resistance, Equivalent Circuit of diode, Temperature dependence. Diode numerical. Varactor Diode, TunnelDiodes,LED,LCD. (8hrs)

Applications of Diodes & Linear Circuits:

Rectifier with C Filter, Numerical on Rectifiers, Clippers, Clampers, Limiters, Low pass filter, High pass filter with characteristics. (8hrs)

Bipolar Junction Transistor and its Applications

:

Transistor Doping , Transistor action, Current Components, BJT configurations: CE, CC, CB characteristics, Base Width Modulation. Punch Through Effect. DC load line, Fixed Bias Method. Single stage CE transistor as amplifier, BJT as a switch. (8hrs)

Books:

1. Basic Electronics & Linear Circuits, (Late) N N. Bhargava, Tata McGraw Hill, 2013, Second Edition.
2. Electronic Devices & Circuits Theory, Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, 10th Edition.
3. Integrated Electronics, Jacob Millman, Tata McGraw-Hill, 2009, Second Edition.
4. Microelectronics Circuits, A.S. Sedra&K.C.Smith, Oxford University Press, 2013, Seventh Edition

ETHICS & PROFESSIONAL COMPETENCY

Course Objectives:

1. To inculcate the highest level of ethical awareness and conduct among students. To make students ethically and socially aware and active
2. To have a critical reflection of one's personality thereby creating and developing professional competency.

Course Outcomes:

1. To demonstrate awareness regarding ethical issues in daily situations
2. To manage themselves easily in the dynamic environment.

Contents:

SWOT Analysis-Knowing yourself and Orientation, Goal Setting-Vision Board, Movie Analysis, Grooming and Body language Documentary on Social Issues, Aaj ki Adalat (Panel Discussion), Success Saga, Time and Change Management, Leadership Skills, Role Play on Social issues (15hrs)

Books:

1. Success Never Ends, Failure is Never Final, Robert Schuller, Paperback, 1990, Revised,
2. Body Language, b Allen Pease, Paperback, 2005, First

LIBERAL / CREATIVE ARTS

Course Objectives:

1. The Students shall be given exposure on various musical instruments like Guitar, Sitar, and Piano etc. according to their interest.
2. To inculcate healthy life style in students.
3. To impart discipline in students.
4. The students will be given exposure on Indian Classical music. It is aimed at a close interaction between students, artistes and craftsmen.
5. The students will be offered a Film & television Workshop for hands on experience on interactive learning.

Course Outcomes:

1. Play various musical instruments of their interest.
2. Understand and emphasize importance of good health in life
3. Be in self-discipline.
4. Apply the interactive learning experience in the diverse arts.

Contents:

Musical Instruments, Power Yoga/ Pranayam, National Credit Corp, Spic Macay, Film &

Television

(13hrs)

FOREIGN LANGUAGES

FRENCH:

Course Objectives:

1. Written communication: student can create basic-level French written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
2. Oral communication: student can create basic-level French oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

1. Exchange basic greetings in the social context.
2. Respond to classroom directions and basic commands.
3. Express basic needs in day-to-day life.
4. Provide and acquire basic personal and social information.
5. Read and write all characters and compound characters.
6. Form and understand sentences consisting of basic grammar patterns and particles.
7. Count and understand basic numbers.
8. Ask and understand the prices of commodities in stores, as well as purchase them.

Contents:

Introduction to France – its culture and people, Pronunciation and basic greetings, Grammar- Nouns- genders, article Vocabulary- Months, weekdays and daytimes and number system Vocabulary-Time and date Grammar- Auxiliary verbs (Avoiretre), Vocabulary-colors, Vocabulary-Family, profession Vocabulary- Directions, Common words

Test (30 min), Listening to CD, Vocabulary- House and Furniture and Draperies Vocabulary- Food and Drink and Cutlery Grammar-Regular, verbs Vocabulary- Vegetables and fruits. Grammar-Irregular verbs Grammar-Modal verbs Listening to CDS Vocabulary- Body parts and Clothes Translation passage and spoken Test (30 min), Listening to CD Translation passage and spoken Grammar-Imperative sentences and Framing questions Vocabulary- School and college and stationary Grammar- cases in French Vocabulary-Modes of transport, Random vocabulary Grammar-cases in French Test (30 min) , Listening to CD Translation passage Writing emails ...Resume building Listening and speaking sessions Test

(60 min)
(15hrs)

GERMAN:

Course Objectives:

1. Written communication: student can create basic-level German written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
2. Oral communication: student can create basic-level German oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

1. Exchange basic greetings in the social context.
2. Respond to classroom directions and basic commands.
3. Express basic needs in day-to-day life.
4. Provide and acquire basic personal and social information.
5. Read and write all characters and compound characters.
6. Form and understand sentences consisting of basic grammar patterns and particles.
7. Count and understand basic numbers.
8. Ask and understand the prices of commodities in stores, as well as purchase them.

Contents:

Introduction to Germany – its culture and people
Pronunciation – BASIC and ADVANCED
Basic Greetings and Self-Introduction
Grammar- Nouns-genders, article Grammar- Nouns - Plural forms
Vocabulary- Months, weekdays and daytimes and number system
Vocabulary-Time and date
Grammar – Personal Pronouns
Vocabulary-Family, professions
Vocabulary- Directions, Common words
Vocabulary –Job-Related and Modes Of Transport
Grammar – Possessive Pronouns
Vocabulary-House, Furniture and Draperies
Vocabulary- Food and Drinks
Grammar-Regular verbs
Vocabulary-Vegetables and fruits
Grammar-Irregular verbs
Grammar-Modal verbs and Imperative Verbs
WH – Questions
Vocabulary- Body parts and Clothes
Grammar – Sentences- types and Framing.

Grammar-Imperative sentences and Framing questions
Vocabulary-Common Places and Hobbies
Grammar- Adjectives and Opposites. Test –Viva and Written.
(15hrs)

JAPANESE:

Course Objectives:

1. Written communication: student can create basic-level German written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
2. Oral communication: student can create basic-level German oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course outcome:

1. Exchange basic greetings in the social context.
2. Respond to classroom directions and basic commands.
3. Express basic needs in day-to-day life.
4. Provide and acquire basic personal and social information.
5. Read and write all 71 phonetic Hiragana characters and compound characters.
6. Write and understand basic vocabulary written in Hiragana.
7. Form and understand sentences consisting of basic grammar patterns and particles.
8. Count and understand basic numbers.
9. Ask and understand the prices of commodities in stores, as well as purchase them.
10. Ask about the locations and understand the simple directions given to reach there.
11. Talk about oneself, one's family and friends, likes and dislikes, surrounding objects etc.; using limited vocabulary of nouns, adjectives, verbs, counters etc.
12. Become familiar with Japanese customs, greetings, etiquettes and manners.
13. Obtain information about Japanese life style, cultural events, food, products, geographical locations, and other socio-cultural phenomena.
14. Develop background for advanced Japanese language studies.

Contents:

Introduction of Japanese Language

- Origin, history, development, modern contemporary Japanese language
- Linguistic place of language: language family, area, native speakers, dialects
- Role of language in modern Japanese society
- Aspects of Japanese language: written, spoken, communicative

Introduction of Japan as country

- General class discussion about Japan and its cultural aspects. E.g. Japanese Language, Society, History, Geography, Dressing, Food, Economy, Government and Politics, Technological innovations, Scientific advances, Fine arts, Religion and beliefs, War and peace, Education, Family relations, Work culture and daily life, Travel and tourism, Mass media, Law and order, Literature, Performing arts, Drama, Popular music, Movies and entertainment, Games and Sports,
- Environment and Nature and others.
- Introduction of Japanese Language
- Written structure: Scripts- Hiragana, Katakana, Kanji
- Spoken structure: Valid sound patterns, Consonants and vowels
- Introducing oneself in Japanese
(Hello, How do you do, I am _____, Nice to meet you etc.)
- Hiragana Script
- Characters (10) from Aa to Ko: Stroke order writing, practice with flashcards
- General words based on completed hiragana characters (10)
- Hiragana Script
- Characters (15) from Ga to Zo: Stroke order writing, practice with flashcards
- General words based on completed hiragana characters (10)
- Hiragana Script
- Characters (15) from Ta to No: Stroke order writing, practice with flashcards
- General words based on completed hiragana characters (15) Introduction of Basic greetings 1
(Good Morning, Good Day, Good Evening, Thank you, Good Bye etc.)
- Hiragana Script
- Characters (15) from Ha to Po: Stroke order writing, practice with flashcards
- General words based on completed hiragana characters (15)
- Hiragana Script

- Characters (16) from Ma to N: Stroke order writing, practice with flashcards
- General words based on completed hiragana characters (20) Counting in Japanese
- Basic numbers (1 to 10), 2, 3 and 4 digit numbers. Reading and Writing from digits to Japanese and vice versa.
- Hiragana Script
- Rules for sound prolongation and its expression using hiragana.
- Prolongation using 'u' and B. Prolongation using vowels.
- General words based on hiragana prolonged characters (10) Grammar
- Basic sentence pattern 'A wa B desu', 'A wa B desuka'.
- Introduction of particles 'wa' and 'ka', copula 'desu/dewa arimasen'.
- Hiragana Script
- Rules for writing compound characters and its expression using hiragana.
 - o Small characters 'Ya', 'Yu', 'Yo' and B. Small character 'Tsu'
- General words based on hiragana compound characters (15) Grammar (15hrs)

SPANISH:

Course Objectives:

1. Written communication: student can create basic-level Spanish written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
2. Oral communication: student can create basic-level Spanish oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

After the successful completion of this course, the student should be able to:

1. Exchange basic greetings in the social context.
2. Respond to classroom directions and basic commands.
3. Express basic needs in day-to-day life.
4. Provide and acquire basic personal and social information.
5. Read and write all characters and compound characters.

- Form and understand sentences consisting of basic grammar patterns and particles.
- Count and understand basic numbers.
- Ask and understand the prices of commodities in stores, as well as purchase them.

Contents:

Weeks 1-3: Capítulo 1:

Elvocabulario: Saludos y despedidas

En la clase La gramática: el alfabeto, los números 0-199, los días, los meses, las estaciones, el verbo ser, Los pronombres personales, los sustantivos, los artículos, los adjetivos

Weeks 4-6: Capítulo 2:

Elvocabulario: Las descripciones y las nacionalidades, ¿Qué haces? ¿Qué te gusta hacer? La gramática: la hora, preguntarse sí/no, la negación, las palabras interrogativas, el verbo tener, Los verbos regulares en el presente -ar, -er, -ir

Weeks 7-9: Capítulo 3:

Elvocabulario: Las materias académicas y la vida estudiantil Los edificios de la Universidad La gramática: los números 199-3.000.000, los adjetivos posesivos, los verbos ser, hacer, y estar, Las expresiones con el verbo tener, el uso de los verbos ser/estar

Weeks 10-12: Capítulo 4:

Elvocabulario: Miembros de la familia El ocio La gramática: los verbos "boot," los verbos poner, salir, y traer, los verbos saber/conocer, Los complementos directos y sus pronombres, la "a" personal, Los adjetivos y los pronombres demostrativos

Weeks 13-15: Capítulo 5:

Elvocabulario: Las actividades diarias Los quehaceres domésticos La gramática: los verbos reflexivos, el superlativo, el presente progresivo, Las comparaciones de igualdad y de desigualdad (15hrs)

ENVIRONMENTAL SCIENCE

Course objectives:

- Students will develop a sense of community responsibility by becoming aware of scientific issues in the larger social context.
- Recognize the interconnectedness of multiple factors in environmental challenges

Course Outcomes:

- Apply the knowledge of environmental pollution & importance of current environmental issues
- Able to understand environment quality standards
- Able to utilize natural resources properly

Contents:

UNIT I - Environmental Pollution & Current Environmental Issues of Importance
Air Pollution, Water pollution, Climate Change and Global warming: Effects, Acid Rain, Ozone Layer depletion, Photochemical Smog, Waste water treatment.
(4hrs)

UNIT II- Environment Quality Standards

Ambient air quality standards, Water quality parameters; Turbidity, pH, Suspended solids, hardness, residual chlorine, sulfates, phosphates, iron and manganese, DO, BOD, COD.
(4hrs)

UNIT III - Natural Resources

Water Resources, Mineral Resources, Soil, Energy - Different types of energy, Conventional and Non-Conventional sources - Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Geothermal energy and Bio-gas.
(4hrs)

Books:

- Environmental Chemistry by B.K. Sharma & H. Kaur, Goel Publishing House.
- Environmental Chemistry by A. K De, New Age International Publishers.

Reference Books

- Instrumental method of Analysis by B.K. Sharma, Goel Publishing House.
- A Test Book of Environmental Chemistry & Pollution Control by S. S. Dara, S. Chand and Co.
- Environmental Chemistry by Samir K. Banerjee, Prentice Hall of India Pvt. Ltd. New Delhi.

INTEGRAL & MULTIPLE CALCULUS

Course Objectives:

- To introduce the concepts of Integral calculus in the field of Engineering.
- To develop skills in student to apply the concepts of multiple integral in various engineering problems

Course Outcomes:

1. Recall the concept of definite integral.
2. Design the curve and evaluate its integral to solve engineering problem.
3. Evaluate the integrals using different techniques in engineering domains.
4. Apply the concept of integral calculus in solving engineering problems.

Content:

Integral Calculus: Review of Curve tracing , Gamma function, Beta function, Relation between beta and gamma function, applications to area, length, volume and surface area, Differentiation under integral sign.

(12hrs)

Multiple Integral-I: Double integral, Change of variables, Change order of integration, Triple integral.

(6hrs)

Multiple Integral-II (Applications): Applications of multiple integral such as area, mass, volume, centre of gravity, moment of inertia.

Questions related to multiple integral in GATE.

TERM WORK: Prepare .m file in MATLAB to for tracing of curve and find area, volume etc

(12hrs)

Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth Ed.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2013, Forty Third ed.
3. Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers, Alpha Science International, Ltd, 2007, Third Ed.
4. Advanced Mathematics for Engineers and Scientists, Spiegel, M. R, McGraw-Hill, 2010, Second Ed.

ORDINARY & PARTIAL DIFFERENTIAL EQUATIONS

Course Objectives:

1. To develop skills in student to solve problems of Ordinary Differential Equations and its applications in field of engineering.
2. To introduce the concepts of Partial Differential Equations and its applications in the field of Engineering.

Course Outcomes:

1. Solve first order, first degree & higher order differential equations
2. Form differential equations for simple electrical and mechanical for system and solve it.
3. Understand and solve Partial differential equations in engineering problems

Content:

First order first degree differential equations: Linear, Reducible to linear and exact differential equations.

(3hrs)

Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Legendre homogeneous differential equations.

(4hrs)

Simultaneous differential equations, Special types of differential equations, Applications of differential equations to engineering systems.

(4hrs)

Introduction to Partial Differential equations, Partial differential equation of first order and its types , applications to real life problems.

(4hrs)

Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth Ed.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2013, Forty Third ed.
3. Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers, Alpha Science International, Ltd, 2007, Third Ed.
4. Advanced Mathematics for Engineers and Scientists, Spiegel, M. R, McGraw-Hill, 2010, Second Ed.

BIO SYSTEMS IN ENGINEERING

Course Objectives:

This course introduces general biological concepts

1. It helps students to understand importance of biological concepts in engineering fields.
2. To understand application of engineering concepts in medical instrumentation.

Course Outcome:

1. Understand the use of basic Human biology in engineering
2. Understand & Apply the concepts of engineering for design of biomedical instrumentation and the impact of AI on its applications.
3. Understand application of engineering in bio sensors & robotic prosthesis
4. Understanding telemedicine & wireless telemetry in medical

Content:

Human Physiology & Anatomy: Introduction to Human Physiology, the Nervous System, Cardiovascular System, Respiratory System, Digestive system and Excretory system, Integumentary system / Exocrine system, Muscular system, Renal system and Urinary system, Reproductive system, Skeletal system (5hrs)

Biomedical Instrumentation: Bio-imaging techniques, ECG, Computer aided ECG, X-Ray, Portable MRI, CT Scan, Portable scanners, Blood pressure measurement instrument, spirometry, advanced medical instruments, EEG, EEG electrodes and the biosignals analysis, Implementation of AI in Biomedical Instrumentation, AI applications (7hrs)

Bio sensors & Robotic prosthesis: Introduction & types of biosensors, its applications, prosthesis, application in healthcare services, robotic surgery.

(8hrs)

Telemedicine & Wireless Medical Telemetry: Introduction, Benefits & Drawback, History, Types & Categories: Store & Forward, Remote Monitoring, Real- Time Interactive, Future of Telemedicine Wireless medical telemetric devices.

(5hrs)

Case Studies: Role of Engineers in various disciplines of medical science:

Civil- Biomechanics

Mechanics- Biomaterial & 3D Bio printing

ETC. ETRX & EE- Sensors & transducers

IT & CSE- Neurotranslator & prosthesis (5hrs)

Books:

1. Biomedical Instrumentation, Dr. M. Arumugam Anuradha, 2002 Second

IOT PRACTICAL

Course objectives:

1. To understand key technologies in Internet of Things.
2. Analyze, design or develop parts of an Internet of Things solution
3. Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcomes:

1. Identify and adopt knowledge of the terminology, requirements and constraints for IoT development.
2. Demonstrate IoT system for smaller applications.

Content:

- Introduction to Internet of things
- Hands on Raspberry Pi and programming.
- Controlling different displays like LED, Seven Segment, LCD etc, using IoT
- Data acquisitions, monitoring and cloud services.

Books:

1. IoT: Building Arduino-Based Projects, Peter Waher, Pradeeka Seneviratne, Brian Russell, Drew Van Duren, Packt Publishing Ltd., 2016
2. Internet of Things with the ArduinoYún, Marco Schwartz, Packt Publishing Ltd., 2014
3. Building Arduino Projects for the Internet of Things, AdeelJaved, Apress, 2016
4. the Internet of Things, Donald Norris, McGraw-Hill Education, 2015

APPLIED PHYSICS

Course Objectives:

1. Demonstration of the fundamentals of Quantum Mechanics and its related applications.
2. Introduction to the working and applications of fundamental lasers.
3. Familiarization and demonstration of the concepts of interference and polarization and its application
4. Explanation of the concepts of semiconductor physics and working of various diodes.

Course Outcomes:

1. Apply the knowledge of Quantum Mechanics to solve related problems and its applications.
2. Explain the fundamentals of laser & identify its applications.
3. Describe the phenomenon of interference & polarization to solve concerned problems & applications.
4. Demonstrate the knowledge of semiconductor to use related devices and its applications.

Content:

Unit I: Quantum Mechanics: Compton Effect & its applications, Heisenberg's Uncertainty principle & its applications, Schrödinger's wave equation and its application viz. Eigen values and Eigen functions of "particle in a box", quantum constriction, quantum computing. (10hrs)

Unit II: Optics : Interference and Polarization and its applications viz. Antireflection coatings, filters, Polaroid's, LASER and its applications viz. Holograms, printers. (10hrs)

Unit III: Review of Band Theory, Fermi Energy, Intrinsic & Extrinsic Semiconductors, Hall effect, p-n junction diode. Optoelectronic Devices: Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN (8hrs)

Books:

1. Physics for Engineering, Dr. B P Butay, Oxford University Press, 2017, First Ed
2. Fundamentals of Physics, David Halliday and Robert Resnik, New Age, 1994, Fourth Ed
3. Nanotechnology, Dr. Sulbha K Kulkarni, Capital Publishing Co, 2011, Second Ed

INTRODUCTION TO DIGITAL SYSTEM DESIGN

Course Objectives:

1. To familiarize with various Digital IC
2. To understand basic fundamentals of Digital circuits.
3. To prepare for various engineering applications.

Course Outcomes:

1. Solve the problems on Number system codes and their conversions.

2. Identify Digital IC and implement in the circuits.
3. Create, design and simulate canonical logic forms
4. Demonstrate the application of combinational and sequential logic circuits.

Content:

Unit I: Number Systems & Boolean Algebra

Decimal, binary, octal, hexadecimal number system and conversion, binary weighted & non-weighted codes & code conversion, signed numbers, 1s and 2s complement codes, Binary arithmetic, Binary logic functions, Boolean laws, truth tables, associative and distributive properties, De-Morgan's theorems, realization of switching functions using logic gates. (10hrs)

Unit II: Combinational Logic:

Switching equations(Mathematical operations), canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, mixed logic combinational circuits, multiple output functions, Quine Mccluskey Methods for 5 variables. Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers & De-multiplexer, binary adder, subtractor, BCD adder, carry look ahead adder, Binary comparator, Arithmetic Logic Units(10hrs)

Unit III: Sequential Logic & Circuits:

Latch, flip-flops, clocked and edge triggered flip-flops, timing specifications, asynchronous and synchronous counters, counter design, Registers, types of registers. Analysis of simple synchronous sequential circuits, Introduction to Mealy and Moore Circuits.

(10hrs)

Books:

1. Digital Electronics, R P Jain, McGraw Hill, 2017, Second Edition
2. Digital Logic and Computer Design, Morris Mano, PHI, 2017 review, Second Edition
3. Digital Electronic Principles, Malvino, PHI, 2011-13, Seventh Edition

EMBEDDED PROGRAMMING

Course Objectives:

1. To give the awareness of major embedded devices.

2. To give the knowledge about interfacing devices.

Course Outcomes:

1. Recognize and analyze given embedded system design and its performance.
2. Demonstrate application based competencies in Embedded Programming.

Content:

- Introduction to Embedded system and programming.
- Hands on Arduino board and its IDE.
- Interfacing LEDs, switches, seven segment display, LCD, LDR, and Potentiometer.
- Applications using Temperature, IR, Buzzer, finger print sensor.

Books:

1. Designing Embedded Systems with Arduino: A Fundamental Technology for Makers, Tianhong Pan(Author), Yi Zhu(Author), Springer, 2017, First
2. Getting Started With Arduino 3rd Edition, Massimo Banzi, Michael Shiloh, Maker Media, 2014, Third
3. Arduino-Based Embedded Systems: Interfacing, Simulation, and Lab VIEW GUI, Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushabhan Choudhury, CRC Press, 2017, First
4. (Make) Lego and Arduino Projects, John Baichtal, Matthew Beckler and Adam Wolf, Maker Media, 2012, First
5. Arduino projects for Engineer, Neerapraj Rai, BPB publication, First Edition, 2016.

DIGITAL FABRICATION

Course Objectives:

1. To familiarize with basic CAD modeling and digital manufacturing methods.
2. To equip with various techniques to create prototype & product design and developments.
3. To train in 3 D part modeling and additive manufacturing appropriately
4. To understand the concept of rapid tooling and its requirement

Course Outcomes:

1. Define and demonstrate the use of techniques for processing of CAD models for rapid prototyping.
2. Understanding the fundamentals of rapid prototyping techniques for given case studies.
3. Apply appropriate tooling for rapid prototyping process.
4. Analyze the processing parameters best suited to the production of prototype
5. Adopt right approaches and considerations for successful developing new product designs.

Content:

Introduction to Additive Manufacturing - 3 D printing and Computer aided design Software's – CATIA v5
2 D Sketching on CATIA v5 - To prepare 2D geometrical model by using sketcher toolbar, entities and Views

2 D Sketching on CATIA v5 - To prepare 2D geometrical model using drawing constraint and modifying toolbars.

3D Modelling on CATIA v5– To prepare part model using 2 D drawing and with basic extrusion tools.

-Conversion of part file to .stl format

-3D Modelling on CATIA v5 - To prepare part model using Revolve command

-Conversion of part file to .stl format

-3 D Printing Slicing / Pre-processing

-To pre-processed model for 3 D Printing using of Kissslicer/Cura 4.0 Software's

-3 D Printing Slicing - Development of g.code by using Kissslicer/Cura 4.0 Softwares for 3 D Printing

-3 D Printing – Introduction to Fused deposition modelling technique

-Introduction to FDM Machine and operating controls.

-3 D Printing – Development of prototype using additive manufacturing – 3 D Printing

-Case- Studies (30hrs)

Books:

1. Gibson, I, Rosen, D W., and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
2. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
3. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
4. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.

5. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer
6. Bartolo, P J (editor), Virtual and Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Taylor and Francis, 2007.
7. Hopkinson, N, Haque, R., and Dickens, P., Rapid Manufacturing: An Industrial Revolution for a Digital Age: An Industrial Revolution for the Digital Age, Wiley, 2005.
8. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001.
9. Rapid Prototyping by M. Adithan, Atlantic Publication.

MINI-MODEL THROUGH INNOVATION AND CREATIVITY

Course Objective:

1. To enhance the skill of planning and designing.
2. To implement basic concepts.
3. To develop innovative and creative learning.

Course Outcomes:

1. Demonstrate the skills of planning and designing for developing a working mini model.
2. Implement knowledge of concepts learnt and workshop practices to prepare a model.
3. Use innovative ideas and convert these into physical models.

COMMUNICATION SKILLS

Course Objective:

1. To develop an understanding in the students regarding communication skills
2. To develop the four essential communication skills in students i.e. – reading, writing, listening and speaking
3. To develop the vocabulary and English proficiency of the students

Course Outcome:

1. To demonstrate oral communication in a formal manner
2. To apply vocabulary for demonstrating English proficiency.
3. Development of Reading Skills.
4. Development of Writing Skills.
5. Development of Listening Skills.

6. To use grammar for appropriate communication.

Content:

The working Day-Present simple and present continuous, time expressions, state verbs
 Online Communication, Company growth-Past simple and past continuous,
 Corporate culture
 Describing equipment
 Processes and procedures-The present passive
 Distribution and delivery-Modal verbs of obligation
 Advertising and marketing-Words to describe causes and effects
 Making arrangements-Present continuous for future arrangements: will and going to
 Transport-Contrast words
 Working holidays- Comparatives: as
 Conferences-Superlatives
 New places, new people-Present perfect
 Corporate gift giving-Countable and uncountable noun
 Teamwork
 Thinking globally-Expressions of quantity
 Describing statistics-Adjectives and adverbs
 Company finances-Pronouns and reference words
 Investments
 Starting up-which/who/that/where clauses, Job application
 Recruitment-First and Second conditionals
 Staff development
 Employee productivity-Infinitive and ing forms; Grammar revision
 (45hrs)

Books:

1. Effective Technical Communication, M. Ashraf Rizvi, Tata McGraw Hill, 2012, First
2. Communication Skills, Sanjay Kumar and Pushpata, Oxford University Press, 2015, Second
3. High School English Grammar and Composition, P C Wren and H Martin, S Chand, 2005, Revised First

ENTREPRENEURSHIP

Course Objective:

1. To make students aware of the need self-earning system.
2. To develop interest in creative business ideas.
3. To make them capable of becoming entrepreneurs.

Course Outcome:

1. Develop self-confidence to become an entrepreneur.
2. Develop a creative thinking for growth of self and society.

Content:

Lesson 1: Let's Get Started

- Form teams that students will work with for the entire duration of the course.
- Learn how entrepreneurship has changed the world.
- Learn what entrepreneurship is.
- Identify six entrepreneurial myths and uncover the true facts.

Learn how entrepreneurship has changed your country through a class discussion.

(2hrs)

Lesson 2: Explore E-cells on Campus

- Appreciate the fact that E-cells help shape career dreams and develop skills required to build a successful career.
- Understand how E-cells can transform individuals into successful leaders and entrepreneurs.
- Get inspired by the success story of Local Entrepreneurs.
- Express your dreams.

(2hrs)

Lesson 3: Listen to Some Success Stories

- Understand how ordinary people become successful global entrepreneurs, their journeys, their challenges, and their successes.
- Understand how ordinary people from their own countries have become successful entrepreneurs.

(2hrs)

Lesson 4: Characteristics of a Successful Entrepreneur

1. Understand the entrepreneurial journey and the concept of different entrepreneurial styles.
2. Understand each of the five entrepreneurial styles in the model and how they differ from each other.
3. Identify your potential entrepreneurship style based on personality traits, strengths, and weaknesses.
4. Understand how different entrepreneurship styles work, and how people with different styles work together.

(2hrs)

Lesson 5: Design Thinking

- Understand Design Thinking as a problem-solving process.

- Describe the principles of Design Thinking.
- Describe the Design Thinking process.

(2hrs)

Lesson 6: Sales Skills to Become an Effective Entrepreneur

- Understand what customer focus is and how all selling effort should be kept customer-centric.
5. Use the skills/techniques of personal selling, Show and Tell, and Elevator Pitch to sell effectively.

(4hrs)

Lesson 7: Managing Risks and Learning from Failures

- Understand that risk-taking is a positive trait
- Identify risk-taking traits and resilience traits
- Appreciate the role of failure on the road to success and understand when to give up

(2hrs)

Lesson 8: Orientation Program in Entrepreneurship

Identify the reasons why people want to become entrepreneurs.

- Help participants identify why they would want to become entrepreneurs.
- Give participants the real picture of the benefits and challenges of being an entrepreneur.

(2hrs)

Books:

1. Stay Hungry Stay Foolish, Rashmi Bansal, Westland, 2008

WASTE MANAGEMENT

Course objectives

1. To study industrial waste generation patterns, as well as management and disposal techniques
2. To categorize different types of waste

Course Outcomes

1. To apply creative & innovative practices for waste management.
2. To identify hazardous and non-hazardous waste
3. To describe the major categories of waste, disposal techniques and technologies.

Contents

1. Case study of Physiochemical analysis of water from different sources (River/lake/well/bore well)
2. Case study of physiochemical analysis of solid waste (industrial / municipal)
3. Case studies on best practices of solid waste management
4. Visit to a solid waste processing unit
5. Case studies on e-waste
6. Case studies on biomedical waste
7. Case studies biomass generation from organic waste
8. Waste water source of pollution and treatment techniques from Nagpur water resources.

Books:

1. Solid and Hazardous Waste Management, M. N. Rao, Razia Sultana, BS Publications.
2. Solid Waste Management: An Indian Perspective, by M.S. Bhatt, Asheref Illiyan, Synergy Books India (30 May 2012).

INTRODUCTION TO BIOCHEMISTRY **(OPEN ELECTIVE)**

Course Objective

Deals with the study of structural and functional aspects of biomolecules.

Course Outcome

1. Able to understand basics of biochemistry
2. Apply the knowledge of metabolism of carbohydrates.
3. Discuss the structure, properties and reactions of proteins and amino acids
4. Discuss the structure, properties of fats
5. Demonstrate the knowledge of advanced trends in biochemistry

Contents:

Unit I - Carbohydrates, Lipids And Proteins

Monosaccharide's, complex carbohydrates, glycoprotein's, Lipids and cell membranes – types of membrane lipids, phospholipids and glycolipids from bimolecular sheets, Protein structure and function – Primary, Secondary, Tertiary, Quaternary

Structures.
(8hrs)

Unit II- Metabolism Of Carbohydrates

Glycolysis, Glucogenesis, Citric acid cycle and Glycogen metabolism
(5hrs)

Unit III- Protein Metabolism

Protein turnover and Amino acid catabolism, Biosynthesis of amino acids
(5hrs)

Unit IV- Fatty Acid Metabolism And Nucleic Acid Metabolism

Overview of Fatty Acid Metabolism, synthesis and degradation of fatty acids, De novo synthesis of Nucleotides.
(6hrs)

Unit V- Advanced Trends In Biochemistry (6hrs)

Books:

1. Biochemistry, Jeremy M.Berg, W.H. Freeman and Company, 2014, 5th ed
2. Biochemistry, Rastogi, Tata Mc Graw Hill, 2014, 4th Ed.
3. Biochemistry, Stryer L W.H. Freeman and Company, 2007, 7th Ed.

SMART MATERIALS (OPEN ELECTIVE)

Course Objectives

1. Introduction of the Smart Materials and its classification on the basis of structure.
2. Introduction to the concept of various smart materials like metallic glass, shape memory alloys, piezoelectric, magnetostrictive, and photonic materials
3. Introduction to the applications of smart materials in various engineering fields.

Course Outcomes: Student shall be able to

CO1: understand the concepts of Smart materials and its classification.

CO2: Apply the knowledge of metallic glasses to understand working of devices based on it.

CO3: Apply the knowledge of piezoelectric materials to understand related applications.

CO4: Apply the knowledge of photonic materials to understand its applications.

CO5: Apply the knowledge of superconductors to understand its applications.

CO6: Demonstrate the knowledge of advanced topics related to Metallic Glasses, SMA, piezoelectric, photonic and superconductors

Content:

Introduction to Smart Materials:

Introduction to crystal structures, Introduction to the concept of Smart Materials & composites. (3hrs)

Metallic glasses and Shape Memory Alloys:

Metallic glasses and bulk metallic glasses, shape memory alloys: types and applications in engineering fields.

(5hrs)

Piezoelectric Materials & Composites:

PVD & its applications.

(5hrs)

Photonic Materials:

Solar cells, smart coatings and photo biology.

(4hrs)

Super Conductors:

Types I and type II Super Conductors, Meissner effect, critical current, Josephson effect, High temperature superconductors, and their engineering applications, quantum super conductor. (5hrs)

Advanced trends in smart materials:

Introduction to thin film and devices. (3hrs)

Books:

1. Elementary solid state Physics, M. Ali Omar, Pearson Education Inc., 2009, Sixth Ed
2. Engineering Physics, B. K. Pande and S. C. Chaturvedi, Cengage Learning Pvt Ltd, 2012, First Ed
3. Smart Structure and Materials, Brian Culshaw, Artech House – Boston. London, 1996, Second Ed

Nanomaterials and Sensors (Open Elective)

Course Objectives:

- 1 Demonstration of the structures and classification of nano-materials.
- 2 Introduction to the properties of nano-materials.
- 3 Demonstration of various Synthesis and fabrication techniques of nano-materials.
- 4 Explanation of various Characterization techniques of nano-materials.
- 5 Introduction to various types of nano-sensors.

- 6 Explanation of design and application of various nano sensors used in 1U/3U satellites.

Course Outcomes: Student shall be able to

- 1 Identify various structures and classification of nano-materials.
- 2 Describe properties of nano-materials.
- 3 Illustrate various Synthesis and fabrication techniques of nano-materials..
- 4 Recognize various Characterization techniques of nano-materials.
- 5 Demonstrate knowledge of various types of nano-sensors.
- 6 Select and demonstrate design and type of nano-sensors used for various applications in 1U/3U satellites.

Contents

Introduction: Definition of nano materials.

Classification of nanostructured materials.

Properties of Materials: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties

Synthesis Techniques: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method, Self-assembly, **Top down approaches:** Mechanical alloying, Nano-lithography

Characterization Techniques: X-Ray diffraction and Scherrer method (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning probe microscopy, atomic force microscopy (AFM), photoluminescence spectra, Raman spectroscopy

Nano Sensors: What are Sensors and actuators, Nano-Sensors and Nano actuators, Types of Sensors, Physical, Chemical, Bio-Sensors and Optical Sensors, Attitude Sensors-Infrared Band-Pass Filter; Star Tracker; Sun Sensor; Analog Sun Sensor; IR Earth Sensor and Space Sextant, Attitude Actuators- Reaction Wheel; Compact Magnetorquer; Magnetorquer Rod, Infrared Spectrometer, Imager

Design, Applications & Future Challenges: Design aspects of compact Nano-Sensor arrays for various applications in 1U/3U satellite, Sensitivity of Sensor, Nanowires, Carbon Nanotubes and its application in space technology.

List of Books

1. Nano science and nanotechnology, M.S Ramachandra Rao, Shubra Singh, Wiley publishers.
2. Applications of Nano-materials in Sensors and Diagnostics, Editors: Tuantranont, Adisorn (Ed.) Springer Series on Chemical Sensors and Biosensors
3. Introduction to Nano Technology, Charles P. Poole, Jr., Frank J Owens, Wiley India

4. Nanotechnology, Jermy J Ramsden, Elsevier publishers
5. Nano Materials, A K Bandyopadhyay, New Age Introduction
6. Nano Essentials, T Pradeep, TMH
7. Nanotechnology the Science of Small, M.A Shah, K.A Shah, Wiley Publishers
8. Principles of Nanotechnology, Phani Kumar, Scitech.

INTRODUCTION TO BIOCHEMISTRY

Liberal & Creative Arts

Course Objective

1. To enable the student to have good health
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.

Course Outcomes: Student shall be able to

1. Demonstrate basic skills associated with yoga
2. Demonstrate basic skills associated with yoga activities including strength and flexibility, balance and coordination.
3. Demonstrate an understanding of health-related fitness component

Contents:

Anatomy and Physiology of Yogic Practices

- Introduction to Human Body and systems in brief with special reference to Respiratory, Digestive, Muscular and Nervous systems.
- Postural Physiology with reference to Asana.
- Asana - Definition and Classification, Similarities and dissimilarities between Asana and Exercise.
- Pranayama - Definition and Classification. Difference between pranayama and deep breathing. Importance of Rechaka, Kumbhaka, Puraka.
- Introduction to Kriyas, Mudras and Bandhas in brief.

Yogasana

- Sandhi Snchalan
- Suryanamaskar
- Tadasan
- Vrukshasan
- Vajrasana and its types
- Pavan Muktasana
- Urshtasana
- Om Uchharan



G H RAISONI COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

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GHRCE/HoD/Dept./Scheme/UG/PG/02/01/02

Note: Applicable from 2019-20

DEPARTMENT OF CIVIL ENGINEERING

VISION & MISSION OF INSTITUTE

VISION

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards with capabilities of accepting new challenges

MISSION

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stake-holders. Our strength is directed to create competent professionals. Our endeavour is to provide all possible support to promote research and development activities

Programme: UG in Civil Engineering

CIVIL ENGINEERING PROGRAM

VISION

To achieve excellent standards of quality education in Civil Engineering by keeping pace with rapidly changing technologies & to create technical manpower of Global Standards in Civil Engineering with capabilities of accepting new challenges.

MISSION

1. To impart quality and value based education to raise satisfaction of all stake holders.
2. To serve society and nation for providing professional leadership in Civil Engineering for solving the problems consistent with rapidly changing technologies.
3. To create competent Civil Engineering professionals who are trained in the design and implementation of Civil Engineering systems.
4. To promote Research & Development Activities in the field of Civil Engineering and allied areas.

Programme Educational Objectives (PEOs)

The programme educational objectives of the civil engineering program are designed to produce skilled engineers who are ready to contribute effectively to the advancement of civil engineering profession and are ready to handle the challenges of the profession.

They shall be able to:

1. **(PEO1)** Apply fundamental technical knowledge and skills to find creative solutions to technological challenges and problems in various domains of Civil Engineering.
2. **(PEO2)** Analyze, design and use skills in order to formulate and solve Civil Engineering problems.
3. **(PEO3)** Practice Civil Engineering in an ethical manner, as an individual or a team member, implementing eco- friendly sustainable technologies.
4. **(PEO4)** Take up higher education and R & D in civil engineering and allied areas of science and technology for the benefit of industry and society.

PROGRAM OUTCOMES (POs):-

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

A graduate of the Civil Engineering Program will demonstrate:

PSO1:Understanding: Graduates will have an ability to describe, analyze, and solve problems in the core & allied areas of civil engineering

PSO2:Analytical Skills: Graduates will have an ability to conduct investigation of problems to design a system, component, or process using modern tools in accordance with National and ASCE codes.

PSO3:Broadness: Graduate shall be able to engage in lifelong learning and participate in serving the society as a member or leader of diverse team to provide civil engineering solutions in a global, economic and societal context.

B. TECH. CIVIL ENGINEERING

B.TECH FIRST YEAR SCHEME (CIVIL ENGINEERING 2019-20)

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont	
SEMESTER-I											
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100
BECL104	Bio-System in Engineering	1	1	-	2	2	10	15	25	--	50
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25
BECL101 BECF101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25
TOTAL		9	4	16	29	21	80	120	175	225	600

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.	
SEMESTER-II											
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75
BCEL101 BCEP101	Engineering Mechanics	1	1	2	4	3	20	30	--	25	75
BECF103	Embedded Programming	-	-	2	2	1	--	--	--	25	25
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100
BHUP102	Ethics& Professional Competencies	-	-	2	2	1	--	--	--	25	25
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25
TOTAL		4	5	26	35	22	60	90	100	350	600

B.TECH. SCHEME (CIVIL ENGINEERING)

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Mode of Exam
							Theory			Practical		Total	
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int.	Ext .		
TERM – III													
BFYL108	Maths 5 (FS and PDE)	1	1	0	2	2	10	15	25	-	-	50	
BHUP203	Quant	0	0	1	1	0.5		-	-	25	-	25	
BHUP202	Reasoning	0	0	1	1	0.5		-	-	25	-	25	
BAIP202	Skill Development 1 (Linear Algebra)	0	0	2	2	1		-	-	25	-	25	
BCEL221	Materials, Testing & Evaluation	2	0	2	4	3	10	15	25	25	25	100	Offline
BCEL222	Mechanics of materials	1	1	0	2	2	10	15	25	-	-	50	Offline
BCEL223	Soil Mechanics	2	0	2	4	3	10	15	25	-	25	75	Offline
BCEL224	Fluid Mechanics	1	0	2	3	2	10	15	25	25	-	75	Offline
BCEL225	Hydrology & Water resource Engineering	2	0	0	2	2	10	15	25	-	-	50	Online Case Study
BCEL226	Instrumentation & Sensor Technologies for Civil Engineering Applications	1	-	-	1	1	10	15	25	-	-	50	Online Hackathon
BCEL227	Basics of Transportation & Introduction to ITS	2	-	-	2	2	10	15	25	-	-	50	Offline
	TOTAL	12	2	10	24	19	80	120	200	125	50	575	

B.TECH. SCHEME (CIVIL ENGINEERING)

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Mode of Exam
							Theory			Practical		Total	
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int.	Ext.		
TERM – IV													
BFYL109	Maths 6 (Numerical Methods)	2	0	0	2	2	10	15	25	-	-	50	
BCSL221	AI &Machine Learning	2	0	0	2	2	10	15	25	-	-	50	
BHUP206	Aptitude 1	0	0	1	1	0.5		-	-	25	-	25	
BAIL101	Open Elective-I (Artificial Intelligence & its Application)	2	0	0	2	2	10	15	25	-	-	50	
BHUP205	BEC	0	0	4	4	2				50		50	
BMBP102	EDP	0	0	2	2	1	-	-	-	25	-	25	
BCEP234	Skill Development 2(Autocad,3d max)	0	0	2	2	1	-	-	-	25	-	25	
BCEL228	Concrete Technology	2	0	2	4	3	10	15	25		25	75	Offline
BCEP229	Architectural Planning & Drawing	-	-	2	2	1	-	-	-	25	25	50	Online on Auto-CAD
BHUP204	Liberal Arts / Creative Arts (Hobby Module)	0	0	1	1	0.5		-	-	25	-	25	
BCEL230	Surveying & Geomatics	2	0	2	4	3	10	15	25	-	25	75	Offline
BCEL231	Environmental Engineering	1	0	2	3	2	10	15	25	-	25	75	Online Case Study
BCEL232	Structural Analysis	1	1	-	2	2	10	15	25	-	-	50	Offline
	TOTAL	12	01	18	31	22	70	105	175	175	100	625	

B.TECH. SCHEME (CIVIL ENGINEERING)

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Mode of Exam
							Theory			Practical		Total	
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int.	Ext.		
TERM – V													
BFYL110	Maths 7 (Higher Order Matrices & Probability)	1	0	0	1	1	10	15	25	-	-	50	
MBP104	Advanced Communication Skills (Voice Versant &Essay)	0	0	4	4	2				50	-	50	
BCEP324	Skill Development 3 (PRIMAVERA)	0	0	2	2	1	-	-	-	25	-	25	
BCEP325	Internship (Social + Minor Project + Teaching Report Writing)	0	0	2	2	2	-	-	-	50	-	50	
BHUP302	Aptitude 2	0	0	1	1	0.5	-	-	-	25	-	25	
BCELXX1	Elective-I (Engg. Science)	2	0	0	2	2	10	15	25	-	-	50	
BCELXX2	Elective-II (Humanities)	2	0	0	2	2	10	15	25	-	-	50	
BCEL331	Irrigation and Drainage Engineering	1		0	1	1	10	15	25	-	-	50	Online Case Study
BCEL332	Reinforced Concrete Design	2	-	2	4	3	10	15	25	25	-	75	Offline
BCEP333	Building Services	-	-	1	1	0.5	-	-	-	25	-	25	Online Case Study
BCEL334	Foundation Engineering	2	-	2	4	3	10	15	25	25	-	75	Offline
BCEL335	Disaster Preparedness & Planning	2	-	-	2	2	10	15	25			50	Offline
	TOTAL	12	0	14	26	20	70	105	175	225	0	575	

B.TECH. SCHEME (CIVIL ENGINEERING)

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Mode of Exam
							Theory		Practical		Total		
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int.	Ext.		
TERM – VI													
BFYL111	Maths 8 (Optimization & Calculus of variation)	1	0	0	1	1	10	15	25	-	-	50	
BMEP319	Product Development & IPR	0	0	1	1	0.5		-	-	25	-	25	
BCEP326	Skill Development 4 (Analysis & Design Software)	0	0	2	2	1	-	-	-	25	-	25	
BCEP327	Skill Development 5 (Env. Audit & Excel)	0	0	2	2	1	-	-	-	25	-	25	
MBP301	Financial Management for Engineers	0	0	1	1	0.5	-	-	-	25	-	25	
BHUP207	Soft Employability Skill	0	0	1	1	0.5				25		25	
BHUP303	Aptitude 3	0	0	1	1	0.5	-	-	-	25	-	25	
BCELXXX	Elective-III (Building Information Modeling (BIM))	1	0	2	3	2	10	15	25	25	-	75	Online Software Based
Xxx	Open Elective-II	2	0	0	2	2	10	15	25	-	-	50	
BCEL336	Design of Steel Structures	2	0	2	4	3	10	15	25	25	-	75	Offline
BCEL337	Engineering Economics, Estimation & Costing	2	0	2	4	3	10	15	25	25	25	100	Offline
BCEL338	Advanced Structures Analysis	1	1	0	2	2	10	15	25	-	-	50	Offline
BCEL339	Project Planning Construction Management	2	0	0	2	2	10	15	25	-	-	50	Online Case Study
	TOTAL	11	1	14	26	19	70	105	175	225	25	600	

B.TECH. SCHEME (CIVIL ENGINEERING)													Mode of Exam	
Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme							
							Theory			Practical		Total		
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int.	Ext.			
TERM – VII														
BCELxxx	Department Elective-IV	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCELxxx	Department Elective-V	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCELxxx	Department Elective-VI	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCELxxx	Department Elective-VII	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCELxxx	Department Elective-VIII	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCELxxx	Department Elective-IX	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCELxxx	Department Elective-X	2	0	0	2	2	10	15	25	-	-	50	Offline	
BCEP441	Project (Phase-I)	0	0	4	4	4				50	50	100		
BHUP304	Carrer Development Practices	0	0	2	2	1				25		25		
	TOTAL	14	0	6	20	19	70	105	175	75	50	475		

B.TECH. SCHEME (CIVIL ENGINEERING)													
Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Mode of Exam
							Theory			Practical		Total	
		Th.	Tu.	Pr.	Total		TAE	CAE	ESE	Int.	Ext.		
TERM – VIII													
BCEP4 42	6 Months Internship / Field Project	0	0	12	12	12	0	0	0	100	200	300	Offline
	Open Elective –III (Moocs)	2	0	0	2	2	10	15	25	0	0	50	Offline
BCEP4 43	Project (Phase-II)	0	0	4	4	4	0	0	0	50	50	100	Offline
	TOTAL	2	0	16	18	18	10	15	25	150	250	450	
	TOTAL (3 TO 8)	63	4	78	145	117	370	555	925	975	475	3300	
	TOTAL (1 TO2)	13	9	42	64	43	140	210	275	575	-	1200	
	TOTAL (1 TO 8)	76	13	120	209	160	510	765	1200	1550	475	4500	

The Civil Engineering Syllabus offers Electives Specializations within the field of Civil Engineering			
BCEL401.	Advanced Structural Design	BCEL417.	Advanced Transportation Engineering
BCEL402.	Advance Concrete Design	BCEL418.	Urban Transportation Planning
BCEL403.	Earthquake Resistant Structures	BCEL419.	Advanced Surveying
BCEL404.	Advanced Steel Design	BCEL420.	Remote Sensing & Gis
BCEL405.	Matrix Method Of Structural Analysis	BCEL421.	Operation Research & Management
BCEL406.	Repair and Rehabilitation of Structures	BCEL422.	New Engineering Materials & Techniques
BCEL407.	Environmental Management	BCEL423.	Earth and Earth Retaining Structure
BCEL408.	Waste Water Engineering	BCEL424.	Energy Conservation and Environment
BCEL409.	Green Building	BCEL425.	Introduction to Structural Dynamics
BCEL 410.	Air Pollution & Solid Waste Management	BCEL426.	Geology and Earth Science
BCEL411.	Municipal & Industrial Water Treatment	BCEL427.	Pre-Fabricated structure
BCEL412.	Advanced Fluid Mechanics	BCEL428.	Prestressd Concrete Structures
BCEL413.	Ground Water Management	BCEL429.	Bridge Engineering
BCEL414.	Advanced Hydraulics	BCEL430.	Forensic Civil Engineering
BCEL415.	Soil Dynamics	BCEL 431/ STRL405	Theory of Elasticity and Elastic Stability
BCEL416.	Pavement Design		

TERM - I

Energy Sources & Audit

Course Objectives:

1. To Study the various types of electrical sources
2. To study the comparisons of various sources.
3. To study the non-Conventional electrical sources

Course Outcome:

1. To understand present scenario of energy & its importance
2. To Learn Conventional energy sources & Non conventional Energy sources
3. To Understand concept of Energy Management
4. To apply knowledge of energy audit to industry
5. To understand importance of safety components

Contents:

Unit 1 Energy Sources

Current Energy Scenario, Conventional Energy Sources, Types of conventional energy sources, importance & drawbacks of Conventional Energy Sources, Alternatives to conventional energy sources. Non Conventional Energy Sources, Types of non-conventional energy sources, importance & drawbacks of Non-Conventional Energy Sources, Comparison with conventional energy sources & its application.

(4hrs)

Unit 2 Energy Management & Audit

Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, energy audit instruments.

(4hrs)

Unit 3: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, types of Earthing systems. Power factor improvement.

(6hrs)

Books:

1. Non-Conventional Energy Resources, B H Khan Tata McGraw-Hill Education, 01-Jan-2006
2. Non-conventional Energy Sources, G. D. Rai, Khanna Publisher
3. Handbook of Energy Audit, Sonal Desai
4. Energy Management, Audit & Conservation by Barun Kumar De,

PROGRAMMING FOR PROBLEM SOLVING

Course Objectives:

1. This Course introduces basic idea of how to solve given problem.
2. Focuses of paradigms of programming language.
3. Aims at learning python as programming language.

Course Outcomes:

Course Outcome

1. Analyze and understand the behavior of fundamental programming constructs.
2. Develop and Analyze Algorithms for solving problems.
3. Demonstrate the knowledge of various concepts of Python Language.
4. Develop solutions using functions & recursion
5. Demonstrate knowledge of Dictionaries.
6. Demonstrate knowledge of advanced concepts of python programming

Contents:

Algorithmic Problem Solving: Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

(7hrs)

*Data, Expressions, Statements: **Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments.***

(10hrs)

*Control Flow, Functions: **Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if, if-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices.***

(10hrs)

*Dictionaries: **Operations and methods; advanced list processing – list comprehension.***

(4hrs)

Object Oriented Programming: Classes and objects-inheritance-polymorphism

(10hrs)

Exception Handling & File Handling: Overview of exception classes and types: try, except. Finally, File processing: reading and Writing files.

(4hrs)

Books:

1. Python Programming using Problem Solving Approach by Reema Thereja, Oxford Publication.
2. Python Programming: An Introduction to Computer Science 2nd Edition by John Zelle
3. Python Programming for the Absolute Beginner, 3rd Edition by Nicheal Dawson.

Data Structures

Course Objectives:

1. This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
2. It also aimed at developing skill to implement methods to solve specific problems using basic data structures.
3. The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.

Course Outcomes:

1. Identify essential data structures and understand when it is appropriate to use.
2. Explain use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated.
3. Apply linear data structures to solve various real world computing problems using programming language.
4. Analyze standard algorithms for searching and sorting.

Contents:

Database Management System: Database Concepts –Introduction, Data, Information, Metadata, Components of Database Management system, SQL select statement, Operators, Data Types, Single Row Function, Aggregating Data, Using Group Function, Data Manipulation Statement, Data Definition Statement, Constraints.

(7hrs)

Arrays & Pointers: Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Multidimensional Arrays, Pointers; Pointer Arrays, Dynamic Memory Management.

(7hrs)

Linked List : Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation; Insertion into a Linked List, Deletion from a Linked List, Circularly Linked Lists, Two-Way Lists (or Doubly Linked Lists).

(8hrs)

Stacks, Queue and Recursion : Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Application of Stacks, Recursion, Queues as ADT, Types of Queues (Circular Queues, Dequeues), and Applications of Queues. **Sorting and Searching** Introduction: Sorting; Bubble Sort, Insertion Sort, Selection Sort, Searching; Linear

Search, Binary Search.

(8hrs)

Books:

1. Ivan Bayross, 'SQL, PL/SQL The programming language of Oracle
2. Data Structures with C, Seymour Lipschutz, Schaums Outlines, Tata McGraw Hill
3. Horowitz E. & Sahani S., 'Fundamentals of Computer Algorithms', Galgotia Publications Ltd
4. S. Sahani, Data Structures in C.
5. D. Samantha, Classic Data Structures, PHI Publications.

Data Analytics

Course Objective:

1. This course helps to understand data and usage of data in solving real time problems.
2. It introduces general idea of database management systems.
3. It also explains the fundamental concepts of big data analytics and data visualization.

Course Outcomes:

1. Understand data and usage of data in data analytics.
2. Apply data analytics techniques for visualization through Excel.
3. Analyze and design multidimensional data models.
4. Visualize trends and discover insights of data.
5. Derive Entity- Relationship (E-R) model from specifications and transform it into relational model.
6. To design SQL queries to perform CRUD operations on database (Create, Retrieve, Update, and Delete)

Contents:

Unit 01: Introduction to Data Analytics

Introduction, MS Excel Basics (options: Create, Save Rename, Add, Delete), Editing data in Worksheet (options: Insert, Select, Delete, Copy & Paste, Find & Replace) Formatting Cells, Worksheets (operations: Add/Remove Columns & Rows, Hiding/Unhiding Columns & Rows, Merging Cells), Setting Colors.

(2hrs)

Unit 02: Manipulation of Excel Data

Working with Formula: Data Filtering, Sorting, Use of Range, Functions: SUM(), AVERAGE(), MAX() & MIN(), COUNT() & COUNTA(), IF(), Data Representation using Charts & Graphs, Creation of Pivot table, Create a Chart, Change Chart Type, Switch Row/Column, labels and legends, Print Area.

(6hrs)

Unit 03: Basics of DBMS

Introduction, Characteristics, Data models (Entity-Relationship Model, Relational Model, Network model), Relational algebra.

(2hrs)

Unit 04: Getting started with basic design templates

Multidimensional Models, Basic Design, Chart Generation, Dashboard Creation, Data Visualization.

(6hrs)

Unit 05: Basics of Open Source RDBMS

Introduction, Installation, MySQL Commands (Administrative Commands), Various Syntax of SQL, DDL and DML Commands.

(4hrs)

Books:

1. Microsoft Excel 2013 Step by Step by Curtis D. Frye; Microsoft Press 2013.
2. Database System Concepts, by Abraham Silberschatz, Professor, Henry F. Korth, and S. Sudarshan, 3RD Edition, Publisher: McGraw-Hill Education
3. Learning Tableau by Joshua N. Milligan, ISBN 139781784391164, PACKT Books - Packt Publishing
4. **Urls:**
 5. <https://www.guru99.com/excel-tutorials.html>
 6. <https://www.tableau.com/>
 7. <https://www.smartdraw.com/uml-diagram/>
 8. <http://www.nptel.ac.in/courses/106104135/> [For Fundamentals of Database Systems]

Engineering Graphics

Course Objectives:

1. To familiarize with basic engineering graphics principles and standards of drafting.
2. To use various engineering drawing techniques to create drawing of machine parts.
3. To understand and read drawings and blue prints for industrial applications.

Course Outcomes:

1. Apply various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient
2. Read and interpret drawings of simple machine parts in first and third angle of projection systems
3. Read and interpret projections of lines and planes along with traces

4. Visualize and project solid geometry in different positions
5. Visualize and project sections and development of solids in different positions
6. Translate the three dimensional engineering objects into two dimensional drawings and vice versa using drafting tools.

Contents:

Lettering, Dimensioning, Introduction to scale and curve: Use of various drawing instruments, lines, lettering and ISI standards for drafting. Simple geometrical construction. Definition of scale, Representative fraction, enlarging scale drawing, reducing scale drawing and full size drawing, dimensioning, Introduction to basic Engineering curves (conic sections)

(2hrs)

Theory of Projections: Theory, techniques, first and third angle projections, Projection of points. Projection of straight lines inclined to both reference planes.

(3hrs)

Projection of Planes: Plane inclined to both reference planes. Auxiliary planes and view: Auxiliary vertical plane and Auxiliary inclined plane.

(2hrs)

Projection of Solids: Projections of solids such as Prisms, pyramids, cone, cylinder with varying position of axes with ground line.

(2hrs)

Sections of solids: Section of solid such as Prisms, pyramids, cone, cylinder

(2hrs)

Development of solid surfaces: Development of surfaces for various regular solids.

(2hrs)

Orthographic Projection and Isometric projection: Conversion of pictorial view of solid to orthographic views and isometric view.

(2hrs)

Books:

1. Engineering Drawing, N.D.Bhatt, Panchal, Charotar Publishing House
2. Engineering Graphics, Venugopal K and Prabhu Raja V, New AGE International Publishers.
3. A text Book of Engineering Graphics using AUTO CAD, Sarkar, Rastogi and Kulkarni, Tata McGraw Hill

Engineering Mechanics

Course Objectives:

1. To describe and be able to predict the conditions of rest or motion of the bodies under the action of forces.

2. To understand the basic concepts of forces moments, couples in two dimensional force system & spatial force system.
3. To be able to analyze simple determinate structures like beam & trusses

Course Outcomes:

1. Apply the concept of two dimensional force systems for replacement into equivalent force system
2. Understand the basic concepts of free body diagrams for static equilibrium for two dimensional force systems
3. Demonstrate the basic concepts of forces, moments, and couples in spatial force system.
4. Apply the basic concepts of Moment of inertia & Virtual Work

Contents:

Fundamentals of Statics: Definition of mechanics, Body, Rigid Body, Scalar quantities, Vector quantities, Representation of vector, Fundamental Units, Derived Units, Particle, Mass, Weight, Fundamental principles of mechanics, Newton's law of universal gravitation.

Equivalent Force System (2-D): Concept of Force, Unit Newton force, System of force, Principle of transmissibility of force, Resolution and composition of coplanar force system, Resultant, Equilibrant, Law of parallelogram of force, Triangle law, Polygon law, Moment of force, Varignon's theorem, Couple and its properties, Reduction of system of forces into a force couple system. Numerical on equivalent force involving co-planer force systems acting on body, Numerical on reduction of system of forces into a force couple system. (5

hrs)

Equilibrium of Two Dimensional Force System: Concept of equilibrium, Principles of equilibrium, Equations of Equilibrium, Lami's theorem, Numerical on equilibrium involving co-planer force systems acting on body. **Beam**, Simply Supported Beam, Overhanging Beam, Beam reaction, Types of load acting over beam i.e. Concentrated load, Uniformly distribute load (UDL), Uniformly varying load (UVL), Types of support i.e. Simple support, Hinge support, Roller Support, Numerical on reaction of beam subjected to combination of loads.

Analysis of Truss: Perfect Frame, Imperfect frame, Deficient frame, Redundant frame, Assumptions made in analysis of truss, Method of joints, & sections, Numerical on forces in the members of a truss.

(10hrs)

Spatial Force System (Three Dimensional Force System): Component of force in a space, Resultant spatial force system, Force multiplier, Cartesian form of representation of vector, Unit vector, Position vector, Displacement Vector, Scalar product or Dot product, Cross product, Length of common perpendicular between two non-intersecting vectors, Shortest distance, Moment of force about point, Moment of force about axis, Moment arm of force about point, Moment arm of force about axis, Resultant moment, Couple,

Friction: Definition of friction, Types of friction, Angle of repose Coulombs laws of dry friction, Analysis of rigid bodies on rough inclined surfaces.

(8hrs)

Properties of Areas: Centroid of plane areas, Moment of Inertia of composite lamina, Radius of gyration, Second moment of area, Product of inertia, Parallel axis theorem, Perpendicular axis theorem, Polar moment of inertia, Moment of inertia & product of inertia about new axes, Principal moment of inertia and principal axis direction by analytical method only.

(7hrs)

Virtual Work: Virtual Displacement, Definition of virtual work, Principles of virtual work Virtual work method applied to beams & frames mechanisms.

Books:

4. K Vijaya Kumar Reddy & J Suresh Kumar, Singer's Engineering Mechanics , 3rd Edition, BS Publications, 2010
5. Beer F.P. and Johnston E.R., Vector Mechanics for Engineers: Statics and Dynamics, Tata McGraw-Hill, 9th edition 2012
6. Irving H. Shames, Engineering Mechanics: Static and Dynamics, Pearson Education, Asia Pvt Ltd, 4th edition 2009

Analog Circuit

Course Objectives:

4. To familiarize with various electronic components and understand their properties.
5. To understand basic fundamentals of analog circuits.
6. To prepare for various engineering applications.

Course Outcomes:

- 5 Use knowledge of diode for related application.
- 6 Demonstrate the knowledge of transistor and its application
- 7 Demonstrate the knowledge of oscillator
- 8 Use devices for designing of small electronics projects.

Contents:

Linear Circuits & Applications of Diodes: Clippers, Clampers, Limiters, AC to DC convertor, voltage regulator, low pass filter, high pass filter

with characteristics.

(8hrs)

Bipolar Junction Transistor and its applications:

Transistor action, BJT configurations: CE, CC, CB with normal biasing, DC load line, Single stage CE transistor as amplifier, Practical amplifier biasing, BJT as a switch.

(8hrs)

Oscillator: LC Oscillator, RC Oscillator, Crystal oscillator using transistor, Need of Power Amplifier and difference between Voltage and Power Amplifier 555 Timer: IC 555 pin Configuration and its applications.

(8hrs)

Books:

5. Basic Electronics & Linear Circuits, (Late) N N. Bhargava, Tata McGraw Hill, 2013, Second Edition.
6. Electronic Devices & Circuits Theory, Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, 10th Edition.
7. Integrated Electronics, Jacob Millman, Tata McGraw-Hill, 2009, Second Edition.
8. Microelectronics Circuits, A.S. Sedra & K.C. Smith, Oxford University Press, 2013, Seventh Edition

Ethics & Professional Competency

Course Objectives:

3. To inculcate the highest level of ethical awareness and conduct among students. To make students ethically and socially aware and active
4. To have a critical reflection of one's personality thereby creating and developing professional competency.

Course Outcomes:

3. To demonstrate awareness regarding ethical issues in daily situations
4. To manage themselves easily in the dynamic environment.

Contents:

Orientation & SWOT Analysis, Plagiarism, Movie analysis, Movie analysis, AajKiAdalat (Panel Discussion) Goal Setting & Time management, Goal Setting & Time management, Thinking hats, 6 Thinking hats, Telephone etiquettes, Leadership & Team work, Time management.

(15hrs)

Books:

3. Success Never Ends, Failure is Never Final, Robert Schuller, Paperback, 1990, Revised,
4. Body Language, b Allen Pease, Paperback, 2005, First

Liberal / Creative Arts

Course Objectives:

6. The Students shall be given exposure on various musical instruments like Guitar, Sitar, and Piano etc. according to their interest.
7. To inculcate healthy life style in students.
8. To impart discipline in students.
9. The students will be given exposure on Indian Classical music. It is aimed at a close interaction between students, artistes and craftsmen.
10. The students will be offered a Film & television Workshop for hands on experience on interactive learning.

Course Outcomes:

5. Play various musical instruments of their interest.
6. Understand and emphasize importance of good health in life
7. Be in self-discipline.
8. Apply the interactive learning experience in the diverse arts.

Contents:

Musical Instruments, Power Yoga/ Pranayam, National Credit Corp, Spic Macay, Film & Television

(13hrs)

Foreign Languages

FRENCH:

Course Objectives:

3. Written communication: student can create basic-level French written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
4. Oral communication: student can create basic-level French oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

9. Exchange basic greetings in the social context.
10. Respond to classroom directions and basic commands.
11. Express basic needs in day-to-daylife.
12. Provide and acquire basic personal and social information.
13. Read and write all characters and compound characters.
14. Form and understand sentences consisting of basic grammar patterns and particles.
15. Count and understand basic numbers.
16. Ask and understand the prices of commodities in stores, as well as purchase them.

Contents:

Introduction to France – its culture and people, Pronunciation and basic greetings, Grammar- Nouns- genders, article Vocabulary- Months,

weekdays and daytimes and number system Vocabulary-Time and date Grammar- Auxiliary verbs (Avoiretre), Vocabulary-colors, Vocabulary-Family, profession Vocabulary- Directions, Common words

Test (30 min), Listening to CD, Vocabulary- House and Furniture and Draperies Vocabulary- Food and Drink and Cutlery Grammar-Regular, verbs Vocabulary- Vegetables and fruits. Grammar-Irregular verbs Grammar-Modal verbs Listening to CDS Vocabulary- Body parts and Clothes Translation passage and spoken Test (30 min), Listening to CD Translation passage and spoken Grammar-Imperative sentences and Framing questions Vocabulary- School and college and stationary Grammar- cases in French Vocabulary-Modes of transport, Random vocabulary Grammar-cases in French Test (30 min) , Listening to CD Translation passage Writing emails ...Resume building Listening and speaking sessions Test.

(60 min)

(15hrs)

GERMAN:

Course Objectives:

3. Written communication: student can create basic-level German written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
4. Oral communication: student can create basic-level German oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

9. Exchange basic greetings in the social context.
10. Respond to classroom directions and basic commands.
11. Express basic needs in day-to-day life.
12. Provide and acquire basic personal and social information.
13. Read and write all characters and compound characters.
14. Form and understand sentences consisting of basic grammar patterns and particles.
15. Count and understand basic numbers.
16. Ask and understand the prices of commodities in stores, as well as purchase them.

Contents:

Introduction to Germany – its culture and people Pronunciation – BASIC and ADVANCED Basic Greetings and Self-Introduction Grammar- Nouns-genders, article Grammar- Nouns - Plural forms Vocabulary- Months, weekdays and daytimes and

number system Vocabulary-Time and date Grammar – Personal Pronouns Vocabulary-Family, professions Vocabulary- Directions, Common words Vocabulary –Job-Related and Modes Of Transport Grammar – Possessive Pronouns Vocabulary- House, Furniture and Draperies Vocabulary- Food and Drinks Grammar-Regular verbs Vocabulary- Vegetables and fruits Grammar-Irregular verbs Grammar-Modal verbs and Imperative Verbs WH – Questions Vocabulary- Body parts and Clothes Grammar – Sentences-types and Framing. Grammar-Imperative sentences and Framing questions Vocabulary-Common Places and Hobbies

Grammar- Adjectives and Opposites. Test –Viva and Written.

(15hrs)

JAPANESE:

Course Objectives:

3. Written communication: student can create basic-level German written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
4. Oral communication: student can create basic-level German oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

15. Exchange basic greetings in the socialcontext.
16. Respond to classroom directions and basiccommands.
17. Express basic needs in day-to-daylife.
18. Provide and acquire basic personal and socialinformation.
19. Read and write all 71 phonetic Hiragana characters and compound characters.
20. Write and understand basic vocabulary written in Hiragana.
21. Form and understand sentences consisting of basic grammar patterns and particles.
22. Count and understand basic numbers.
23. Ask and understand the prices of commodities in stores, as well as purchase them.
24. Ask about the locations and understand the simple directions given to reach there.
25. Talk about oneself, one's family and friends, likes and dislikes, surrounding objects etc.; using limited vocabulary of nouns, adjectives, verbs, counters etc.
26. Become familiar with Japanese customs, greetings, etiquettes and manners.
27. Obtain information about Japanese life style, cultural events, food, products, geographical

locations, and other socio-cultural phenomena.

28. Develop background for advanced Japanese language studies.

Contents:

Introduction of Japanese Language

- Origin, history, development, modern contemporary Japanese language
- Linguistic place of language: language family, area, native speakers, dialects
- Role of language in modern Japanese society
- Aspects of Japanese language: written, spoken, communicative Introduction of Japan as country
- General class discussion about Japan and its cultural aspects. E.g. Japanese Language, Society, History, Geography, Dressing, Food, Economy, Government and Politics, Technological innovations, Scientific advances, Fine arts, Religion and beliefs, War and peace, Education, Family relations, Work culture and daily life, Travel and tourism, Mass media, Law and order, Literature, Performing arts, Drama, Popular music, Movies and entertainment, Games and Sports,
- Environment and Nature and others.
- Introduction of Japanese Language
- Written structure: Scripts- Hiragana, Katakana, Kanji
- Spoken structure: Valid sound patterns, Consonants and vowels
- Introducing oneself in Japanese
- (Hello, How do you do, I am _____, Nice to meet you etc.)
- Hiragana Script
- Characters (10) from Aa to Ko: Stroke order writing, practice with flash cards
- General words based on completed hiragana characters(10)
- Hiragana Script
- Characters (15) from Ga to Zo: Stroke order writing, practice with flash cards
- General words based on completed hiragana characters(10)
- Hiragana Script
- Characters (15) from Ta to No: Stroke order writing, practice with flashcards
- General words based on completed hiragana characters (15) Introduction of Basic greetings1
- (Good Morning, Good Day, Good Evening, Thank you, Good Bye etc.)
- Hiragana Script
- Characters (15) from Ha to Po: Stroke order writing, practice with flashcards
- General words based on completed hiragana

characters(15)

- Hiragana Script
 - Characters (16) from Ma to N: Stroke order writing, practice with flashcards
 - General words based on completed hiragana characters (20) Counting in Japanese
 - Basic numbers (1 to 10), 2, 3 and 4 digit numbers. Reading and Writing from digits to Japanese and vice versa.
 - Hiragana Script
 - Rules for sound prolongation and its expression using hiragana.
 - Prolongation using 'u' and B. Prolongation using vowels.
 - General words based on hiragana prolonged characters (10) Grammar
 - Basic sentence pattern 'A wa B desu', 'A wa B desuka'.
 - Introduction of particles 'wa'and 'ka', copula 'desu/dewaarimasen'.
 - Hiragana Script
 - Rules for writing compound characters and its expression using hiragana.
 - o Small characters 'Ya', 'Yu', 'Yo' and B. Small character 'Tsu'
 - General words based on hiragana compound characters
- (15)**
- Grammar
- (15hrs)**

SPANISH:

Course Objectives:

1. Written communication: student can create basic-level Spanish written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
2. Oral communication: student can create basic-level Spanish oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.

Course Outcomes:

After the successful completion of this course, the student should be able to:

9. Exchange basic greetings in the social context.
10. Respond to classroom directions and basic commands.
11. Express basic needs in day-to-day life.
12. Provide and acquire basic personal and social information.
13. Read and write all characters and compound characters.
14. Form and understand sentences consisting of

basic grammar patterns and particles.

- Count and understand basic numbers.
- Ask and understand the prices of commodities in stores, as well as purchase them.

Contents:

Weeks 1-3: Capítulo 1:

Elvocabulario: Saludos y despedidas

En la clase La gramática: el alfabeto, los números 0-199, los días, los meses, las estaciones, el verbo ser, Los pronombres personales, los sustantivos, los artículos, los adjetivos

Weeks 4-6: Capítulo 2:

Elvocabulario: Las descripciones y las nacionalidades, ¿Qué haces? ¿Qué te gusta hacer?

La gramática: la hora, preguntarse sí/no, la negación, las palabras interrogativas, el verbo tener, Los verbos regulares en el presente -ar, -er, -ir

Weeks 7-9: Capítulo 3:

Elvocabulario: Las materias académicas y la vida estudiantil Los edificios de la Universidad La gramática: los números 199-3.000.000, los adjetivos posesivos, los verbos ir, hacer, y estar, Las expresiones con el verbo tener, el uso de los verbos ser/estar

Weeks 10-12: Capítulo 4:

Elvocabulario: Miembros de la familia El ocio La gramática: los verbos "boot," los verbos poner, salir, y traer, los verbos saber/conocer, Los complementos directos y sus pronombres, la "a" personal, Los adjetivos y los pronombres demostrativos

Weeks 13-15: Capítulo 5:

Elvocabulario: Las actividades diarias Los quehaceres domésticos La gramática: los verbos reflexivos, el superlativo, el presente progresivo, Las comparaciones de igualdad y de desigualdad (15hrs)

Environmental Science

Course objectives:

- Students will develop a sense of community responsibility by becoming aware of scientific issues in the larger social context.
- recognize the interconnectedness of multiple factors in environmental challenges

Course Outcomes:

- Apply the knowledge of environmental pollution & importance of current environmental issues
- Able to understand environment quality standards
- Able to utilize natural resources properly

Contents:

UNIT I - Environmental Pollution & Current Environmental Issues of Importance

Air Pollution, Water pollution, Climate Change and Global warming: Effects, Acid Rain, Ozone Layer depletion, Photochemical Smog, Waste water treatment.

(4hrs)

UNIT II- Environment Quality Standards

Ambient air quality standards, Water quality parameters; Turbidity, pH, Suspended solids, hardness, residual chlorine, sulfates, phosphates, iron and manganese, DO, BOD, COD.

(4hrs)

UNIT III - Natural Resources

Water Resources, Mineral Resources, Soil, Energy - Different types of energy, Conventional and Non-Conventional sources - Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Geothermal energy and Bio-gas.

(4hrs)

Books:

- Environmental Chemistry by B.K. Sharma & H. Kaur, Goel Publishing House.
- Environmental Chemistry by A. K De, New Age International Publishers.

Reference Books

- Instrumental method of Analysis by B.K. Sharma, Goel Publishing House.
- A Test Book of Environmental Chemistry & Pollution Control by S. S. Dara, S. Chand and Co.
- Environmental Chemistry by Samir K. Banerjee, Prentice Hall of India Pvt. Ltd. New Delhi.

TERM - II

Integral & Multiple Calculus

Course Objectives:

- To introduce the concepts of Integral calculus in the field of Engineering.
- To develop skills in student to apply the concepts of multiple integral in various engineering problems

Course Outcomes:

- Trace various curve and use integral to solve engineering problem.
- Use special integral in solving engineering problems.
- To solve various applications of engineering problems using multiple integral.

Content:

Integral Calculus: Review of Curve tracing , Gamma function, Beta function, Relation between beta and gamma function, applications to area, length, volume and surface area, Differentiation

under integral sign.

(12hrs)

Multiple Integral-I: Double integral, Change of variables, Change order of integration, Triple integral.

(6hrs)

Multiple Integral-II (Applications): Applications of multiple integral such as area, mass, volume, centre of gravity, moment of inertia. Questions related to multiple integral in GATE.

(12hrs)

Books:

5. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth Ed.
6. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2013, Forty Third ed.
7. Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers, Alpha Science International, Ltd, 2007, Third Ed.
8. Advanced Mathematics for Engineers and Scientists, Spiegel, M. R, McGraw-Hill, 2010, Second Ed.

Ordinary & Partial Differential Equations

Course Objectives:

3. To develop skills in student to solve problems of Ordinary Differential Equations and its applications in field of engineering.
4. To introduce the concepts of Partial Differential Equations and its applications in the field of Engineering.

Course Outcomes:

1. Solve first order, first degree & higher order differential equations
2. Form and solve the differential equations in engineering.
3. Understand and solve Partial differential equations in engineering problems

Content:

First order first degree differential equations: Linear, Reducible to linear and exact differential equations.

(3hrs)

Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Legendre homogeneous differential equations.

(4hrs)

Simultaneous differential equations, Special types of differential equations, Applications of differential equations to engineering systems.

(4hrs)

Introduction to Partial Differential equations, Partial differential equation of first order and its types, applications to real life problems.

(4hrs)

Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth Ed.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2013, Forty Third ed.
3. Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers, Alpha Science International, Ltd, 2007, Third Ed.
4. Advanced Mathematics for Engineers and Scientists, Spiegel, M. R, McGraw-Hill, 2010, Second Ed.

Bio Systems In Engineering

Course Objectives:

This course introduces general biological concepts

1. It helps students to understand importance of biological concepts in engineering fields.
2. To understand application of engineering concepts in medical instrumentation.

Course Outcomes:

5. Understand the use of basic biology in engineering
6. Understand & Apply the concepts of engineering for design of biomedical instrumentation
7. Understand application of engineering in bio sensors & robotic prosthesis
8. Understanding telemedicine & wireless telemetry in medical

Content:

Human Physiology & Anatomy: Introduction to Human Physiology, the Nervous System, Cardiovascular System

(5hrs)

Biomedical Instrumentation: Bio-imaging techniques, ECG, Computer aided ECG, X-Ray, Portable MRI, CT Scan, Portable scanners, Blood pressure measurement instrument, spirometry, advanced medical instruments.

(7hrs)

Bio sensors & Robotic prosthesis: Introduction & types of biosensors, its applications, prosthesis, application in healthcare services, robotic surgery.

(8hrs)

Telemedicine & Wireless Medical Telemetry: Introduction, Benefits & Drawback, History, Types & Categories: Store & Forward, Remote Monitoring, Real- Time Interactive, Future of Telemedicine. Wireless medical telemetric devices.

(5hrs)

Case Studies: Role of Engineers in various disciplines of medical science:

Civil- Biomechanics

Mechanics- Biomaterial & 3D Bio printing

ETC. ETRX & EE- Sensors & transducers

IT & CSE- Neurotranslator & prosthesis (5hrs)

Books:

2. Biomedical Instrumentation, Dr. M. Arumugam Anuradha, 2002 Second

IOT Practical**Course objectives:**

3. To understand key technologies in Internet of Things.
4. Analyze, design or develop parts of an Internet of Things solution
5. Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcomes:

1. Identify and adopt knowledge of the terminology, requirements and constraints for IoT development.
2. Demonstrate IoT system for smaller applications.

Content:

1. Introduction to Internet of things
2. Hands on Raspberry Pi and programming.
3. Controlling different displays like LED, Seven Segment, LCD etc, using IoT
4. Data acquisitions, monitoring and cloud services.

Books:

1. IoT: Building Arduino-Based Projects, Peter Waher, Pradeeka Seneviratne, Brian Russell, Drew Van Duren, Packt Publishing Ltd., 2016
2. Internet of Things with the ArduinoYún, Marco Schwartz, Packt Publishing Ltd., 2014
3. Building Arduino Projects for the Internet of Things, AdeelJaved, Apress, 2016
4. the Internet of Things, Donald Norris, McGraw-Hill Education, 2015

Applied Physics**Course Objectives:**

1. Demonstration of the fundamentals of Quantum Mechanics and its related applications.
2. Introduction to the working and applications of fundamental lasers.
3. Familiarization and demonstration of the concepts of interference and polarization and its application
4. Explanation of the concepts of semiconductor physics and working of various diodes.

Course Outcomes:

1. Apply the knowledge of Quantum Mechanics to solve related problems and its applications.
2. Explain the fundamentals of laser & identify its applications.
3. Describe the phenomenon of interference & polarization to solve concerned problems & applications.

4. Demonstrate the knowledge of semiconductor to use related devices and its applications.

Content:

Unit I: Quantum Mechanics: Compton Effect & its applications, Heisenberg's Uncertainty principle & its applications, Schrödinger's wave equation and its application viz. Eigen values and Eigen functions of "particle in a box", quantum constriction, quantum computing.

(10hrs)

Unit II: Optics : Interference and Polarization and its applications viz. Antireflection coatings, filters, Polaroid's, LASER and its applications viz. Holograms, printers.

(10hrs)

Unit III: Semiconductors: Basics of semiconductor physics, Hall Effect, types, devices viz. pn junction diode & its applications.

(8hrs)**Books:**

1. Physics for Engineering, Dr. B P Butey, Oxford University Press, 2017, First Ed
2. Fundamentals of Physics, David Halliday and Robert Resnik, New Age, 1994, Fourth Ed
3. Nanotechnology, Dr. Sulbha K Kulkarni, Capital Publishing Co, 2011, Second Ed

Introduction To Digital System Design**Course Objectives:**

1. To familiarize with various Digital IC
2. To understand basic fundamentals of Digital circuits.
3. To prepare for various engineering applications.

Course Outcomes:

1. Solve the problems on Number system codes and their conversions.
2. Identify Digital IC and implement in the circuits.
3. Create, design and simulate canonical logic forms
4. Demonstrate the application of combinational and sequential logic circuits.

Content:**Unit I: Number Systems & Boolean Algebra**

Decimal, binary, octal, hexadecimal number system and conversion, binary weighted & non-weighted codes & code conversion, signed numbers, 1s and 2s complement codes, Binary arithmetic, Binary logic functions, Boolean laws, truth tables, associative and distributive properties, De-Morgan's theorems, realization of switching functions using logic gates.

(10hrs)**Unit II: Combinational Logic:**

Switching equations(Mathematical operations), canonical logic forms, sum of product & product of

sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, mixed logic combinational circuits, multiple output functions, QuineMccluskey Methods for 5 variables. Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers & De-multiplexer, binary adder, subtractor, BCD adder, carry lookahead adder, Binary comparator, Arithmetic Logic Units (10hrs)

Unit III: Sequential Logic & Circuits:

Latch, flip-flops, clocked and edge triggered flip-flops, timing specifications, asynchronous and synchronous counters, counter design, Registers, types of registers. Analysis of simple synchronous sequential circuits, Introduction to Mealy and Moore Circuits. (10hrs)

Books:

1. Digital Electronics, R P Jain, McGraw Hill, 2017, Second Edition
2. Digital Logic and Computer Design, Morris Mano, PHI, 2017 review, Second Edition
3. Digital Electronic Principles, Malvino, PHI, 2011-13, Seventh Edition

Embedded Programming

Course Objectives:

3. To give the awareness of major embedded devices.
4. To give the knowledge about interfacing devices.

Course Outcomes:

3. Recognize and analyze given embedded system design and its performance.
4. Demonstrate application based competencies in Embedded Programming.

Content:

1. Introduction to Embedded system and programming.
2. Hands on Arduino board and its IDE.
3. Interfacing LEDs, switches, seven segment display, LCD, LDR, and Potentiometer.
4. Applications using Temperature, IR, Buzzer, finger print sensor.

Books:

1. Designing Embedded Systems with Arduino: A Fundamental Technology for Makers, Tianhong Pan(Author), YiZhu (Author), Springer, 2017, First
2. Getting Started With Arduino 3rd Edition, Massimo Banzi, Michael Shiloh, Maker Media, 2014, Third
3. Arduino-Based Embedded Systems: Interfacing, Simulation, and Lab VIEW GUI,

Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushabhan Choudhury, CRC Press, 2017, First

4. (Make) Lego and Arduino Projects, John Baichtal, Matthew Beckler and Adam Wolf, Maker Media, 2012, First
6. Arduino projects for Engineer, NeeraprajRai, BPB publication, First Edition, 2016.

Digital Fabrication

Course Objectives:

1. To familiarize with basic CAD modeling and digital manufacturing methods.
2. To equip with various techniques to create prototype & product design and developments.
3. To train in 3 D part modeling and additive manufacturing appropriately
4. To understand the concept of rapid tooling and its requirement

Course Outcomes:

1. Understand and use techniques for processing of CAD models for rapid prototyping
2. Understand and apply fundamentals of rapid prototyping techniques.
3. Use appropriate tooling for rapid prototyping process.
4. Select the processing parameters best suited to the production of prototype
5. Incorporate and select right approaches and considerations for successfully developing new product designs.

Content:

Introduction to Additive Manufacturing - 3 D Printing and Computer aided design Software's – CATIA v5
 2 D Sketching on CATIA v5 - To prepare 2D geometrical model by using sketcher toolbar, entities and Views
 2 D Sketching on CATIA v5 - To prepare 2D geometrical model using drawing constraint and modifying toolbars.
 3D Modelling on CATIA v5– To prepare part model using 2 D drawing and with basic extrusion tools.
 -Conversion of part file to .stl format
 -3D Modelling on CATIA v5 - To prepare part model using Revolve command
 -Conversion of part file to .stl format
 -3 D Printing Slicing / Pre-processing
 -To pre-processed model for 3 D Printing using of Kisslicer/Cura 4.0 Software's
 -3 D Printing Slicing - Development of g.code by using Kisslicer/Cura 4.0 Softwares for 3 D Printing

- 3 D Printing – Introduction to Fused deposition modelling technique
- Introduction to FDM Machine and operating controls.
- 3 D Printing – Development of prototype using additive manufacturing – 3 D Printing
- Case- Studies

(30hrs)

Books:

1. Gibson, I, Rosen, D W., and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
2. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
3. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
4. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.
5. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer
6. Bartolo, P J (editor), Virtual and Rapid Manufacturing: Advanced Research in
7. Virtual and Rapid Prototyping, Taylor and Francis, 2007.
8. Hopkinson, N, Haque, R., and Dickens, P., Rapid Manufacturing: An Industrial Revolution for a Digital Age: An Industrial Revolution for the Digital Age, Wiley, 2005.
9. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001.
10. Rapid Prototyping by M. Adithan, Atlantic Publication.

Mini-Model Through Innovation And Creativity

Course Objective:

1. To enhance the skill of planning and designing.
2. To implement basic concepts.
3. To develop innovative and creative learning.

Course Outcomes:

1. Demonstrate the skills of planning and designing for developing a working mini model.
2. Implement knowledge of concepts learnt and workshop practices to prepare a model.
3. Use innovative ideas and convert these into physical models.

Communication Skills

Course Objectives:

4. To develop an understanding in the students regarding communication skills

5. To develop the four essential communication skills in students i.e. – reading, writing, listening and speaking
6. To develop the vocabulary and English proficiency of the students

Course Outcomes:

7. To demonstrate oral communication in a formal manner
8. To apply vocabulary for demonstrating English proficiency.
9. Development of Reading Skills.
10. Development of Writing Skills.
11. Development of Listening Skills.
12. To use grammar for appropriate communication.

Content:

Basics of Grammar (Noun, Pronoun, adjective, verbs, tenses, punctuation), 7 Cs of Communications, Communication Process, Presentation Skills and Mock Presentation, Essay and Creative writing, Effective Writing, Skills: Elements of Effective Writing Email Etiquettes, Listening (Voice Versant), Ad making, Story Telling, IETLS training, BEC Training, Group Discussion and mock Gds, Self-Introduction, Book Review and Elocution. (45hrs)

Books:

4. Effective Technical Communication, M. Ashraf Rizvi, Tata McGraw Hill, 2012, First
5. Communication Skills, Sanjay Kumar and Pushpata, Oxford University Press, 2015, Second
6. High School English Grammar and Composition, P C Wren and H Martin, S Chand, 2005, Revised First

Entrepreneurship

Course Objectives:

4. To make students aware of the need self-earning system.
5. To develop interest in creative business ideas.
6. To make them capable of becoming entrepreneurs.

Course Outcomes:

3. Develop self-confidence to become an entrepreneur.
4. Develop a creative thinking for growth of self and society.

Content:

Lesson 1: Let's Get Started

- Form teams that students will work with for the entire duration of the course.
- Learn how entrepreneurship has changed the world.
- Learn what entrepreneurship is.

- Identify six entrepreneurial myths and uncover the true facts.

Learn how entrepreneurship has changed your country through a class discussion.

(2hrs)

Lesson 2: Explore E-cells on Campus

- Appreciate the fact that E-cells help shape career dreams and develop skills required to build a successful career.
- Understand how E-cells can transform individuals into successful leaders and entrepreneurs.
- Get inspired by the success story of Local Entrepreneurs.
- Express your dreams.

(2hrs)

Lesson 3: Listen to Some Success Stories

- Understand how ordinary people become successful global entrepreneurs, their journeys, their challenges, and their successes.
- Understand how ordinary people from their own countries have become successful entrepreneurs.

(2hrs)

Lesson 4: Characteristics of a Successful Entrepreneur

6. Understand the entrepreneurial journey and the concept of different entrepreneurial styles.
7. Understand each of the five entrepreneurial styles in the model and how they differ from each other.
8. Identify your potential entrepreneurship style based on personality traits, strengths, and weaknesses.
9. Understand how different entrepreneurship styles work, and how people with different styles work together.

(2hrs)

Lesson 5: Design Thinking

1. Understand Design Thinking as a problem-solving process.
2. Describe the principles of Design Thinking.
3. Describe the Design Thinking process.

(2hrs)

Lesson 6: Sales Skills to Become an Effective Entrepreneur

1. Understand what customer focus is and how all selling effort should be kept customer-centric.
2. Use the skills/techniques of personal selling, Show and Tell, and Elevator Pitch to sell effectively.

(4hrs)

Lesson 7: Managing Risks and Learning from Failures

1. Understand that risk-taking is a positive trait

2. Identify risk-taking traits and resilience traits
3. Appreciate the role of failure on the road to success and understand when to give up

(2hrs)

Lesson 8: Orientation Program in Entrepreneurship

Identify the reasons why people want to become entrepreneurs.

1. Help participants identify why they would want to become entrepreneurs.
2. Give participants the real picture of the benefits and challenges of being an entrepreneur.

(2hrs)

Books:

2. Stay Hungry Stay Foolish, Rashmi Bansal, Westland, 2008

Waste Management

Course objectives

1. To study industrial waste generation patterns, as well as management and disposal techniques
2. To categorize different types of waste

Course Outcomes

1. To apply creative & innovative practices for waste management.
2. To identify hazardous and non-hazardous waste
3. To describe the major categories of waste, disposal techniques and technologies.

Contents

1. Case study of Physiochemical analysis of water from different sources (River/lake/well/bore well)
2. Case study of physiochemical analysis of solid waste (industrial / municipal)
3. Case studies on best practices of solid waste management
4. Visit to a solid waste processing unit
5. Case studies on e-waste
6. Case studies on biomedical waste
7. Case studies biomass generation from organic waste
8. Waste water source of pollution and treatment techniques from Nagpur water resources.

Books:

1. Environmental Chemistry, B.K. Sharma & H. Kaur, Goel Publishing House, 2014, fourth ed.
2. Environmental Studies, R. Rajgopalan, Oxford Publication, 2016, hird ed.
3. A Test Book of Environmental Chemistry & Pollution Control, S. S. Dara, S. Chand and Co., 2007, seventh ed.

Introduction To Biochemistry

(OPEN ELECTIVE)

Course Objectives

1. Deals with the study of structural and functional aspects of biomolecules.

Course Outcomes

1. Able to understand basics of biochemistry
2. Apply the knowledge of metabolism of carbohydrates.
3. Discuss the structure, properties and reactions of proteins and amino acids
4. Discuss the structure, properties of fats
5. Demonstrate the knowledge of advanced trends in biochemistry

Contents:

Unit I - Carbohydrates, Lipids And Proteins

Monosaccharide's, complex carbohydrates, glycoprotein's, Lipids and cell membranes – types of membrane lipids, phospholipids and glycolipids from bimolecular sheets, Protein structure and function – Primary, Secondary, Tertiary, Quaternary Structures.

(8hrs)

Unit II- Metabolism Of Carbohydrates

Glycolysis, Glucogenesis, Citric acid cycle and Glycogen metabolism

(5hrs)

Unit III- Protein Metabolism

Protein turnover and Amino acid catabolism, Biosynthesis of amino acids

(5hrs)

Unit IV- Fatty Acid Metabolism And Nucleic Acid Metabolism

Overview of Fatty Acid Metabolism, synthesis and degradation of fatty acids, De novo synthesis of Nucleotides.

(6hrs)

Unit V- Advanced Trends In Biochemistry (6hrs)

Books:

1. Biochemistry, Jeremy M.Berg, W.H. Freeman and Company, 2014, 5th ed
2. Biochemistry, Rastogi, Tata Mc Graw Hill, 2014, 4th Ed.
4. Biochemistry, Stryer L W.H. Freeman and Company, 2007, 7th Ed.

Smart Materials (OPEN ELECTIVE)

Course Objectives

1. Introduction of the Smart Materials and its classification on the basis of structure.
2. Introduction to the concept of various smart materials like metallic glass, shape memory alloys, piezoelectric, magnetostrictive, and photonic materials
3. Introduction to the applications of smart materials in various engineering fields.

Course Outcomes: Student shall be able to

CO1: understand the concepts of Smart materials and its classification.

CO2: Apply the knowledge of metallic glasses to understand working of devices based on it.

CO3: Apply the knowledge of piezoelectric materials to understand related applications.

CO4: Apply the knowledge of photonic materials to understand its applications.

CO5: Apply the knowledge of superconductors to understand its applications.

CO6: Demonstrate the knowledge of advanced topics related to Metallic Glasses, SMA, piezoelectric, photonic and superconductors

Content:

Introduction to Smart Materials:

Introduction to crystal structures, Introduction to the concept of Smart Materials & composites.

(3hrs)

Metallic glasses and Shape Memory Alloys:

Metallic glasses and bulk metallic glasses, shape memory alloys: types and applications in engineering fields.

(5hrs)

Piezoelectric Materials & Composites:

PVD & its applications.

(5hrs)

Photonic Materials:

Solar cells, smart coatings and photo biology.

(4hrs)

Super Conductors:

Types I and type II Super Conductors, Meissner effect, critical current, Josephson effect, High temperature superconductors, and their engineering applications, quantum super conductor.

(5hrs)

Advanced trends in smart materials:

Introduction to thin film and devices.

(3hrs)

Books:

- 1 Elementary solid state Physics, M. Ali Omar, Pearson Education Inc., 2009, Sixth Ed
- 2 Engineering Physics, B. K. Pande and S. C. Chaturvedi, Cengage Learning Pvt Ltd, 2012, First Ed

Smart Structure and Materials, Brian Culshaw, Artech House – Boston. London, 1996, Second Ed

Nanomaterials and Sensors (Open Elective)

Course Objectives:

- 1 Demonstration of the structures and classification of nano-materials.
- 2 Introduction to the properties of nano-materials.
- 3 Demonstration of various Synthesis and fabrication techniques of nano-materials.
- 4 Explanation of various Characterization techniques of nano-materials.
- 5 Introduction to various types of nano-sensors.
- 6 Explanation of design and application of various nano sensors used in 1U/3U satellites.

Course Outcomes: Student shall be able to

- 1 Identify various structures and classification of nano-materials.
- 2 Describe properties of nano-materials.
- 3 Illustrate various Synthesis and fabrication techniques of nano-materials..
- 4 Recognize various Characterization techniques of nano-materials.
- 5 Demonstrate knowledge of various types of nano-sensors.
- 6 Select and demonstrate design and type of nano-sensors used for various applications in 1U/3U satellites.

Contents

Introduction: Definition of nano materials. Classification of nanostructured materials.

Properties of Materials: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties

Synthesis Techniques: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method, Self-assembly, **Top down approaches:** Mechanical alloying, Nano-lithography

Characterization Techniques: X-Ray diffraction and Scherrer method (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning probe microscopy, atomic force microscopy (AFM), photoluminescence spectra, Raman spectroscopy

Nano Sensors: What are Sensors and actuators, Nano-Sensors and Nano actuators, Types of Sensors, Physical, Chemical, Bio-Sensors and Optical Sensors, Attitude Sensors-Infrared Band-Pass Filter; Star Tracker; Sun Sensor; Analog Sun Sensor; IR Earth Sensor and Space Sextant, Attitude Actuators- Reaction Wheel; Compact Magnetorquer; Magnetorquer Rod, Infrared Spectrometer, Imager

Design, Applications & Future Challenges: Design aspects of compact Nano-Sensor arrays for various applications in 1U/3U satellite, Sensitivity of Sensor, Nanowires, Carbon Nanotubes and its application in space technology.

List of Books

1. Nano science and nanotechnology, M.S Ramachandra Rao, Shubra Singh, Wiley publishers.
2. Applications of Nano-materials in Sensors and Diagnostics, Editors: Tuantranont, Adisorn (Ed.) Springer Series on Chemical Sensors and Biosensors
3. Introduction to Nano Technology, Charles P. Poole, Jr., Frank J Owens, Wiley India
4. Nanotechnology, Jermy J Ramsden, Elsevier publishers
5. Nano Materials, A K Bandyopadhyay, New Age Introduction
6. Nano Essentials, T Pradeep, TMH
7. Nanotechnology the Science of Small, M.A Shah, K.A Shah, Wiley Publishers

8. Principles of Nanotechnology, Phani Kumar, Scitech.

Introduction To Biochemistry Liberal & Creative Arts

Course Objective

1. To enable the student to have good health
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.

Course Outcomes: Student shall be able to

1. Demonstrate basic skills associated with yoga
2. Demonstrate basic skills associated with yoga activities including strength
3. and flexibility, balance and coordination.
4. Demonstrate an understanding of health-related fitness component

Contents:

Anatomy and Physiology of Yogic Practices

- Introduction to Human Body and systems in brief with special reference to Respiratory, Digestive, Muscular and Nervous systems.
- Postural Physiology with reference to Asana.
- Asana - Definition and Classification, Similarities and dissimilarities between Asana and Exercise.
- Pranayama - Definition and Classification. Difference between pranayama and deep breathing. Importance of Rechaka, Kumbhaka, Puraka.
- Introduction to Kriyas, Mudras and Bandhas in brief.

Yogasana

- Sandhi Snchalan
- Suryanamaskar
- Tadasan
- Vrukshasan
- Vajrasana and its types
- Pavan Muktasana
- Urshtasana
- Om Uchharan

TREM –III

BFYL 108 (Mathematics-V) (LT, FS and applications)

Teaching Scheme				Credits						ESE Duration Hours	
T	T	P	Total		Theory			Practical			Total
					TA	CA	ES	Int.	Ext.		
2	1	-	3	2	10	15	25	-	-	50	2
H	H										

COURSE OBJECTIVES

Students undergoing this course are expected to:

1. Learning periodic functions and their Fourier expansion.
2. Learning partial differential equation

Course Outcomes

Upon the successful completion of the course, learners will be able to

Course Outcomes

CO1 Understand Fourier Series and its applications to solve civil engineering problems.

CO2 Use concepts of partial differential equation and its relevance in engineering.

Pre Requisite

Higher Secondary Level Mathematics BE First year

Course Contents

UNIT I - Fourier series: Periodic functions and their Fourier expansion, even and odd function, change of interval, half range expansion

UNIT II- Partial Differential Equations and its application: Partial differential equations of first order & first degree (i.e. Lagrange's form), linear homogeneous partial differential equation of nth order with constant coefficients. Method of separation of variable. Simple applications.

UNIT III- Method of separation of variable. Simple applications.

Text Books

Higher Engineering Mathematics, Grewal B.S.: Khanna Publishers; 2013 Forty Third

Reference Books

- o Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2013, Tenth
- o Advanced Engineering Mathematics Jain, R.K. and Iyengar, S.R.K Narosa Publishers; Alpha Science International, Ltd., 2007, Third
- o Advanced Mathematics for Engineers and Scientists, Spiegel, M. R McGraw-Hill 2010, Second

BCEL224: Fluid Mechanics (Theory)

(Lectures–Tutorial–Practical–Credit) / Week (1-0-2-1)
Total Hrs: 30 Marks-50

Course objective

1. To study the basic behavior of fluids and fluid system and the laws governing this behavior
2. To understand and apply the basic concepts of Fluid Mechanics to carry out professional engineering activities in the field of fluids.

3. To apply scientific strategies to analyze qualitatively and quantitatively the problems and give solutions.

Course Outcomes: Student shall be able to

CO1. classify the various properties of fluid and its behavior

CO2 Analyse hydrostatic forces in submerged bodies

CO3 Identify type of flow for compressible and in compressible fluid

CO4 Explain the concepts of dynamics of fluid flows and the governing non-dimensional parameters

Unit-I Kinematics of Fluid flow: Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential, source, sink, doublet and half-body.

Hrs-04

Unit-II Fluid Statics Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies,

Hrs-04

Unit-III Dynamics of Fluid Flow : Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, notches and weirs, momentum equation and its application to pipe bends.

Hrs-04

Unit-IV Laminar and Turbulent Flow:

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow,

Hrs-04

Text Books:

1. Modi, P.N., and Seth, S.H., Hydraulics and Fluid Machines 19th Edition, Standard, Book House, 2011
2. F M White, Fluid Mechanics, Tata McGraw Hill Publication 2011. .

Reference Books: (At Least 04 to 05)

1. Som S.K. & Biswas G, Introduction of fluid mechanics & Fluid Machines, 2nd Edition, TMH, 2000

2. Garde, R.J, Fluid Mechanics through Problems, 2nd Edition, New Age International, Pvt. Ltd, New Delhi, 2005
3. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid Mechanics, Student Edition Seventh, Wiley India Edition, 2011.
4. Shames, Mechanics of Fluids, McGraw Hill Book Co., New Delhi, 1988.
5. Streeter V.L., Benjamin Wylie, Fluid Mechanics, McGraw Hill Book Co., New Delhi, 1999.

e- Learning Resources:

www.nptel.iitm.ac.in/iitkanpur. &
www.nptel.iitm.ac.in/iitDelhi.

BCEL224 Fluid Mechanics (Practical)

List of Practical's

Total Hrs: 02/Week Marks-25

Course Outcome: Student shall be able to

C01	Understand the various properties of fluid and its behavior
C02	Identify type of flow for compressible and incompressible fluid
C03	Compute hydrostatic forces in submerged bodies
C04	understand the concepts of dynamics of fluid flows and the governing non-dimensional parameters,
C05	Apply concepts of mass, momentum and energy conservation to flows
C06	Understand the basic ideas of turbulence.
PR-1	To verify Bernoulli's theorem
C01	
PR-2	To determine co-efficient of discharge of Venturimeter.
C02	
PR-3	To determine co-efficient of discharge of Orifice Plate.
C03	
PR-4	To determine co-efficient of discharge of Rectangular Notch.
C02	
PR-5	To determine co-efficient of discharge of Triangular Notch.
C04	
PR-6	To determine co-efficient of discharge, contraction & velocity of an orifice.
C06	
PR-7	To verify momentum equation using the experimental set-up on diffusion of submerged air jet
C05	
PR-8	To determine co-efficient of discharge of Orificemeter.
C06	
PR-9	To find a critical Reynold's number for a pipe flow
C04	

- PR-9** To determine the meta centric height of a floating body

C03

- PR-10** To determine head loss in pipe (Expansion, Contraction and Bend)

C02

BCEL225: Hydrology & Water Resource Engineering (Theory)

(Lectures–Tutorial–Practical–Credit) /

Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. **To understand the hydrological cycle and its process.**
2. **To understand the infiltration characteristics of runoff**
3. **To characterize developing hydrograph.**

Course Outcome: Student shall be able to

C01	Classify hydro-meteorological parameters & estimate abstractions from precipitation
C02	Apply the mechanism of Evaporation, Transpiration and Evapotranspiration in real life situation
C03	Analyze rainfall-runoff models and analysis of hydrographs
C04	Interpret hydrologic flood routing models for recharging through rain water harvesting.

Unit-I Introduction.

Hydrological Equations and brief description of its components. Importance of temperature, wind and humidity in hydrology. Earth and its atmosphere and importance. Definition and classifications. Selection of site, density and adequacy of rain-gauge station.

Hrs-04

Unit-II Infiltration: Definition, mechanism, factors affecting, numerical.

Evaporation: Definition, mechanism, factors affecting, numerical.

Transpiration: Definition, mechanism, factors affecting. Numerical. **Hrs-06**

Unit-III Run off : Source components of runoff, classification of streams, factors affecting. Estimation of discharge and Measurement methods, numerical.

Hydro graphs:

Unit hydrographs. Base flow and base flow separation, S-Curve theories Numerical.

Hrs-10

Unit-IV Floods

Causes and effects, factors affecting Flood routing and flood forecasting, numerical.

Ground water recharge

Recharging methods, spreading methods. Recharge through rain water harvesting.

Hrs-10

Text Books:

1. Dr. P. Jaya and Rami Reddy, Text book of hydrology, 3rd Edition, Laxmi Publication, 2007
2. R. K. Sharma and T. K. Sharma, Text book of hydrology and water resource engineering, 5th Edition, Dhanpat Rai Publications, 2007

Reference Books: (At Least 04 to 05)

1. Subrahmanya, K., 2008, Engineering Hydrology, Tata McGraw Hill Pub. Co., New Delhi.
2. Viesmann W and Lewis G Lt (2008) "Introduction to Hydrology". Prentice Hall of India.
3. Chow, V. T., Maidment and Mays, L. A., 2010, Applied Hydrology, Tata McGraw Hill Pub. Co., New York.

e- Learning Resources:

www.nptel.iitm.ac.in/iitkanpur.
www.nptel.iitm.ac.in/iitDelhi.

BCEL 221: Materials, Testing & Evaluation
(Theory)

(Lectures–Tutorial–Practical) / Week (1-0-0-2)

Total Hrs: 16 Marks-50

Course Objectives:

1. Make measurements of behavior of various materials used in Civil Engineering
2. Introduce experimental procedures and common measurement instruments, equipment, devices
3. Exposure to a variety of established material testing procedures and techniques

Course Outcome: **Student shall be able to**

- C01** Observe various modes of failure in compression, tension, and shear
- C02** Document the experimental program including the test procedures, collected data, method of interpretation and final results
- C03** Measure physical properties of common structural and geotechnical construction materials
- C04** Interpret the laboratory data including conversion of the measurements into engineering values and derivation of material properties (strength and stiffness) from the engineering values

Syllabus

Unit-I Introduction to Engineering Materials

Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these

Hrs-05

Unit-II Mechanical behavior and mechanical characteristics

Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep – fundamentals and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

Hrs-05

Unit-III Standard Testing & Evaluation Procedures covering

Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep

Hrs-06

Text Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.), R. Butterworth-Heinemann
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Materials and Pavement Testing', Nem Chand & Bros, Fifth Edition

Reference Books:

1. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications
2. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
3. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)

BCEL 221: Materials, Testing & Evaluation
(Practical)

Total Hrs: 02/Week

Marks-25

Course Outcome: **Student shall be able to**

- C01** Observe various modes of failure in compression, tension, and shear
- C02** Document the experimental program including the test procedures, collected data, method of interpretation and final results
- C03** Measure physical properties of common structural and geotechnical construction materials
- C04** Interpret the laboratory data including conversion of the measurements into engineering values and derivation of material properties (strength and stiffness) from the engineering values

List of Practical's

- PR-1** Gradation of coarse and fine aggregates
CO2

- PR-2** Compressive strength test on aggregates
CO1
- PR-3** Tests on unmodified bitumen and modified binders with polymers
CO3
- PR-4** Bituminous Mix Design and Tests on bituminous mixes - Marshall method
CO3
- PR-5** Different corresponding tests and need/application of these tests in design and quality control
CO3
- PR-6** Tensile Strength of materials & concrete composites
CO1
- PR-7** Tension I - Elastic Behaviour of metals & materials
CO1
- PR-8** Tension II - Failure of Common Materials
CO4
- PR-9** Torsion test
CO1
- PR-10** Hardness tests (Brinell's and Rockwell)
CO1
- PR-11** Soil Classification
CO2
- PR-12** Consolidation and Strength Tests
CO3

BCEL 222: MECHANICS OF MATERIAL (Theory)

(Lectures–Tutorial–Practical) / Week (2-1-0-0)
Marks-50 Total Hrs: 30

Course Objectives:

1. To study the various mechanical properties of materials.
2. To provide systematic methods for solving engineering problems in solid mechanics.
3. To use the fundamental concepts of stress, strain and elastic behavior of materials.

Course Outcome: **Student shall be able to**

- CO1** Understand the linear & lateral stresses in sections
- CO2** Construct the shear force and bending moment diagrams
- CO3** Develop the bending stress and shear stress distribution of beam
- CO4** Design the hollow & solid shafts for torsional stresses
- CO5** Evaluate the slope and deflection of beams subjected to loads
- CO6** Determine the principal stresses and principal planes

Syllabus

Unit-I Mechanical Properties and Uniaxial Problems:
Concept of stress and strain, Stress strain behavior of ductile and brittle material in uniaxial state of stress.

Elastic constants, Relation between elastic constants. Uniaxial loading and deformation of simple cases of statically indeterminate problems under axial loading.

Hrs-06

Unit-II Shear Force & Bending Moment Diagrams:

Determination of shear forces and Bending moment at a section, SF and BM diagram in beams, Differential relation between shear force and bending moment, Relation between load and shear force.

Hrs-05

Unit-III Shear & Bending Stresses in Beam: Bending stresses in simple beam, Assumptions and derivation of simple bending, Homogeneous and composite beams. Shear stresses in simple beams, shear stress distribution, Shear Stress in composite beams.

Torsion of Shafts: Torsion of circular sections, Assumptions and derivation of relations between torsional moment, Shear stresses and angle of twist. Torsional stress in solid and Circular sections

Hrs-09

Unit-IV Slope & Deflection of determinate beams:

Differential equation relating deflection and moment shear and load, Deflection of simple beams by integration.

Hrs-

05

Unit-V State of Stress In Two Dimensions:

State of stress in two dimensions, Differential equation of equilibrium, Transformation of stresses , Principal stresses, Maximum shear stresses, Mohr's circle, Combined bending and torsion, Combined effect of Torsion and Shear. **Hrs-05**

Text Books:

1. R. K. Rajput, Strength of material, 4th Edition, S.Chand, 2006
2. Beer and Johnston, "Mechanics of Material", Tata Mc Graw Hill publication

Reference Books:

1. James Gare, Mechanics of Material, 8th Edition, Cengage Learning, 2012
2. B. C. Punmia, Mechanics of Material, 15th Edition, Laxmi Publications, 2005
3. Gere and Timoshenko, "Mechanics of Materials", CBS publishers

Online Certification Courses:

1. Strength of Materials, Prof. Sriman Kumar Bhattacharyya, IIT Kharagpur. (NPTEL Course)

Best faculty members from IIT:

1. Prof. Sriman Kumar Bhattacharyya, IIT Kharagpur
2. Dr. A. D. Ghare, Professor, VNIT, Nagpur
3. Dr. R. S. Jangid, Professor, IIT, Bombay

BCEL 223 Soil Mechanics-I (Theory)

(Lectures–Tutorial–Practical) / Week (1-1-2-4)

Marks-50 Total Hrs: 30

Course Objective :

Course Outcome: **Student shall be able to**

CO1 Characterize and classify different types of soils

CO2 Identify the methods for determination of soil properties and different types of classification systems

CO 3 Implement the concepts of flow of water through soil

CO 4 Apply the concept of compaction and consolidation on field

Unit-I Introduction & Physical properties of soil:: Introduction to Soil and Soil Mechanics, Civil Engineering problems related to soils, Complexity of soil nature, Soil formation and soil types, Soil- a three-phase system, Solids-water-air relationships, water content, void ratio, porosity, degree of saturation, unit weight, specific gravity, their interrelationships and Laboratory determination

Hrs-07

Unit-II Index properties of soil & Classification of soils:: Grain size distribution by sieve analysis, Consistency of clays and determination, Atterberg's limits and indexes as per IS code, Necessity of classification, criteria for classification, classification based on grain size and plasticity, Indian standard classification system

Hrs-

07

Unit-III Permeability & Seepage analysis: Darcy's law, methods of determination of coefficient of permeability of soils – constant head and falling head permeability tests, factors affecting permeability, approximate coefficient of permeability of common soils, field permeability tests, Seepage pressure, upward flow, quick condition, two-dimensional Laplace equation, Flow net and its properties Effective Stress Principle

Hrs-07

Unit-IV Soil compaction: Necessity of compaction in field, Standard Proctor test, Modified Proctor test, compaction curve, OMC and Maximum dry density, Compaction curve for sand, factors affecting compaction, structure and engineering behavior of compacted soil, Zero air void line, Compaction in field, suitability of various compaction equipments

Consolidation: The consolidation process, spring analogy, consolidation of laterally confined soil, Terzaghi's theory of one-dimensional consolidation (no derivation), solution of the consolidation equation, determination of coefficient of consolidation, square root time fitting method, logarithm of time fitting method, coefficient of compression, coefficient of volume change, consolidation settlement, consolidation of undisturbed specimen, determination of pre-consolidation pressure.

Hrs-09

Text Books:

- V.N.S Murthy, Text Book of Soil Mechanics and Foundation Engineering, CBS Publishers

Reference Books:

1. Alam Singh, Soil Mechanics in Theory & Practice, 12th Edition, Asia Publishing House, 2011
2. Holtz, R.D. and Kovacs, W.D, An Introduction to Geotechnical Engineering, 2nd Edition, Prentice Hall, 1981
3. Couduto, D.P., Geotechnical Engineering – Principles and Practices, 2nd Edition, Prentice Hall of India, 2002
4. Ranjan, G. and Rao, A.S.R, Basic and Applied Soil Mechanics, 3rd Edition, New Age International Publishers, 2005
5. K.R. Arora, Soil Mechanics & Foundation Engineering, 5th Edition, Standard Publishers

I.S. Codes:- IS 2720- Part 1 to 41(1977)

e- Learning Resources:

www.nptel.iitm.ac.in/iitkanpur.

www.nptel.iitb.ac.in/iitBombay.

BCEL226 Instrumentation & Sensor Technologies

for Civil Engineering Applications (Theory)

(Lectures–Tutorial–Practical-credits) /

Week (2-0-0- 2)

Marks-50 Total Hrs: 30

Course objective

1. **To Understand the fundamental mechanisms of various modern analytical instrumentation**
2. **To Design an instrumentation circuit and analyse its properties**
3. **To Understand the application of sensor technologies in transportation**

Course Outcome: **Student shall be able to**

CO1 To Understand the fundamental mechanisms of various modern analytical instrumentation.

CO2 Design an instrumentation circuit and analyse its properties

CO3 To Understand the techniques for *Data Analysis* for modern instrumentation system

CO4 Demonstrate knowledge on sensor system and usage of various sensors smart sensor system.

CO5 Application of sensor technologies in transportation

Unit-I General Instrumentation measurement system: Static Characteristics: systematic characteristics, statistical characteristics, calibration; Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, and dynamic error in measurement systems. Techniques for dynamic compensation, loading effect, signal and noise in measurement system. **Hrs-07**

Unit-II Signal Conditioning Elements in instrumentation: instrumentation amplifier, Deflection bridges: design of resistive and reactive

bridges, push-pull configuration for improvement of linearity and sensitivity Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non inverting and differential amplifiers, and filters. A.C. carrier systems, phase sensitive demodulators, signal processing elements: A/D conversion: sampling, quantization, encoding

Hrs-07

Unit-III Data Analysis and Interpretation : Fundamental statistical concepts, Data reduction and interpretation, Piezometer, Inclinator, Strain gauge, etc. Discrete signals, Signals and noise . Statistical methodology: Average value (mean), standard deviation.

Hrs-08

Unit-IV Smart Sensors: Introduction to fiber-optic sensors, Integrated Hall Magnetic Sensors, Inertial Sensors, liquid level sensing, fluid flow sensing, Smart Acoustic Sensors, Multi-Electrode Capacitive Sensors.

Digital Sensors: Introduction to digital encoding transducer- classification-digital displacement transducers- shaft encoder-optical encoder,

Hrs-08

Text Books:

1. "Measurement and Instrumentation - Theory and Application", by A. Morris & R. Langari, Elsevier 2012
2. "Instrumentation", by F. W. Kirk, T. A. Weedon, and P. Kirk, Amer Technical Pub, 5th edition, 2010
3. The Measurement, Instrumentation and Sensors Handbook", by J. G. Webster

Reference Books: (At Least 04 to 05)

1. Putten, A.F.P.V. Electronic measurement systems: theory and practice. 2nd ed. Bristol; Philadelphia: IOP Publishing, 1996. ISBN 978-0750303408.
2. Cooper W.D., Helfrick A.D., Electronic Instrumentation and Measurement Techniques, Prentice Hall of India Limited, New Delhi.
3. Meijer, G.C.M. (ed.). Smart sensor systems. Chichester, UK: J. Wiley & Sons, 2008. ISBN 0470866918.
4. Pallás Areny, R.; Webster, J.G. Sensors and signal conditioning. 2nd ed. New York: John Wiley and Sons, 2001. ISBN, 0471332321.
5. "Handbook of Modern Sensors: Physics, Designs, and Applications" by J. Fraden, Springer, 4th ed., 2010

I.S. Codes:- NA

BCEL 227 Basic Transportation Engineering & Introduction to ITS (Theory)

(Lectures) / Week (2-0-0-2)

Marks-50 Total Hrs: 30

Course objective

Course Outcome: **Student shall be able to**

CO1 Understand basic concept of highway engineering and intelligent transportation system

CO2 Design highway geometrics

CO3 Design flexible and rigid pavements & understand maintenance of highways

CO4 Identify factors governing railway infrastructure

Unit-I Principal of highway planning and ITS: Different modes of transportation, role of highway transportation, Classification of highways, network patterns, planning surveys, preparation of plans, final report, master plan, evaluation by saturation system, introduction to highway economics. Smart Transportation, intelligent transportation system Intelligent Traffic Management, Smart parking, Advance Safety control, Sustainable and efficient public transportation

Hrs-07

Unit-II Highway Alignment and Geometric Design : Principles of highway alignment, requirements, controlling factors, engineering surveys, importance of geometric design, design controls and criteria, cross section elements, pavement surface characteristics, camber, carriageway, kerbs, road margins, formation, right of way, typical cross sections. Sight distance, stopping sight distance, overtaking sight distance, sight distance at intersections. Design of horizontal alignment, super elevation, transition curves. Design of vertical alignment, gradients, vertical curves. **Hrs-08**

Unit-III Materials: Sub grade soil properties, CBR test, aggregates, desirable properties, tests, bituminous materials, bitumen and tar, tests. Bituminous mixes, requirements, design, Marshall Method

Design of Pavements: Types of pavement structures, functions of pavement components, design factors. Design of flexible pavements, methods, GI method, CBR method, IRC method, Burmister's method. Design of rigid pavements, design considerations, wheel load stresses, temperature stresses, frictional stresses, design of joints, IRC method of rigid pavement design.

Maintenance of highways

Hrs-08

Unit-IV Bridges and Railways: General Components, classification and identification, Data Collection site selection, Economic Span, IRC Specification & code of practices,. Different Structural Forms, culverts, causeway, minor and major bridges, Methods & Techniques of rating of existing bridges, Inspection, Repairs and maintenance Railways Transportation, Classification of Railways: Lines and their track standards. Railway Terminology, Permanent Way: Alignment Surveys, Requirement, gauges, track section. Rail types and functions, selection for rails, sleepers – function, types, merits and demerits, Ballast cushion, Rail fixtures and fasteners. Railway Signaling and interlocking

Hrs-07

Text Books:

1. Khanna and Justo, Highway engineering, 8th Edition, Nemachand Bors, 2002
2. Saxena and Arora, Railway Engineering, Dhanpat Rai Publications

Reference Books:

1. Dr. L R Kadiyali, Traffic Engineering And Transport Planning, 18th Edition, Khanna publications, 2013.
2. S P Bindra, Bridge Engineering, 12th Edition, S Chand, 2002
3. C S Papacostas and P D Prevedouros, Transportation Engineering and Planning
4. P H Wright and K Dixon, Highway Engineering

I.S.Codes:-

IRC 003: 1983-Dimensions and Weights of Road Design Vehicles

IRC SP 100:2014-Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion

IRC006:2014-Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fourth Revision)

IRC19:2005-Standard Specifications and Code of Practice for Water Bound Macadam

e- Learning Resources:

Mitopencourseware

<https://ocw.mit.edu/courses/transportation-courses/>

www.nptel.iitm.ac.in/iitDelhi.

<https://www.class-central.com>

Subjects > Engineering moocs

TREM –IV

CO1 Implement variety of Numerical techniques to solve various transcendental and simultaneous equations.

CO2 Compute solutions for ordinary differential equations through numerical techniques.

Course Contents

UNIT I - Numerical Methods (Equations)

Solutions of algebraic and transcendental equations. Iteration method, Bisection method, false position method, Newton-raphson method and their convergences, solution of system of linear equations, Gauss elimination method, Gauss Seidel method, Crouts method

UNIT II- Numerical Methods (Differential Equations)

Numerical solution of ordinary differential equation by Taylor series method, Picard's method, Runge-Kutta method, Euler modified method, Milne's Predictor corrector method.

Text Books

1. Higher Engineering Mathematics, Grewal B.S.: Khanna Publishers; 2013 Forty Third

Reference Books

1. Advanced Engineering Mathematics, Kreyszig, E. John Wiley & Sons; 2000 Eight
2. Introductory methods of Numerical analysis S. S. Sastri Prentice Hall of India Pvt. Ltd., 2006 Fourth.
3. Numerical Methods, Kandasamy, P. Thilagavathy, K., and Gunavathy, S, S.Chand & Company 1998
4. Numerical Methods for Scientific and Engineering Computation Jain, M.K., Iyengar, S.R. and Jain, R.K., Wiley Eastern 1987

BFYL109 (Mathematics VI) (Numerical Methods and Differential Equations)

Teaching Scheme				Cred its							ESE Duriati on Hours
T	T	P	Tot al		Theory			Practi cal		Tot al	
					TA E	CA E	ES E	Int.	Ext.		
2 H	1 H	-	3 H	2	10	15	25	-	-	50	2

Course Objectives

Students undergoing this course are expected to:

1. Learn Numerical methods to solve simultaneous equations.
2. To develop the basic understanding of numerical techniques for solving linear, non-linear and Ordinary Differential Equations.
3. To develop the basic understanding of numerical techniques for solving linear, non-linear and Ordinary Differential Equations.

Course Outcomes

Upon the successful completion of the course, learners will be able to

Course Outcomes

BCEL228: CONCRETE TECHNOLOGY (Theory)
(Lectures–Tutorial–Practical) / Week (1-1-2-4)
Marks-50 Total Hrs: 30

Course Objectives:

1. To understand the properties of concrete ingredients.
2. To study the compressive, flexural, split strengths etc and other non destructive tests.
3. To learn mix design of concrete and its application in construction work.

Course Outcome: **Student shall be able to**

CO1 Understand Properties of cement , aggregates and water use in concrete

CO2 Prepare and test the fresh concrete. Determine the Mechanical properties of hardened concrete with destructive and non-destructive testing instrument.

CO3 Use various additives & admixtures of concrete, Get acquainted to concrete handling equipment and different Special concrete types.

C04 Design concrete mixes as per IS codes and to understand the durability requirements of concrete.

Syllabus

Unit-I Cement: Main constituents of cements, Hydration of cement, Water required. Physical properties, Types of cement, test on Cement, field tests & laboratory

Aggregates: Classification and nomenclature, Coarse and fine aggregate, normal weight (light and heavy weight aggregates). Aggregate characteristics and their significance in strength, workability, placement and compaction of concrete. Sampling, Particle shape and texture, Bond of aggregate, size & grading of aggregate strength of aggregate. Mechanical properties and laboratory tests – Specific gravity, bulk density, porosity, absorption of aggregate, moisture content of aggregate, bulking of sand abrasion test, impact value. Deleterious substances in aggregate, organic impurities clay and other fine material etc. Introduction of IS: 383-1970,

Water:-Water quality for mixing and curing, Acceptable water, pH value, Seawater chlorides content. Provisions in IS: 456-2000

Hrs-07

Unit-II Fresh Concrete: Batching, Mechanical mixers, automatic batching and mixing plants. Efficiency of mixing, Workability Measurement - Slump cone test, compacting factor test, flow table, Vee-Bee consistometer, Factor affecting workability, setting time, Significance of w/c ratio, Segregation, bleeding, voids, and permeability. placing of concrete, compaction, vibrators, methods of curing, temperature effects on curing
Strength of concrete- Factors affecting compressive strength, Tensile and flexural strengths, relation between compressive and tensile strength.

Testing of hardened concrete. Compression strength test on cubes / cylinder strength and their relation,. Flexural strength of concrete, determination of tensile strength, indirect tension test, Non Destructive test- significance, rebound hammer, ultra sonic pulse velocity test. Pullout test.

Hrs-10

Unit-III Additives and admixtures- Types of admixtures, byproducts – pozzolans, fly ash, silica fume, rice husk ash, metakaoline, G.G. blast furnace slag, admixtures- air entraining, water reducing, accelerators, retarders, plasticizers and super plasticizers,.

Special concretes – Light weight concrete, types of fibers, fiber reinforced Concrete, high density concrete, self compacting concrete and applications. Ferrocement: Definition, Basic concepts in forming ferrocement composites, Methods of casting. **Hrs-06**

Unit-IV Mix Design- Standard deviation, factors affecting mix properties, Degree of quality control, design of mix by IS code method.

Durability of concrete- Significance, water as an agent of deterioration, permeability of concrete, air sulphate attack and control, sea water attack, acid attack, efflorescence, resistance of corrosion, abrasion and cavitations, process of rusting of steel.

Hrs-07

Text Books:

1. M L Gambhir, Concrete Technology, 5th Edition, The McGraw-Hill Companies, 2013
2. Krishnaswamy, K.T., Kamasundara Rao, A., and Khandekar,A.A., „Concrete Technology“,

Reference Books:

1. M S Shetty, Concrete Technology, 5th Edition, S Chand & Co. Ltd., 2005
2. AM Neville, Properties of concrete, 4th Edition, ELBS, London, 2012
3. Concrete Technology by R.S. Varshney, Oxford and IBH.
4. Shanthakumar A.R.,“Concrete Technology”,Oxford University Press, 2007

I.S. Codes

1. IS 456-2000, IS 383-1970, IS 516-1959, IS 9103-1999, IS 10262-2009

Online Certification Courses:

1. Concrete Technology, Prof. Bhattacharjee B, Indian Institute of Technology - Delhi

Best faculty members from IIT:

1. Prof. Bhattacharjee B, Indian Institute of Technology - Delhi
2. Manu Santhanam, IIT Madras

BCEP 228: CONCRETE TECHNOLOGY (Practical)

List of Practical's

Marks-25 Total Hrs: 02/Week

Course Outcome: **Student shall be able to**

- C01** Understand Properties of cement, aggregates and water use in concrete
- C02** Prepare and test the fresh concrete, Determine the Mechanical properties of hardened concrete with destructive and non-destructive testing instrument.
- C03** Use various additives & admixtures of concrete, Get acquainted to concrete handling equipments and different Special concrete types.
- C04** Design concrete mixes as per IS codes and to understand the durability requirements of concrete.
- PR-1** To determine Fineness of cement and Standard Consistency of Cement by Vicat's Apparatus
- C01**
- PR-2** To determine initial and Final Setting time of given cement by Vicat's Apparatus and Soundness cement
- C01**
- PR-3** To determine compressive strength of cement mortar cube
- C01**
- PR-4** To determine Moisture content, silt content, density and Specific gravity of fine aggregate by pycnometer method
- C01**
- PR-5** To determine Fineness Modulus (FM) by sieve analysis of Fine Aggregate
- C01**
- PR-6** To determine Moisture content, water absorption, density and Specific gravity of

coarse aggregate

C01

PR-7 To determine Fineness Modulus (FM) by sieve analysis of coarse Aggregate

C01

PR-8 To determine the Workability of Concrete by Slump Test, Compaction Factor and Vee Bee test. Effect of admixture and retarders on setting time concrete **C02, C03**

PR-9 To determine compressive strength by rebound hammer test and ultrasonic pulse velocity test

C02, C03

PR-10 To determine the Flexural Strength of Concrete **C02, C03**

PR-11 Concrete mix design by IS code method

C03, C04

PR-12 Site Visit to RMC Plant compulsory **C01, C02, C03 C04**

BCEL 230_SURVEYING & GEOMATICS (Theory)

(Lectures–Tutorial–Practical) / Week (1-1-0- 2)
Marks-50 Total Hrs:

30

Course Outcome: **Student shall be able to**

1. To understand the basic principles of surveying.
2. To study the coordinate systems and measuring techniques.
3. To study different types of survey and instruments used.

C01 Apply basic principles of survey for linear measurements, bearings measurements.

C02 Estimate bearings & angular measurements.

C03 Explain elevation of various points, Prepare Plan contour & topographical maps.

C04 Determine horizontal and vertical distances of points at angular observations

Unit-I Chain Traversing: Geo-informatics, Principles of Surveying, Linear measurements, Principle of Chain Surveying.

Compass Traversing: Prismatic compass, Surveyor's compass, Compass Traversing: Bearings & azimuths. Local attraction. Open & closed traverses. Adjustment of closed traverse.

Hrs-08

Unit-II Leveling & Sectioning: Principle of leveling, Temporary & Permanent adjustments. Profile leveling, Longitudinal sectioning, Cross Sectioning, Reciprocal leveling, curvature & refraction.

Contouring: Methods of contouring. Interpolation of Contours, Computation of area and volume – Trapezoidal and Simpson's Rule, Planimeter.

Hrs-08

Unit-III Theodolite Traversing: Temporary & Permanent adjustment, Measurement of Horizontal & Vertical angles. Consecutive & Independent Coordinates, Adjustment of Closed traverse, latitude & departure, Gale's traverse table, area calculation by coordinates.

Hrs-07

Unit-IV Tacheometry: Stadia method, fixed hair and movable hair and tangential method, Distance and Reduce level determination. Theory of anallatic lens, fundamental principles,

Hrs-07

Text Books:

1. T. P. Kanetkar & S.V.Kulkarni, Surveying and Leveling Part II, 5th Edition, Laxmi Publication Ltd, 2005
2. B. C. Punmia, Surveying Vol. II and III, 5th Edition, Laxmi Publication Ltd, 2005
3. C.P. Lo, Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, 2nd Edition, Prentice Hall, 2006, ISBN-13: 9780131495029
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004. ISBN: 978-0-471-05930-1
5. Guocheng Xu, GPS Theory, Algorithms and Applications, Publication Date: September 14, 2007 | ISBN-10: 3540727140 | ISBN-13: 978-3540727149 | Edition: 2nd

Reference Books:

1. D. Clark, Plane and Geodetic Surveying Vol II, 3rd Edition, New age international limited, 2005
2. Dr. A. M. Chandra, Surveying, 5th Edition, New age international limited, 2005

e- Learning Resources:

www.nptel.iitr.ac.in/iitroorki.
www.nptel.iitg.ac.in/iitGuahati.

BCEP 230 SURVEYING & GEOMATICS (Practical)

(Lectures–Tutorial–Practical) / Week (0-0-2- 1)

Marks-

25

Course Outcome: **Student shall be able to**

1. **C01** Apply basic principles of survey for linear measurements, bearings measurements.
2. **C02** Estimate bearings & angular measurements.
3. **C03** Explain elevation of various points, Prepare Plan contour & topographical maps.
4. **C04** Determine horizontal and vertical distances of points at angular observations
 - i) **PR-01** Measurement of distance by Ranging and Chaining.
 - ii) Locating various objects by Chain & Cross staff surveying.
Determination of area of polygon by Chain and Cross staff survey.
CO-01
 - i) **PR-02** Measurement of bearings of sides of traverse with Prismatic Compass and computation of correct included angle.
One full size drawing sheet locating given building by Chain and Compass traversing.
CO-01
 - i) **PR-03** Determination of elevation of various points with dumpy level by Collimation Plane Method and Rise & Fall Method.

Determination of elevation of various points with Dumpy Level by keeping staff inverted.

CO-02

- i) **PR-04** Fixing Bench Mark with respect to Temporary Bench Mark with Dumpy Level by Fly leveling and Check leveling.
- ii) One full size drawing sheet on L – section and C – section of Road.

One full size drawing sheet Contour Plan of given area.

CO-02

- i) **PR-05** Measurement of horizontal angles with Theodolite by means of Repetition Method.
- ii) Measurement of vertical angles using Theodolite.

One full size drawing sheet locating given building (traverse) by Theodolite traversing.

CO-03

- i) **PR-06** Determination of constant of Tacheometer.
- ii) Determination of elevation of point by Tacheometric surveying.

Determination of elevation of point and horizontal

distance between them by Tacheometric survey.

CO-

04

PR-07 Topographic survey & Setting out of any building by using Total Station.

CO-01, CO-02,

CO-03,

PR-08 Open Ended Experiment.

CO-01, CO-02, CO-03,

CO-04

BCEL 231 Environmental Engineering (Theory)

(Lectures–Tutorial–Practical) / Week (1-0-2-3)

Marks-25 Total Hrs: 16

Course Objectives: **Student shall be able to**

- 1. **Understand the concept of water supply scheme, conveyance of water and objectives of water treatment**
- 2. **Gain knowledge of water demand and water quality.**
- 3. **Learn and solve water treatment unit design problems**
- 4. **Know about water distribution system.**

Course Outcome: **Student shall be able to**

CO1 Know the concept of water supply scheme conveyance of water and objectives of water treatment

CO2 Identify & evaluate water demand and analyze water quality.

CO3 Explain and design water treatment units for municipal use.

CO4 Choose appropriate water distribution system for a particular area.

Unit-I Introduction: Importance and necessity of water supply scheme.

Water demand: Types of demand, factors affecting per capita demand, variation in demands, design period and population forecasting methods and examples.

Sources of water, Intake structures, Rising main: Classification and design water: General idea of water borne diseases, physical, chemical, and bacteriological characteristics of water, IS 10500:2012 standards of drinking water, introduction to intake structure.

Water treatment: Objective of treatment: treatment flow sheet of conventional water treatment plant.

Hrs-

05

Unit-II Aeration : Purpose, types of aerators

Coagulation and Flocculation : Definition, principles, types of coagulants and reactions, coagulant doses, types of mixing and flocculation devices.

Sedimentation: Principles types of setting basins.

Clariflocculator : Principles and operation

Hrs-05

Unit-III Filtration: Mechanism of filtration, types of filters RSF, SSF, pressure filters, and operational problems in filtration.

Disinfection : Purpose Mechanism , criteria for good disinfectant various disinfectants their characteristics, disinfection by chlorination using different forms of chlorine

Distribution systems : Requirements for a good distribution system, methods of distribution systems distribution systems and layouts of distribution system

Hrs-

06

Text Books:

- 1. S. K. Garg, Water Supply And Sanitary Engineering, 5th Edition, Khanna Publishers Delhi, 2010
- 2. B. C. Punmia, Water Supply & Sanitary Engineering, 1st Edition, Laxmi Publication, 2005
- 3. Dr. P.N Modi, Water supply Engineering, 3rd Edition, Rajsons Publications, 2010

Reference Books:

- 1. G. S. Birdie and JS. Birdie, Water Supply And Sanitary Engineering, 6th Edition, Dhanpat Rai Publishers Delhi, 2002
- 2. Paneerselvam .R, “Environmental Engineering”, Vol. I, SPGS Publishers , Chennai – 88, 2006
- 3. Manual on Water Supply and Treatment,” CPHEEO, Ministry of Urban, Development, Government of India, New Delhi, 2009.

IS Codes: IS 10500: 2012 Drinking Water – Specification

e-Learning Resources:

www.nptel.iitr.ac.in/iitroorki &

www.nptel.iitg.ac.in/iitGuahati

Online Certification Courses:

- 1. Water and Wastewater Treatment Engineering, Tsinghua University, China.

Best faculty members from IIT:

1. B. J. Alappat Professor in IIT Delhi

BCEP231 Environmental Engineering (Practical)
Total Hrs: 02/Week Marks-25

List of Practical's

Course Outcome: **Student shall be able to**

CO1 Know the concept of water supply scheme and conveyance of water.

CO2 Identify & evaluate water demand and analyze water quality.

CO3 Explain and design water treatment units for municipal use.

CO4 Choose appropriate water distribution system for a particular area.

PR-1 Water Quality Standards as per IS:10500:2012

CO1, 4

PR-2 Determination of pH and Conductivity of given water sample.

CO2

PR-3 Determination of Chloride in given water sample.

CO2

PR-4 Determination of Solids in given water sample.

CO2,

3

PR-5 Determination of Optimum Dose of Coagulant by Jar test.

CO2

PR-6 Determination of Alkalinity – Acidity of given water sample

CO2

PR-7 Determination of Dissolved Oxygen of given water sample

CO2

PR-8 Determination of Hardness of given water sample

CO2

PR-9 Determination of Available Chlorine and Residual Chlorine in given water sample

CO2

PR-10 Determination of BOD value for given wastewater sample.

CO2

PR-11 Determination of COD value for given wastewater sample.

CO2

PR-12 To perform Bacteriological Plate count and MPN tests for given water sample

CO2

BCEL: 232 STRUCTURAL ANALYSIS (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)
Marks-50 Total Hrs: 30

Course Objectives:

1. To study basic concepts of analysis of structural components.

2. To study the behavior of structural components under the various combination of loads.

3. To study various methods for the analysis of indeterminate structure.

Course Outcome: **Student shall be able to**

CO1 Identify the basic concept used in the analysis of Indeterminate structure.

CO2 Solve the concept of Strain energy for the analysis of different structures.

CO3 Distinguish the theories involved in the analysis of columns.

CO4 Analyzed the continuous beam with and without sinking of support, Non Sway and sway frames by different methods.

Syllabus

Unit-I Static determinacy of structure Analysis of loads on simply supported beams with concentrated and uniformly distributed loads, maximum B.M. and S.F.

Influence lines for reactions, bending moments and shear forces in simply supported beams, cantilevers and beams with overhangs.

Influence lines for forces in members of simple trusses and for BM and SF in panels of simple trusses. **Hrs-07**

Unit-II Strain energy method as applied to the analysis of redundant frames and redundant trusses up to two degrees. Determination of deflection of trusses. Willot Mohr diagram, Castiglianos theorems, Maxwell's reciprocal theorem. Betti's theorem

Hrs-

07

Unit-III Buckling of Columns and beams columns, Euler's and Rankine's formula. Analysis of Two-Hinged arches, S.F. and normal thrust, parabolic arches. **Hrs-**

08

Unit-IV Slope deflection method as applied to indeterminate beams & continuous beams portal frames, frame with inclined legs up to 3 degrees of freedom. **Hrs-**

08

Text Books:

1. S.S. Bhavikatti, Structural Analysis, Vol- I, 2nd Edition, Vikas Publication, 2009
2. Wang C.K., Intermediate Structural Analysis, 1st Edition, McGraw Hill, 2010

Reference Books:

1. Wilbur J.B. & Norris C.H, Elementary Structural Analysis, 3rd Edition, McGraw Hill, 2009
2. Theory of Structures, Stephen P. Timoshenko, Donovan H. Young, McGraw-Hill Inc.,US; 2nd edition, 1968

Online Certification Courses:

1. Structural Analysis-I, Prof. Amit Shaw, Indian Institute of Technology Kharagpur

Best faculty members from IIT:

1. Prof. Amit Shaw, Indian Institute of Technology Kharagpur

TREM V

BFYL110 Mathematics 7
(Higher order Matrices and Probability)

Marks-50 Total Hrs: 30

Teaching Scheme				Credits							ESE Duration Hours
					Theory			Practical		Total	
T	T	Pr	Total		TA	CA	ES	Int.	Ext.		
h	u	.			E	E	E				
1	1	-	2	2	10	15	25	-	-	50	2
H	H										

Course Objectives

Students undergoing this course are expected to:

- Learn the various method to solve basic operations for higher order Matrices
- how to translate real-world problems into probability models.

Course Outcomes

Upon the successful completion of the course, learners will be able to

Course Outcomes

CO1 Apply the knowledge of matrices to solve the problems related to civil engg.

CO2 Apply the concept of probability and random variables in engineering field.

Pre Requisite

Higher Secondary Level Mathematics

Course Contents

UNIT I - Higher order Matrices Elementary Operations

UNIT II- Probability: Elements of probability ,Random Variables-discrete and continuous, cumulative distribution function and probability density function,

Text Books

1. Probability and Statistics Murray R.Spiegel Schaums outline series Fourth Edition 2013

Reference Books

1. Higher Engineering Mathematics B.S. Grewal.
2. Khanna Publishers 2013 Forty Third Probability and Statistics Spiegel M. R: The McGraw-Hill Company 2000 Second
3. Introduction to probability and statistical applications P L Mayer Addison-Wesley Publishing Company 2013 Second

BCEL331 IRRIGATION AND DRAINAGE ENGINEERING (Theory)

(Lectures–Tutorial–Practical) / Week (1-0-0-1)

Course Objectives:

1. To understand the irrigation systems and its components & parameters required for planning of reservoir
2. To understand the design criteria's of all types of dams & spillways.
3. To plan the canal systems & understand the advance concepts of irrigation engineering.

Course Outcome: Student shall be able to

C01 Demonstrate an Irrigation System

C02 Plan & Design of reservoir.

C03 Plan and design diversion head works

C04 Design irrigation canal structures

CO5 Analyze gravity and earth dams

Syllabus

Unit-I Irrigation Systems: Types of irrigation systems, Soil moisture, Irrigation crop water requirements, Methods of irrigation **Hrs-06**

Unit-II Reservoir planning: Selection of site for Reservoirs: Engineering surveys, Geological and Hydrological investigations; Fixing of LWL, FTL, HFL, TBL; Different storage zones, in reservoirs; Determination of storage capacity by mass curve method; Reservoir sedimentation; life estimation of reservoir by Brune's method; Organization & Administration of irrigation projects. Reservoir operation and scheduling. **Hrs-05**

Unit-III Gravity Dams: Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam.

Earth dams: Types of earth dams, Causes of failure of earth dams, Seepage analysis, Seepage control, Stability analysis. **Hrs-09**

Unit-IV Spillways and energy dissipation systems: Types of spillways, Design of Ogee spillway, Design of stilling basins.

Design of diversion head works: Types of hydraulic structures, Layout of a diversion head work, Design of vertical drop weir, Design of sloping glacis weir. **Hrs-05**

Unit-V Canal Systems: Types of canals, Principles of design of stable irrigation canals, Silt theories, Tractive force theory, Design of lined canal, Design of longitudinal section.

Water logging. Canal regulators, Types of canal falls. Types of cross drainage works, aqueduct/syphon aqueduct. River training work.

Hrs-05

Text Books:

1. Modi P.M, Irrigation Water Resources and Hydropower Engineering, Standard Publishing Company, New Delhi, 2000.
2. Arora K.L. Irrigation Water Resources Engineering, Standard Book Publishing Co., Delhi, 1996.

Reference Books:

1. Asawa G.L., Irrigation and Engineering, New Age Publishing Co., Delhi, 1996.
2. Murthy C.S.N., Water Resources Engineering – Principles and Practice, New Age Publishing Company, Delhi, 2002.

Online Certification Courses:

4. 'Irrigation and Drainage', NPTEL, Prof. Damodhara Rao Mailapalli, Professor, Department of Agricultural and Food Engineering, Indian Institute of Technology, Kharagpur

Best faculty members from IIT:

1. Dr. A K Rastogi, Professor, akr@civil.iitb.ac.in

BCEL 332: Reinforced Concrete Design (Theory)

(Lectures–Tutorial–Practical) / Week (1-1-0-0)___

Total Hrs: 30 Marks-50

Course Objectives:

1. To design RCC members of building using Limit State Design method.
2. To apply the conventional methods to design structural components of building.
3. To determine the structural behavior of rebar and concrete.

Course Outcome: Student shall be able to

- C01** Demonstrate the conceptual difference between Working stress method, Ultimate load theory method & Limit state Design method.
- C02** Design the structural elements like RCC beam, slab, column, and footings by limit state Design method as per I.S.456-2000.
- C03** Apply the concepts of limit state of collapse in flexure and in shear and bond as per IS 456:2000. To design columns & footings for eccentric loads.
- C04** Design water tanks and staircase.

Syllabus

Unit-I Introduction to working stress method of RCC design by using IS 456:2000.

Limit state Design by using IS 456:2000, Partial safety factors, load factors, stress-strain relationship, stress block parameters, failure criteria, Limit state of collapse in flexure: Design of simply supported one way single span and two way slabs using IS code coefficients.

Hrs-08

Unit-II Limit State of collapse in shear, Bond and Torsion, Analysis and Design of Singly and Doubly reinforced Beams, "T" beam. Design for Interaction between Bending moment, Torsional moment and Shear.

Limit state of serviceability: Deflection and moment curvature relationship, for beams and one-way slabs.

Hrs-08

Unit-III: Limit state of collapse under compression axially loaded short and long column, column with axial load, uniaxial moment, Interaction diagram / Charts. Design of rectangular pad/slopped footing for axial load and uniaxial bending.

Hrs-07

Unit-IV: Design of Dog legged Staircase.

Design of Circular and Rectangular water tank with roof slab / dome resting on ground by approximate method. (Using Working Stress Method).

Hrs-07

Text Books:

1. Varghese P.C.; Limit state design of Reinforced Concrete Structures Prentice Hall of India, 1999.
2. Karve S.R. and Shah V.L, Limit State Theory and Design of Reinforced Concrete, Structures Publications, Pune. 2007.

Reference Books:

1. S.U.Pillai ,D.Menon: Reinforced Concrete Design, Tata Mcgraw-Hill Publishing Company New Delhi 2003.
2. Ramchandra. Limit state Design Standard Book House 1990. Bureau of Indian Standards, I.S.456-2000: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards 2000.
3. I.S.3370-1967: Part I, II and Part IV, Code of Practice for Concrete structures for storage of liquids. Bureau of Indian Standards 1967.

Online Certification Courses:

1. Design of reinforced concrete structures, Prof. Nirjhar Dhang, IIT Kharagpur (Nptel).

Best faculty members from IIT:

1. Prof. Nirjhar Dhang, IIT Kharagpur
2. Prof. A. K. Jain, IIT Delhi

BCEP333 Building Services

(Lectures–Tutorial–Practical–Credit) / Week

(0-1-1-0.5)

Total Hrs: 15 Marks-25

Course Objective :

Course Outcome: Student shall be able to

- C01** Understand the various concept of vastu
- C02** Identify type factor and selection of building.
- C03** Compute command of vastu
- C04** Layout of Rooms as per Vastu Shastra
- Unit-I** Introduction about Vastu Concepts, Principal of Planning, Aspects of different Room
- Hrs-03**
- Unit-II** Factor for selection of site for Residential Building, What Does Bad Vastu Cause & Good Vastu Give, Four zones ,Ten Commandments of Vastu Shastra
- Hrs-03**
- Unit-III** Location of Doors, Ucham And Neecham, Aspect According to Vastu Shastra According to

modern building science of National Building code of India rules & practice

Hrs-05

Unit-IV Layout of Rooms as per Vastu Shastra & Modern building science.

Hrs-04

Text Books:

1. Saral vastu Shastra vastu Shastra by Bhavan Bhaskar

Reference Books:

1. Building Design and Drawing (Shah and Kale)

IS Codes: National Building Code -16

BCEL 334 Foundation Engineering

(Lectures–Tutorial–Practical) / Week (1-1-2-4)

Total Hrs: 30 Marks-50

Course Outcome: **Student shall be able to**

CO 1 Plan and execute the soil exploration and study various methods of ground improvement

CO 2 Perform field/lab tests on soil & Calculate the bearing capacity of soils and foundation settlements

CO 3 Analyze deep and shallow foundations

CO 4 Determine the earth pressures on foundations and retaining structures

Unit-I Soil exploration: planning, objectives and methods of exploration, soil boring, spacing and depth of boring, types of drilling, Soil investigation report

Field Tests: Plate load test, Standard Penetration test (SPT) , California Bearing Ratio test, Field Vane Shear test

Ground Improvement: Advanced methods for soil stabilization: Reinforced soil, Geo-textiles, Vibroflotation, Preloading, Grouting

Hrs-07

Unit-II Shallow Foundation:

Bearing Capacity: Bearing capacity, its criteria, factors and various methods. Analytical Methods: Terzaghi's, Skempton's, Meyerhoff, BIS method for bearing capacity, Effect of water table, contact pressure. Bearing capacity based on plate load test results, SPT value

Settlement: Evaluation of soils settlement: Immediate, primary and secondary settlement, combined footing, concept of differential settlement

Hrs-07

Unit-III Deep Foundation:

Pile foundation : Classification of piles and their uses, static analysis, formula for determination of pile capacity for driven and bored pile in sand and in clay, dynamic pile formula, Negative skin friction, piles in groups and their capacity, group efficiency, factors affecting group efficiency, settlement ratio, under-reamed pile

Introduction Well foundation and Raft foundation

Stress Distribution: Stress distribution in soil mass, Boussinesque's, Theory point & Uniformly

loaded rectangular & circular areas, Newmarks charts.

Hrs-08

Unit-IV Slope Stability: Slopes, uses and failure of slope, stability analysis of infinite and finite slope in sand, clay and c-stability number, Swedish circle method, Friction circle method, Bishop Method

Earth Pressure: Earth Pressure at rest, active and passive, Stages of plastic equilibrium Rankin's and Coulombs theory of active and passive earth pressure on retaining wall. Influence of surcharge, water table, wall friction, Rebhann and Culmann's simple graphical methods

Hrs-08

Text Books:

1. Dr. K.R. Arora, Soil Mechanics and Foundation Engineering, 5th Edition, Standard Publishers Distributors, 2005

Reference Books:

1. Dr. B.C. Punmia, Soil Mechanics and Foundation Engineering, 16th Edition, Laxmi Publications, 2005
2. Das B. M., Principal of Foundation Engineering, 5th Edition, Thomson Brooks/Cole, 2004
3. Bowles J.E., Foundation Analysis and Design, 5th Edition, McGraw Hill International, 1996

I.S.Codes:- IS 1892(1979), IS 2720- Part 1 to 41 (1977)

e- Learning Resources:

www.nptel.iitm.ac.in/iitkanpur.

www.nptel.iitb.ac.in/iitBombay.

BCEL335 Disaster Preparedness & Planning

(Lectures–Tutorial–Practical) / Week (2-0-0-2)
(Theory) Marks-50

Course Objective

1. To study the basic concept disaster management
 2. To understand and apply the basic concepts Causes, Consequences and Control of Disasters
 3. To apply scientific strategies for preparedness
- Course Outcome: **Student shall be able to**

C01 Apply the concept of Disaster Management.

C02 Understand Types, Trends, Causes, Consequences and Control of Disasters.

C03 Analyses risk information and early warning, Reducing the risks in key sectors.

C04 Implement emergency services, Identify the Role of Engineer in Disaster Management.

Unit-I Understanding Disaster

Understanding the concept and definition of Disaster, Hazard, Vulnerability, Risk, Capacity-Disaster and Development and Disaster Management

Hrs-04

Unit-II Types, Trends, Causes, Consequences and Control of Disasters

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning,

thunderstorms, hail storms, avalanches, droughts, cold and heat waves); Biological Disasters (epidemic, pest attacks, forest fire); Technological Disasters (Chemical Industries, Radiological, Nuclear) and Man made Disasters (Building collapse, rural and urban fire, road and rail accident, nuclear, radiological, chemicals and biological disasters); Global Disaster trends – Emerging Risk of Disasters – Climate change and urban disaster.

Hrs-08

Unit-III Disaster Preparedness: Saving lives and livelihoods

Structure of the Document and Use of this Indicator and Guidance Tool, Terminology, Key terms, Guiding Principles for implementing Disaster Risk Reduction

Key Components in Preparedness Planning

Contingency Planning, Capacity Analysis and Capacity-Building, Hazard Monitoring, Forecasting and Early Warning, Information Management and Communication.

Hrs-10

Unit-IV Readiness for Response

Emergency Services and Stand-by Arrangements, Incorporating Early Recovery into Preparedness Planning, Resource Allocation and Funding.

Study of Recent Disasters (at local, State and National Level) and Preparation of risk management plan on an area or sector. Role of Engineer in Disaster Management.

Hrs-08

Text Books:

1. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
2. Encyclopedia of disaster management, Vol I, II and III, Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006

Reference Books:

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
4. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
5. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management

e- Learning Resources:

<https://www.preparecenter.org/topics/disaster-preparedness>
<https://www.cdmsmith.com/en/Client-Solutions/.../10-Steps-to-Disaster-Preparedness>

Teaching Scheme				Credits							ESE Duration Hours
					Theory			Practical		Total	
T	T	Pr	Total		TA	CA	ES	Int.	Ext.		
1	1	-	2	2	10	15	25	-	-	50	2

Course Objectives

Students undergoing this course are expected to:

1. Teaching of basic knowledge of Statistics
2. Learn the Linear Programming Problem
3. Learning calculus of variation and its relevance in engineering.

Course Outcomes

Upon the successful completion of the course, learners will be able to

Course Outcomes

- CO1** Understand the Basics of statistics
CO2 Understand the Linear Programming Problem and will use to solve simple problems in the field of civil engineering.
CO3 Use concept of calculus of variation to solve the problems based on Functional.

Course Contents

UNIT I - Statistics: Mean median mode std deviation correlation regression

UNIT II - Introduction to optimization techniques
 Linear programming, mathematical model formulation, Solutions by Graphical & Simplex method.

UNIT III - Calculus of variations:
 Maxima and minima of function, variation and its properties, Euler's equation, functionals dependent on 1st and 2nd order derivatives

Text Books

Higher Engineering Mathematics, Grewal B.S.: Khanna Publishers; 2013 Forty Third

Reference Books

1. Advanced Engineering Mathematics, Kreyszig, E. John Wiley & Sons; 2000, Eighth
2. Higher Engineering Mathematics Grewal B.S.: Khanna Publishers; 2013 Forty Third
3. Advanced Mathematics for Engineers and scientists Spiegel M. R McGraw-Hill Book Company 2010 Second
4. Probability and Statistics Spiegel M. R: The McGraw-Hill Company 2000 Second

(2-0-0- 2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To study the specifications in IS: 800
 2. To understand the concepts and different aspects to be considered for design of steel structures.
 3. To design the various structural components as per the codal provision.
- Course Outcome: **Student shall be able to:**

- C01** Understand design philosophies according to IS 800:2007 & behavior of structural steel and fasteners
- C02** Design various structural components such as of steel structures using bolted & welded connections
- C03** Design welded plate girders, gantry girders for the loads specified as per IS:800-2007
- C04** Design laced and battened columns, columns subjected to axial & biaxial moments

Syllabus

Unit-I Structural Fasteners: Behavior of bolted and welded connections (types, Designations, properties, permissible stresses. Strength of bolt and strength of weld. Efficiency of joints. Design of simple bolted and welded connections.

Hrs-05

Unit-II Design of axially loaded members Tension members, Compression members Moment resistant bolted and welded connection.(bending and torsion).Design of connection Beam to beam, beam to column-framed connection.

Hrs-05

Unit-III Design of simple built up beams: Laterally restrained and Laterally unrestrained, Curtailment of flange plates. Design of welded plate girder,

Hrs-10

Unit-IV Design of single rolled steel section column subjected to axial load and biaxial moment including base design. Design of axially loaded built up columns. Laced and Battened. Column base: Design of slab Bases, introduction to gusseted bases

Hrs-10

Text Books:

1. S. K .Duggal, Limit State Design of steel structures, 2nd Edition, Tata Mc-GRAW HILL, 2013
2. Dr. V.L. Shah, Veena Gore, Limit State Design of steel structures, 3rd Edition, Structures Publications, 2012
3. N. Subramaniam, "Design of Steel Structures as per IS:800-2007", Oxford university press.

Reference Books:

1. L. S. Negi, Design of steel structures, 2nd Edition, Tata Mc-GRAW HILL, 2008
2. S. S. Bhavikatti, Design of steel structures by Limit State Method as Per IS 800-2007, 4th Edition, I.K. International Publication, 2014
3. S .K. Duggal, Design of steel structures, 3rd Edition, Tata Mc-GRAW HILL, 2009

I. S. Codes:-

IS:800-2007, IS:875-Part 1,2 & 3

NPTEL courses:

Prof. Damodar Maity, Indian IIT, Kharagpur

BCEL 337 Engineering Economics, Estimation & Costing (Theory)
(Lectures–Tutorial–Practical) / Week (1-0-2-2)

Total Hrs: 18 Marks-100

Course Objective:

1. To write detailed specification for any Civil Engineering Structure.
2. To determine approximate and detailed estimate of Civil Engineering Structure.
3. To understand the process of tendering, valuation and economics behind it.

Course Outcome: **Student shall be able to**

- C01** Enumerate specifications of building, irrigation, road work & methods of estimate.
- C02** Estimate the quantity of Civil Engineering works.
- C03** Evaluate the cost & economy of Civil Engineering aspects.

Unit-I SPECIFICATIONS: Specification of a few items related to building, Irrigation Work, Road work.

ESTIMATE OF BUILDINGS: Detailed estimation of framed structures (Residential & Commercial), Schedule of Rates. Recommendations from N.B.O. Analysis of rates.

Hrs-08

Unit-II ESTIMATE OF OTHER STRUCTURES: Detailed estimation of Structures other than Residential & Commercial, i.e. septic tank, soak pit, sanitary and water supply, bituminous and cement concrete roads, retaining walls, culverts, irrigation works, aqueduct, siphon, fall. Schedule of Rates.

Hrs-

05

Unit-III Tenders: Tender notice and procedure.

Contracts: Type, Documentations, land acquisition act, Legal aspects of contract provisions, Arbitration. Qualification of contractor, Authenticity for public works.

Valuation: Value and cost, types, methods of valuation, valuation of old building.

Economics: Cost Accounting, classification of cost, direct & indirect charges. Net & gross return, Tenure of land, free hold & lease holds property. Sinking fund, Depreciation, rent fixation. MAS account, issue rate of store accounts.

Hrs-05

Text Books:

1. Dutta B.N., Estimating and Costing in Civil Engineering, Theory and Practice, 23rd Edition, UBS Publisher, New Delhi, 2003
2. Popescu C. M., Estimating Building Cost, 17th Edition, Phaobunjong Kan and Nuntapong vararin Dekker Publication, 2000

Reference Books:

1. Patil B. S, Estimating and Costing, 19th Edition, Oriental Longmans Publication, New Delhi, 2002
2. D. D. Kohali & R. C. Kohali, Text book of Estimating & Costing (Civil), 12th Edition, S. Chand, 2010

IS Codes: IS1200

e- Learning Resources:

www.nptel.iitg.ac.in/iitGuahati.

BCEL 337 Engineering Economics, Estimation & Costing (Theory)

(Lectures–Tutorial–Practical) / Week (0-0-2-1)

Marks-50

Course Outcome: **Student shall be able to**

- CO-01** Enumerate specifications of building, irrigation, road work & methods of estimate.
- CO-02** Estimate the quantity of Civil Engineering works.
- CO-03** Evaluate the cost & economy of Civil Engineering aspects.
- PR-01** Specification for TEN items (Building works –6 items, road work –2 items, irrigation work – 2 items).
- CO-01**
- PR-02** Detailed estimate of a RCC G + 3 Storied Residential Building with flat roof frame type structure.
- CO-01**
- PR-03** Detailed estimate of a RCC G + 8 Storied Commercial Building with flat roof frame type structure.
- CO-01**
- PR-04** Detailed estimate of C.C. Road (Or Hot Mix Coat Road) of minimum 1 km length.
- CO-01**
- PR-05** Detailed estimate of any two of the following:
1. Septic tank for a colony
 2. Water Supply Scheme
- Earth or Water Retaining Structures
- PR-06** Analysis of Rates for above mentioned Problems. **CO-02**
- PR-07** Prepare DPR of buildings in PR-02 & 03 **CO-01, CO-02, CO-03,**
- PR-08** Tender documents for PR-02 & 03 **CO-01, CO-02**

BCEL: 338 ADVANCED STRUCTURAL ANALYSIS (Theory)

(Lectures–Tutorial–Practical) / Week (1-1-0-0)

Marks-50

Course Objectives:

1. To understand the principals involved in the analysis of indeterminate structures
2. To study the analysis of continuous beams and frames subjected to lateral sway
3. To study approximate methods of analysis for portal frames

Course Outcome: **Student shall be able to**

- CO1** Analyze the frames subjected to lateral sway using slope deflection method
- CO2** Analyze the frames subjected to lateral sway using moment distribution method
- CO3** Apply different Approximate methods for analysis of 2D frames subjected to horizontal & vertical loads
- CO4** Analyze the non-prismatic sections

Syllabus

Unit-I Slope deflection method as applied to indeterminate beams & continues beams portal frames, frame with inclined legs up to 3 degrees of freedom. **Hrs-08**

Unit-II Analysis of continues beams and simple portals (Non sway) using Moment Distribution methods, Moment distribution applied to frames with sway (up to single storey two bay) **Hrs-08**

Unit-III Approximate method of Structural analysis for multi- storeyed frames with lateral loads (Portal and Cantilever method), Approximate methods for vertical loads i.e. Substitute frame method etc.(Max. three bay three storey) **Hrs-07**

Unit-IV Column Analogy method, Application to beams, Calculations of Stiffness factors and carry over factors for non-prismatic method, Analysis of non-prismatic fixed beams. **Hrs-07**

Text Books:

1. S.S. Bhavikatti, Structural Analysis, Vol- I, 2nd Edition, Vikas Publication, 2009
2. Wang C.K., Statically Indeterminate Structures, 1st Edition, McGraw Hill, New York, 1983
3. Reddy C.S, Basic Structural Analysis, 3rd Edition, Tata McGraw Hill, 2011

CO-02

Reference Books:

1. Wilbur J.B. & Norris C.H, Elementary Structural Analysis, 3rd Edition, McGraw Hill, 2009
2. Theory of Structures, Stephen P. Timoshenko, Donovan H. Young, McGraw-Hill Inc., US; 2nd edition, 1968
3. R. Vaidyanathan, P. Perumal, Comprehensive Structural Analysis, 1st Edition, Tata McGraw Hill, 2005

Online Certification Courses:

1. Advanced Structural Analysis, Prof. Devdas Menon, Indian Institute of Technology, Madras

Best faculty members from IIT:

1. Prof. Devdas Menon, Indian Institute of Technology, Madras

BCEL 339: Project Planning and Construction Management (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To learn elements of management in civil engineering projects, organization structure and quality control.
2. To study project planning, project monitoring, cost planning, and resource allocation through network techniques.
3. To understand engineering economics and laws related to contracts, labor safety etc.

Course Outcome: **Student shall be able to**

- CO 1** Understand the project life cycle and organization.
- CO 2** Solve problems related to Network and total duration of the project using different network techniques.
- CO 3** Apply effectively the principles of economics, contracts techniques & industrial relations in projects.
- CO 4** Calculate operational cost, owning and hiring cost of the equipment.

Syllabus

Unit-I Elements of Management:

Introduction, Definition, functions of management, advances and societal influences in construction management, Project life cycle, Quality control. Phases of a project, agencies involved, Indian standards on construction and project management Stages of project planning Process of development of plans and schedules, work break-down structure role of client and contractor

Hrs-07

Unit-II Network Techniques & Resource Scheduling:

Bar charts, milestone charts, preparation of CPM, PERT & GERT networks, analysis of networks, Application of network Techniques.

Line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothing and leveling

Hrs-08

Unit-III Engineering Economics Contract Management & Industrial Relations

Time value of money, Present economy studies, Equivalence concept, financing of projects, cash flow diagrams, evaluating alternatives by equivalence, balance sheet and profit and loss statement. Classification of costs, time cost trade-off in construction projects. Types of contracts, Legal aspects of contraction, laws related to contracts, prequalification of contracts, Elements of tender preparation, process of tendering, Evaluation of tenders, contract negotiation and award of work, Payment of wages Act, Employees State Insurance Act, Industrial safety and welfare provision. Dispute resolving techniques.

Hrs-09

Unit-IV Materials & equipment management

Functions and objective, procurement, Inventory control, ABC analysis & material codification. Classification, selection, operation & maintenance, depreciation & replacement cost, cost of owning of equipment.

Hrs-06

Text Books:

1. Chitkara K K, Construction Project Management, Tata McGraw Hill
2. Jha K N, Construction Project Management, Pearson, 2011

Reference Books:

1. Srinath L, CPM & PERT, East-West Press Pvt. Ltd New Delhi
2. S.K. Bhatnagar, Network Analysis Techniques, 1st Edition, Willey Eastern Ltd., 1986

Online Certification Courses:

1. www.nptel.iitm.ac.in/iitkanpur.
2. www.nptel.iitb.ac.in/iitBombay.

Best faculty members from IIT:

1. Koshy Varghese from IIT Madras

TREM VII

BCEL 401 ADVANCED STRUCTURAL DESIGN (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To design of advanced structural elements like retaining walls, combined footings
2. To design doubly reinforced beam, Two way slab, biaxial column, long column.

Course Outcome: **Student shall be able to**

C01 Design doubly reinforced & T-beam with torsion shear and Deflection.

C02 Design of columns subjected to biaxial moments and long columns.

C03 Design Two way slab as per IS 456:2000.

C04 Design Rectangular and Trapezoidal combined footing.

C05 Design cantilever and counter-fort retaining walls.

Syllabus

Unit-I Limit state of collapse in torsion:

Concept of interaction of torsion, shear and flexure.

Analysis and design of doubly reinforced beam for torsion, shear and flexure.

Limit state of serviceability: Deflection calculations for doubly reinforced beam.

Hrs-06

Unit-II Analysis and design for columns subjected to biaxial moments. Design of long columns **Hrs-05**

Unit-III Design of RCC Two way slab with various end conditions using IS 456 :2000 coefficients

Hrs-04

Unit-IV Design of combined footing (Rectangular footing)

Design of Raft Foundation **Hrs-08**

Unit-V Design of RCC cantilever and counter-fort retaining walls. **Hrs-07**

Text Books:

1. Dr. B. C. Punmia, Arun Kumar Jain, Ashok Kumar Jain, Comprehensive RCC Design, 8th Edition, Laxmi Publication Pvt. Ltd., 2005
2. V. L. Shah, S. R. Karve, Illustrated Reinforced Concrete Design, 3rd Edition, Structures Publication, 1996
3. Krishna Raju, "Advanced Concrete Structures", McGraw Hill, New Delhi, 2000.
4. Varghese .P.C, "Advanced Reinforced Cement Concrete", Pretince-Hall India, Second edition, 2006

Reference Books:

1. James Gare, Mechanics of Material, 8th Edition, Cengage Learning, 2012
2. B. C. Punmia, Mechanics of Material, 15th Edition, Laxmi Publications, 2005
3. Gere and Timoshenko, "Mechanics of Materials", CBS publishers
4. Unnikrishna Pillai .S and Deavadas Menon, "Reinforced Concrete Design", Tata MacGraw Hill Publishing Company Limited, Second Edition, New Delhi, 2003.

Online Certification Courses:

1. Design of Reinforced Concrete Structures, Prof. Nirjhar Dhang, IIT Kharagpur. (NPTEL)

Best faculty members from IIT:

1. Prof. Nirjhar Dhang, IIT Kharagpur
 2. Prof. A. K. Jain, IIT Delhi
- BCEL 402 ADVANCED CONCRETE DESIGN (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30Marks-50

Course Objectives:

1. To understand the philosophies of design of reinforced cement concrete and to justify this is the best
2. To know design of advanced structural elements with safety, stability and economical way
3. To study of provisions in IS 1893 and IS 456 for design of structures

Course Outcome: **Student shall be able to**

- CO1** Design overhead circular service reservoirs.
CO2 Design Highway Bridge Slab and Girder type as per IRC loading
CO3 Design building frames using Limit state Method
CO4 Design cylindrical shells by beam theory. Design Silos using Limit state Method.

Syllabus

Unit-I Design of overhead circular service reservoirs. Analysis of staging by cantilever method

Hrs-08

Unit-II Design of highway bridge with IRC loading and equivalent UDL Slab type

Hrs-08

Unit-III Design of building frames up to two bay/two storey, including design of foundation. Using Limit state Method.

Hrs-07

Unit-IV Design of Silos and Bunkers (Using Limit state Method)

Hrs-07

Text Books:

1. Dr. B. C. Punmia, Arun Kumar Jain, Ashok Kumar Jain, Comprehensive RCC Design, 8th Edition, Laxmi Publication Pvt. Ltd., 2005
2. V. L. Shah, S. R. Karve, Illustrated Reinforced Concrete Design, 3rd Edition, Structures Publication, 1996

Reference Books:

1. Ashok K. Jain, Reinforced Concrete: Limit State Design, 4th Edition, Nem Chand, 1993
2. T.R. Jagadeesh, M.A. Jayaram, Design of Bridge Structures, 2nd Edition, PHI Learning Pvt. Ltd., 2010

BCEL 403 Earthquake Resistant Structures (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. **Geology of the Earth, Movements of Tectonic Plates, and Effects of Earthquakes**
2. **Dynamic Behavior of simple structural systems**
3. **Structural dynamics of simple systems subject to harmonic and random earthquake loading**

Course Outcome: **Student shall be able to**

- CO1** Identify movements of tectonic plates, and characterize earthquake ground shaking
CO2 Estimate the magnitude & intensity of Earthquake
CO3 Utilize the principles behind Earthquake resistant design of structures
CO4 Formulate earthquake analysis of multi-storeyed buildings
CO5 Design earthquake resistant design and ductile detailing of frame members

Syllabus

Unit-I Earth and its interior, circulations, plate tectonics, faults, seismic waves, strong ground motions, characteristics of strong ground motions, Magnitude (and Richter Scale), Intensity (and Modified Mercalli Scale)

Hrs-06

Unit-II Earthquake Resistant Design Philosophy for Normal Buildings; Four Virtues of Earthquake Resistant Buildings – Structural Configuration, Lateral Stiffness, Lateral Strength and Ductility; Seismic Zones in India; IS Codes for Earthquake Resistant Design and Construction of Buildings; geotechnical Design Considerations and Selection of Sites **Hrs-06**

Unit-III Special aspects in Multi-storey Buildings - Open Ground Storeys, P-delta effect, Soil-Structure Interaction, Drift Limitation, Short Column Effect **Hrs-06**

Unit-IV Introduction to IS 1893 (Part 1) - 2017, Design Base Shear, Earthquake Analysis of Buildings by Equivalent Static Method **Hrs-06**

Unit-V Introduction to IS 13920 - 2016, design strategy, capacity design of RC frame members, Structural Walls and Beam-Column joints, ductile detailing in RC Beams and Columns **Hrs-06**

Text Books:

1. Pankaj Agrawal and Manish Shrikhande, Earthquake resistant Design of Structures, 3rd Edition, Prentice Hall of India Pvt, Ltd. Publications, 2006

Reference Books:

1. S. K. Duggal, Earthquake Resistant Design of Structures, 1st Edition, Oxford University Press Publications, 2007
2. Dowrick, D. L., "Earthquake Resistance Design for Engineers and Architects", 2nd Edition, John Wiley & Sons, 1987

Online Certification Courses:

1. Introduction to Earthquake Engineering, Dr. R. S. Jangid, IIT, Bombay

Best faculty members from IIT:

1. Dr. CVR Murty, IIT Jodhpur
2. Dr. R. S. Jangid, IIT, Bombay

(Lectures–Tutorial–Practical-credits) / Week

(2-0-0- 2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To understand the IS code specifications
2. Understand the design concept and able to design the components of structures
3. To identify and calculate the loads as per codal provisions

Course Outcome: **Student shall be able to:**

- C01** Understand design philosophies according to IS 800:2007,IS:875
- C02** Design Round tubular structures
- C03** Design gantry girders for the loads specified as per IS code
- C04** Design Foot over bridge

Syllabus

Unit-I Design philosophy & IS code recommendations. Design of connections **Hrs-05**

Unit-II Design of round tubular structures, Design of steel chimneys.

Hrs-05

Unit-III Design of industrial gantry Girders

Hrs-10

Unit-IV Design of Foot Bridge

Hrs-10

Text Books:

1. S. K. Duggal, Limit State Design of steel structures, 2nd Edition, Tata Mc-GRAW HILL, 2013
2. Dr. V.L. Shah , Veena Gore, Limit State Design of steel structures, 3rd Edition, Structures Publications, 2012
3. N. Subramaniam, "Design of Steel Structures as per IS:800-2007", Oxford university press.

Reference Books:

1. L. S. Negi, Design of steel structures, 2nd Edition, Tata Mc-GRAW HILL, 2008
2. S. S. Bhavikatti, Design of steel structures by Limit State Method as Per IS 800-2007, 4th Edition, I.K. International Publication, 2014
3. S. K. .Duggal, Design of steel structures, 3rd Edition, Tata Mc-GRAW HILL, 2009

I.S.Codes:- IS:800-2007, IS:875-Part 1,2 & 3

NPTEL courses: Prof. A.Shantha Kumar, IIT, Madras

Prof. S. R. Satishkumar, IIT,

Madras

BCEL 405 MATRIX METHOD OF STRUCTURAL ANALYSIS (ELECTIVE –) (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To introduce stiffness method for analysis of statically indeterminate structures.
 2. To develop a computer program for structural analysis based on the matrix stiffness method
 3. To understand the basics of finite element method and application to structural analysis
- Course Outcome: **Student shall be able to**

C01 Understand the basic concept of Direct Stiffness Method for structural analysis.

C02 Understand the concept of elemental stiffness matrix for different elements.

C03 Understand the concept of global stiffness matrix for different elements.

C04 Apply the fundamental concepts in the analysis of member with temperature loading.

C05 Identify the concept involved in finite element method and application to structural analysis

Syllabus

Unit-I Basic concept, Degree of Freedoms, Basic concept of Direct Stiffness Method, Formulation of elemental / local stiffness matrix and global stiffness matrix for plain truss. Transformation Matrix, Assembly of

Global/ Structure stiffness matrix up to (4X4). Member load matrix, Assembly of Global / Structure load matrix, Solution to problems with maximum degree of Freedom four.

Hrs-07

Unit-II Formulation of elemental / local stiffness matrix and global stiffness matrix for Beam members (without axial deformation) for continuous beams, Transformation matrix Assembly of global/Structure stiffness matrix, Member load matrix due to concentrated load, Uniformly distributed load, Moment assembly of global/ structure load matrix up to (8X8) Solution to problem with maximum degree of freedom four.

Hrs-07

Unit-III Formulation of elemental /local stiffness matrix and global stiffness matrix for Plane Frame member (With axial deformation), Transformation matrix, Assembly of global / Structure stiffness matrix, Member load matrix due to concentrated loads, Uniformly distributed loads, moments, Assembly of Global /Structure load matrix. Solution to plane frame problems with maximum degree of freedom six, Inclined member problem.

Hrs-

06

Unit-IV Analysis of Member for temperature loading, initial joint displacement (sinking of support), lack of fit in trusses, trusses with inclined roller, storing of global/ structure stiffness Matrix, full storage, banded storage, band Minimization.

Hrs-06

Unit-V Introduction to finite Element method , basic concept, discretization of structure, Rayleigh Ritz member for bar elements (prismatic / Non prismatic) Displacement based Bar elements (prismatic / non-prismatic) and Beam elements (prismatic) Displacement based bar elements (prismatic / Non-prismatic) and Beam element (prismatic), Load, Matrix for body forces

Hrs-04

Text Books:

1. V. N. Vazirani M. M. Ratwani, Advanced Theory of Structures And Matrix Methods Of Analysis, 5th Edition, Khanna publisher, 2002
2. Harry H.West, Louis F. Geschwindner, Fundamentals of Structural Analysis, 2nd Edition, Wiley Publishers, 2002

Reference Books:

1. C S Reddy, Basic Structural Analysis, 3rd Edition, Tata McGraw Hill, 2011
2. Bhavikatti S S, Structural Analysis – II, 3rd Edition, VIKAS PUBLISHERS, 2009

Online Certification Courses:

1. Matrix Method of structural Analysis, Prof. Amit Show, IIT Kharagpur. (NPTEL)

Best faculty members from IIT:

1. Prof. Baidurya Bhattacharya, Department of Civil . IIT Kharagpur
2. Prof. Amit Show, Department of Civil. IIT Kharagpur

BCEL 406 Repair & Rehabilitation of Structures (Theory) (Elective) (Lectures) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. **To Understand the Natural Causes/Agencies which Deteriorates the Structures.**
2. **To be Able to Understand the Role of Field Civil Engineers in Disaster Management.**
3. **To get the Knowledge of Techniques Available for Rehabilitation.**
4. **To Implement different Methods of Rehabilitation and Demolish.**

Course Outcome: **Student shall be able to**

- C01** Understand the need of Maintenance of Structures with Passage of Time.
C02 Opt proper material for Complex Situations.
C03 Come up with different techniques to Cater the Situation.
C04 Demolish the Structure in the Right Way.

Syllabus

Unit-I REPAIR STRATEGIES AND MAINTENANCE:

Importance of Maintenance various aspects of Inspection. Assessment procedure for evaluating a damaged structure, causes of deterioration. Corrective & preventive maintenance of foundation as sub-structures.

Hrs-07

Unit-II REPAIR BY DIFFERENT MATERIALS: Special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

Hrs-07

Unit-III TECHNIQUES FOR REPAIR: Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.

Hrs-08

Unit-IV REPAIRS, REHABILITATION, RETROFITTING

AND DEMOLITION OF STRUCTURES: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure. Non Engineering Demolition, Mechanical Method of demolition, Dismantling of building and reuse of material and fittings. - Case studies. **Hrs-08**

Text Books:

1. Shetty M.S, Concrete Technology – Theory and Practice, 10th Edition, S.Chand and Company, 2005
2. Dov Kominetzky.M.S, Design and Construction Failures, 8th Edition, Galgotia Publications Pvt. Ltd, 2008

Reference Books:

1. Ravishankar.K., Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, 3rd Edition, Allied Publishers, 2004
2. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, 10th Edition, Narosa Publishers, 2008

Online Certification Courses:

1. SWAYAM
COURSE==<https://swayam.gov.in/courses/4901-july-2018-structural-health-monitoring>.

Best faculty members from IIT:

1. Prof. Albert Thomas, Assistant Professor, Department of Civil Engineering, IIT Bombay; Email: albert@iitb.ac.in (Phone No. : (+91-22 25767301))

BCEL 407 ENVIRONMENTAL MANAGEMENT (Theory) (Elective-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course Objective Student shall be able to

1. **Gain environmental awareness.**
2. **Understand basic concept of environmental management**
3. **Know Environmental Legislation and acts.,**
Course Outcome: **Student shall be able to**

CO1 Outline the principles of environmental management.

CO2 Understand the concept of sustainable development and Environmental Management Plan.

CO3 Apply the knowledge of Environmental Impact Assessment to real life.

CO4 The gain knowledge of environmental legislations and environmental acts.

Unit-I Definition of Environmental Management, Principles of Environmental Management, Nature, Scope and Components of Environmental Management, Policies and Legal Aspect of Environmental Management. **Hrs -08**

Unit-II Public Private Participation Model, ISO Certification, EHS, EDM. Environmental organizations for planning and implementation sustainable development. Preventive and reactive strategies for environmental pollution control. Life Cycle Assessment as Environmental Management Tool. Environmental Management Plan (EMP), Components of EMP, Preparation of EMP, Case Study **Hrs-07**

Unit-III Environmental Impact Assessment (EIA), Need and Importance, Steps involved, Methods of EIA, Ad-hoc, checklist, network, matrix etc. Typical case studies of environmental impact assessment, Environmental impact statement and risk assessment. **Hrs-07**

Unit-IV Environmental Legislation, Air, Water and Environmental acts, Preventive and reactive strategies for environmental pollution control, Environmental organization for planning and implementation, sustainable development Environmental Audit

Hrs-08

Text Books:

1. Assessment and analysis of Environmental management, Shukla S. S., Shrivastva P. R. 1992, commonwealth publishers New Delhi 2003

Reference Books:

1. Environmental Impact Assessment, second edition, Larry W. Canter, McGraw-Hill International editions.
2. Primes on 'Environmental Management prof. P. Khanna, Multitech publications Co. New Delhi 2001.

IS Codes

e-Learning Resources:

www.nptel.iitr.ac.in/iitroorki.
www.nptel.iitg.ac.in/iitGuahati.

Best faculty members from IIT:

1. Dr. Shasidhar IIT Hyderabad

BCEL 408 WASTEWATER ENGINEERING (THEORY) (ELECTIVE-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course Objectives:

1. **To understand waste water and conveyance system.**
2. **To determine the physico-chemical characties of waste water**
3. **To provide proper arrangement and operation of units in waster water treatment plant**

Course Outcome: Student shall be able to

CO1 Know wastewater treatment design and storm water, domestic sewage etc. flow system.

CO2 Explain wastewater characteristic, sampling of sewage, physical, chemical and biological characterization.

CO3 Explain and design wastewater treatment units for municipal use.

CO4 Explain low cost waste treatment.

Unit-I Introduction and objective of Waste water treatment, Quantity of storm water, domestic sewage, variation of sewage flow systems of sewerage - separate combined and partially combined layouts of sewerage system, capacity of sewers, design of sewers. Laying out of circular sewers-Boning rod and sight rail method, Testing & maintenance of sewers.

Hrs-07

Unit-II Waste water characteristic, sampling of sewage, physical, chemical and biological characterization, B.O.D.,C.O.D., TOC, B.O.D.

equation, problems on B.O.D. Pollution due to domestic and industrial waste. Sewage and Industrial effluent standards for disposal on land, into stream and into sewers.

Hrs-07

Unit-III Treatment of sewage - purpose of treatment, preliminary treatment, primary treatment and secondary treatment. Preliminary Treatment:- Screening, Grit chamber, detritus tank., Oil and grease removal Sedimentation.

Hrs-07

Unit-IV Biological treatment: Trickling filters, low rate & high rate trickling filters. Activated sludge process - Process description, Methods of aeration, loading rates, Different modified forms of A.S.P. design criteria using MLSS, MLVSS & SVI, F/M., Anaerobic Digestion – UASB, AFFR, Hybrid reactors., biogas generation, concept of CETP

Hrs-07

Unit-V Low cost waste treatments - Oxidation ponds, Aerated Lagoon, Treatment and Disposal of sludge - Digestion of sludge, sludge disposal. Septic tank, working and design, Disposal of septic tank effluent. Disposal of sewage on land and in stream. Self-purification capacity of stream

Hrs-07

Text Books:

1. Rao, M. N. and Rao H. V. N., Air Pollution, 26th Edition, Tata McGraw Hill, 2007
2. Rao and Datta, Waste Water Treatment, 4th Edition, Oxford & IBH Pub. Co. Pvt.Ltd., New Delhi., 2009
3. Punmia, Wastewater Engineering, 2nd Edition, Laxmi Publication, 2005

Reference Books:

1. Mactcalf and Eddy, Waste Water Treatment, Disposal and Reuse, 4th Edition, McGraw Hill Pub. Co., New Delhi, 2004

IS Codes

e- Learning Resources:

www.nptel.iitr.ac.in/iitroorki.
www.nptel.iitg.ac.in/iitGuahati.

Online Certification Courses:

1. Water and Wastewater Treatment Engineering, Tsinghua University, China.

Best faculty members from IIT:

1. **Makarand M. Ghangrekar**, Professor, Department of Civil Engineering, Indian Institute of Technology Kharagpur
2. **Dr. Debraj Bhattacharyya**, Associate Professor, Environmental Engineering, Indian Institute of Technology Hyderabad.

BCEL 409 GREEN BUILDING (Theory) (Elective-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course Objective

1. To understand the concept of high performance green buildings and sustainability.
2. To study the various existing rating systems for sustainable building design.
3. To study various methods of energy and water conservations.

Course Outcome: Student shall be able to

CO1 Gain a broad understanding of Green Building and explore the phases of sustainable development.

CO2 Apply knowledge of national and international rating systems while designing green buildings.

CO3 Apply modern green engineering concept, tools, techniques & skills necessary for engineering practice in energy efficiency concept during execution.

CO4 Explain the contemporary issues and development associated with green building.

Unit-I Introduction to Green Buildings. Impacts of building construction, operation and disposal. The green building process and assessment. Phases of sustainable development: site planning and evaluation, construction, commissioning, and occupancy phases; site selection and location of building on a site; building design: orientation, components, systems, integrated design, scale; material selection, historic, present, properties, how they work, efficiency; construction: phasing, sequencing, minimization of erosion; occupancy – proper use; reuse; building lifecycle Ecological design.

Hrs-08

Unit-II Introduction and description of existing rating systems for sustainable building design and construction (both new construction and renovations) at local, national, and international level; BEES, LEED, CHPS, ASHRAE Green Guide, Energy Star Homes, international: BREEAM, BEPAC, Green Star Certification, CASBEE, World Green Building Council.

Hrs-07

Unit-III Energy Considerations in Green Building. Buildings' contribution in environment devastation – why the way we build is so critical for sustainable development; electricity consumption per capita in houses. Creating a low energy profile. Building systems: lighting – day lighting; ventilation – natural ventilation; indoor air quality; heating/cooling – geothermal; passive and active systems for energy production and conservation; water conservation – grey water reuse, water saving plumbing fixtures.

Hrs-

08

Unit-IV Sustainable features in buildings – case studies of interesting items related to topic.

Construction Operations and Building Commissioning. Economic issues and future directions in green building. Proper way to promote sustainability, western world as a role model; how to stop it, motivation for conservation, marketing, tax incentives, corporate and government Environmental responsibilities

Hrs-07

Text Books:

Reference Books:

1. Michael Bauer, Peter Möslle and Michael Schwarz, "Green Building – Guidebook for Sustainable Architecture" Springer Publication, ISBN 978-3-642-00634-0.
2. Kibert, C. J. "Sustainable construction: Green building design and delivery", Wiley, Hoboken, NJ. 2013.

IS Codes: National Building Code 2017.

e-Learnin Resources:

www.nptel.iitr.ac.in/iitroorki.

www.nptel.iitg.ac.in/iitGuahati.

Best faculty members from IIT:

1. Prof. Ashish Modi, Dept. of Energy science nad Engg., IIT Bombay

BCEL 410 AIR POLLUTION & SOLID WASTE MANAGEMENT (THEORY) (ELECTIVE-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course objective

1. Understand the terminologies & problems associated with air pollution.
2. Familiar with regulations related to air pollutions.
3. Have working knowledge of all unit operations involved in solid waste management.

Course Outcome: **Student shall be able to**

CO1 List the terminologies & problems associated with air pollution

CO2 Summarize various meteorological parameters, management strategies and techniques for air pollution control.

CO3 Elaborate the Solid Waste Management System also the various characteristics of solid waste.

CO4 Discuss policy regarding Transportation and Disposal of solid waste.

Unit-I General: Air pollution episodes, local and global effects of air pollution, pollution sources and emission inventories

Thermodynamics and Kinetic:- Combustions, equilibrium calculation, chemical kinetics.

Meteorology and Transport of Air Pollution:

Wind roses, topographical effects, temperature distribution in atmosphere, inversions, plume behavior and dispersion models.

Hrs-07

Unit-II Air Pollution Control:

Control techniques for pollutants such as particulates, sulfur oxides, nitrogen oxides, hydrocarbons etc. Noise pollution

Air Pollution Control Management:

Air quality requirements, legislation, emission standards, management for air pollution control.

Hrs-08

Unit-III Solid Waste Management System:

Introduction, Solid waste management system and organization. Sources, types, Quantity and composition, sampling, physical, chemical and biological properties of solid waste. Collection of solid waste. Tools and equipment used.

Hrs-08

Unit-IV Transportation & Disposal:

Transportation & optimization of routes, Transfer station, volume reduction, Scientific method of disposal. Sanitary landfill, Composting, Incineration, anaerobic digestion, leachate control, Future processing method, pyrolysis, refuse derived fuel

Hrs-07

Text Books:

1. S. Mushraf, Legal aspects of environmental pollution and its management, 1st Edition, C.B.S. publishers, Delhi, 1992

Reference Books:

1. Rao, M. N. and Rao H. V. N., Air Pollution, 26th Edition, Tata McGraw Hill, 2007
2. George Tachonobanoglous, Hilary Thesin, Samuel, Integrated Solid Waste Management, Vigil McGraw Hill

IS Codes

e- Learning Resources:

www.nptel.iitr.ac.in/iitroorki.

www.nptel.iitg.ac.in/iitGuahati.

Best faculty members from IIT:

1. Khare Mukesh IIT Delhi

BCEL 411 MUNICIPAL AND INDUSTRIAL WATER TREATMENT (THEORY) (ELECTIVE-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course Objectives:

1. To understand the basic concept and requirement of treatment for municipal and industrial water.
2. To study theory and design of various filters
3. To study various theories and methods of adsorption

Course Outcome: Student shall be able to

CO1 Use knowledge about quality water for drinking and industry purposes,

CO2 Explain Principles of sedimentations and Filtration

CO3 Apply knowledge of adsorption and ion exchange in real life depending up to contamination in water

CO4 Apply knowledge of miscellaneous method of water treatment in real life.

Unit-I Water quality criteria and standards, requirements of water treatment facilities – unit operations and unit processes – characteristics of water.

Theory and Application aeration, Theories of chemical coagulation, common coagulant in water. Factors affecting coagulation, determination of coagulant doses, perikinetik and orthokinetic coagulation, theory and use of coagulant aids, design, construction. operation of flocculators, design of clariflocculator.

Hrs-07

Unit-II Principles of sedimentations – effect of temperature, viscosity – efficiency short circulating – design of inlets and outlets, High rate sedimentation

Theory of filtration design construction and operation of filters – hydraulics of filtration and filter back washing. Performance of rapid sand filters. High rate and variable rate filtration. Two layer filter pressure filters diatomaceous earth filters. Modern developments in filtration. Factors affecting disinfect ion – free and combined available chlorine, ultraviolet irradiation, ozonization disinfection of new mains – emergency chlorination.

Hrs-08

Unit-III Water treatment for swimming pools.

Theories of adsorption. Freundlich equation. Removal of taste and dour by adsorption. Activated carbon phenol value. Other method of taste and odour control and colour removal. Boiler, cooling and other industrial water requirements. Langelier index. Softening of water

Hrs-07

Unit-IV Lime – soda methods. Dosage control. Excess dose. Hot lime – soda. Split treatment. Recarbonation. Use of polyphosphates Softening by ion exchange. Natural and synthetic media, capacity, regeneration. Ion exchange demineralization. Miscellaneous method of water treatment, iron and removal, desalination, nitrate, phosphate and arsenic removal and recent advances.

Hrs-08

Text Books:

1. S.K. Garg, Water Supply And Sanitary Engineering, 5th Edition, Khanna Publishers Delhi, 2010
2. N.J.McGhee, Water supply and sewerage, 1st Edition, Tata McGraw Hill, 1991
3. B.C. Punmia, Water Supply & Sanitary Engineering, 1st Edition, Laxmi Publication, 2005

Reference Books:

1. Matcalf and Eddy, Waste Water Treatment, Disposal and Reuse, 4th Edition, McGraw Hill Pub. Co., New Delhi, 2004
2. N.J. Weber, Physicochemical process for water quality control, 3rd Edition, John wiley and sons, 1972
3. Nordel, E, Water treatment for industrial and other uses Vol 42nd, 5th Edition, Reinhold Publishing Corporation 2007

e- Learning Resources:

www.nptel.iitr.ac.in/iitroorki.
www.nptel.iitg.ac.in/iitGuahati.

Best faculty members from IIT:

1. B. J. Alappat Professor in IIT Delhi

2. Dr. Debraj Bhattacharyya, Associate Professor, Environmental Engineering, Indian Institute of Technology Hyderabad.

BCEL 412 Advanced Fluid Mechanics (Theory) (Elective)

(Lectures) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To provide basic knowledge for free surface flow
2. To introduce the concepts of channel hydraulics.
3. To Use in design of inland waterways for irrigation and navigation.
4. To Introduce the Concepts of Gradually Varied Flow and Hydraulic Jumps.

Course Outcome: **Student shall be able to**

C01 Identify properties of fluid for free water surface.

C02 Use Concepts of Specific Energy and Specific Force

C03 Use concept for hydraulic jump and apply governing equation for GVF.

C04 Apply flow measurement in open channels.

Syllabus

Unit-I Introduction to Free Surface Flows : Comparison between pipe and channel flows, basic equations governing channel flows.

Uniform Flow : Flow resistance in channel flows, resistance relationships, normal depth, section factor for uniform flow computation

Unit-II Concepts of Specific Energy and Specific Force : Section factor for critical flow computation, critical depth computations, control sections, applications of specific energy and critical depth.

Hrs-06

Unit-III Gradually Varied Flow : Governing equations, characteristics and classification of water surface profiles, computations of GVF profiles in prismatic and non-prismatic channels.

Hydraulic Jump : Types of jump, hydraulic jump in horizontal rectangular channels, forced jump, hydraulic Jump in non-rectangular and sloping channels, stilling basins.

Hrs-08

Unit-IV Flow Measurement in Open Channels : Broad and sharp-crested weirs, free overall, flow over spillways, side weirs, sluice gates.

Hrs-08

Text Books:

1. R. K. Bansal, A Textbook of Fluid Mechanics, Laxmi Publications, 2008 (First Edition)
2. V.L. Streeter and E.B. Wylie, Fluid Mechanics, McGraw Hill, 1997.
3. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998.

Reference Books:

1. B.F. White, Fluid Mechanics, McGraw Hill, 1994.
2. K S. Massey, Mechanics of Fluids, Van Nostrand Reinhold Co., 1979.
3. J. Frabzini, Fluid Mechanics with Engineering Applications, McGraw Hill, 1997.
4. J.H. Spurk, Fluid Mechanics – Problems and Solutions, Springer, 2003.

Online Certification Courses:

1. SWAYAM COURSE=
<https://swayam.gov.in/course/4505-advanced-fluid-mechanics>
2. NPTEL COURSE=
https://onlinecourses.nptel.ac.in/noc18_me10/preview

Best faculty members from IIT:

1. **Dr. Abhijit Guha**, Ph.D., University of Cambridge, Professor.

BCEL413 GROUND WATER MANAGEMENT (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. **To Know groundwater availability and domains; recharge**
2. **To Introduce to Ground Improvement techniques.**
3. **To improve ground water table techniques**

Course Outcome: **Student shall be able to**

- C01** Know about ground water availability zones and ground water management.
- C02** Analyze and suggest proper ground improvement technique for problematic ground conditions.
- C03** Apply the knowledge of ground water availability with proper understanding and for natural resources for sustainable development
- C04** Explain the ground water movement phenomenon
- C05** Understand the ground water recharge methods

Syllabus

Unit-I Geohydrology: Rocks as aquifers, occurrence and availability of Groundwater; Groundwater investigations, groundwater development and management in India; Techniques of groundwater recharge.

Unit-II Groundwater: Introduction, Occurrence and distribution of Groundwater, Water table. Introduction to hydraulics of wells, Open wells - yield test. **Hrs-05**

Unit-III Applications of Geoinformatics for spatial management of resources: Run-off estimations, infiltration characteristics, groundwater potential and recharge characteristics, Watershed management, watershed prioritization, Sediment yield estimation, reservoir capacity studies

Hrs-09

Unit-IV Ground Water movement: Darcy's law, permeability and its measurement, tracing of ground water movement, fundamental equations for steady and unsteady ground water flow, flow nets.

Hrs-05

Unit-V Ground- water replenishment, recharge of ground water, different methods

Hrs-05

Text Books:

1. KVGK Gokhale, Principles of Engineering Geology, BS Publications.
2. David Reith Todd, Groundwater Hydrology John Wiley publishers 2002.

Reference Books:

1. Geographic Information System and Environment Modeling, Keith C. Clerk, Bradely O.Parks, Michel P Crane, Pritince Hall of India, 2002.
2. Ragunath H M Groundwater & Well Hydraulics, Wiley Eastern Ltd, New Delhi 2000

Online Certification Courses:

1. Ground Water Hydrology by Dr Rajib Kumar Bhattacharjya, rkbc@iitg.ernet.in Dept. of Civil Engineering, Indian Institute of Technology Guwahati, Guwahati - 781039, Assam, India
<https://nptel.ac.in/courses/105103026/>

BCEL414: Advanced Hydraulics Engineering (Theory) (Elective)

(Lectures) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. **To provide basic knowledge for the Flow in Open Channel.**
2. **To introduce the concepts of Uniform Flow and Varying Flow.**
3. **To utilize the knowledge of flow in Non-Prismatic Channels.**

To Introduce the Working of Turbines.

Course Outcome: **Student shall be able to**

- C01** Determine the type of Flow in channel.
- C02** Differentiate between the types of Flow taking place in Channel.
- C03** Draw the Various Flow Patterns in any Open Channels.
- C04** Explain the Working of Turbines and Pumps.

Syllabus

Unit-I Open Channel Flow: Kinds of open channel flow, channel geometry, types and regimes of flow Velocity distribution in open channel, wide open channel, specific energy, critical flow and its computation Energy in non-prismatic channel, momentum in open channel flow, specific force.**Hrs-07**

Unit-II Uniform Flow: Qualification of uniform flow, velocity measurement, Manning's and

Chezy's formula, determination of roughness coefficients Determination of normal depth and velocity, most economical sections, non-erodible channels Flow in a channel section with composite roughness, flow in close conduit with open channel flow.

Varied Flow: Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles, classification of flow profile, draw down and back water curves profile determination, graphical integration, direct step and standard step method, numerical methods, flow through transitions, dynamic equation of spatially varied flow Analysis of spatially varied flow profile, computation of spatially varied flow using numerical integration.

Hrs-09

Unit-III Hydraulic Jumps: Hydraulic jump, types of jump, basic characteristics of jump, length and location of jump, jump as energy dissipation, control of jump, surges, surge channel transitions.

Flow Through Non-Prismatic Channel Section: Sudden transition, sub-critical flow through sudden transition, flow through culverts, flow through bridge piers, obstructions, and channel junctions.

Hrs-07

Unit-IV Turbines: Application of momentum principle, impact of jets on plane and curved plates, turbines, classification, radial flow turbines Axial flow turbines, impulse and reaction turbines, draft tube and cavitation, performance of turbines, centrifugal pump, minimum speed to start the pump Multistage pumps, jet and submersible pumps, positive displacement pumps, reciprocating pump, negative slip, flow separation conditions.

Hrs-07

Text Books:

1. K. Subramanya: "Flow in open channels". Tata McGrawHill (1997)
2. Terry Sturm, Open Channel Hydraulics, MG Hill Publications

Reference Books:

1. V.T. Chow: "Open-channel hydraulics." McGraw Hill Publications (1959,1973)
2. Rajesh Srivastava: "Flow through open channels". Oxford University Press (2008)
3. H. Chaudhury: "Open channel flow". Second Edition. Springer (2008)

Online Certification Courses:

1. **SWAYAM COURSE==**
<https://swayam.gov.in/course/3736-computational-hydraulics>
2. **NPTEL COURSE==**
<https://nptel.ac.in/courses/105103021/>

Best faculty members from IIT:

1. Dr. Kamlesh Kumar Pandey, Associate Professor, IIT Bhubaneswar,
(kkp.civ@iitbhu.ac.in)

BCEL 415: Soil Dynamics (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To understand the basics of soil dynamics.
2. To study the soil dynamic properties of soil.
3. To use the fundamental concepts for design of foundation in different conditions.

Course Outcome: **Student shall be able to**

- C01** familiar with identification and solution of a particular dynamic system.
- C02** analyze dynamic behavior of soil through wave propagation theory and also be able to determine the dynamic soil properties.
- C03** analyze and carry out the design of machine foundation.
- C04** provide appropriate vibration isolation technique if necessary.

Syllabus

Unit-I Introduction to Soil Dynamics:

Theory of vibration, Dynamics Systems, single degree and two degree of freedom system, vibration of six and multi degree freedom system, Mass spring analogy - Barkan's Theory, Vibration Isolation: Introduction, Active and passive isolation, Methods of vibration isolation

Hrs-06

Unit-II Wave Propagation:

Wave propagation theory and its application to dynamic problems

Hrs-06

Unit-III Soil Dynamic Properties:

General factors affecting shear modulus, elastic modulus and elastic constants, Field Techniques – Cyclic plate load test, block vibration test, Standard Penetration Test, Seismic bore hole surveys, Laboratory techniques – Resonant column test, Cyclic simple shear and triaxial compression test Problems

Hrs-09

Unit-IV Machine Foundations:

General principles of machine foundation design, Types of machines and foundations, General requirements of machine foundation, Permissible amplitudes and stresses.

Text Books:

1. Vibration Analysis and Foundation Dynamics by N.S.V, Kameswara Rao, published by Wheeler publishing
2. Analysis and Design of Foundation for Vibration by P.J. Moore published by Oxford and IBH Publishing Company

Reference Books:

1. Soil Dynamics and Machine Foundations by Swami Saran
2. Vibration of Soil and Foundation by F.E. Richart, J.R. Hall and R.D. Woods Published by Prentice-Hal Inc, New Jersey
3. Soil Dynamics and Machine Foundation by Swami Saran published by Galgotia Publication

Online Certification Courses:

1. SWAYAM course IIT kharagpur

Best faculty members from IIT:

1. Dilip Kumar Baidya

BCEL 416: PAVEMENT DESIGN (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To study latest methods of analysis and design of flexible and rigid pavements including its maintenance
2. To understand the behaviour of different pavement materials
3. To predict stresses developing in flexible and rigid pavements

Course Outcome: **Student shall be able to**

CO1 Characterize the response characteristics of pavement materials

CO2 Analyse flexible and rigid pavements

CO3 Field testing and evaluation of pavements

CO4 Design and maintain flexible and rigid pavements using IRC and AASHTO methods

Syllabus

Unit-I Pavement Materials :Types and component parts of pavements, highway and airport pavements, Materials used in pavements, basic soil properties relevant to pavement applications, resilient modulus, and modulus of sub-grade reaction, **Physical properties** :Aggregates and blending, Basic properties of bitumen, polymer and rubber modified bitumen, Dynamic modulus, flow time and flow number of bituminous mixes. Cement: chemical composition, types, physical properties.

Hrs-06

Unit-II Stresses in flexible pavements: layered system concepts, stress solution for one, two and three layered systems, fundamental design concepts.

Stresses in rigid pavements: Westergaard's theory and assumptions, stresses due to curling, stresses and deflections due to loading, frictional stresses, stresses in dowel bars and tie bars.

Factors Affecting Pavement Design: Variables considered in pavement design, Classification of axle types, articulated commercial vehicles, legal axle and gross weights on single and multiple units, tyre pressure, contact pressure, ESWL, EWLF and EAL concepts, Traffic analysis: ADT, AADT, growth factor, lane distribution, directional distribution and vehicle damage factors.

Hrs-09

Unit-III Pavement testing and evaluation : Field Density, CBR, Plate load Test, Condition surveys and surface evaluation for unevenness, rut depth, profilometers, Bump integrators, Benkalman Beam Deflection study.

Hrs-05

Unit-IV Design of Pavements: IRC method of flexible pavement design, Design of flexible pavements for low volume roads using IRC method, IRC methods of rigid

pavement design, Design of rigid pavements for low volume roads using IRC method.

Strengthening of pavements: Repairs, Maintenance and rehabilitation of pavements.

Hrs-05

Text Books:

1. Khanna & Justo, Highway Engineering, 10th Edition, Nem Chand Brothers,
2. Huang, Y.H. Pavement Analysis and Design, Second Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi, India, 2008

Reference Books:

1. David and Paul Croney, Design and performance of road pavements, 3rd Edition, Mc Graw hill, 1998

IS Codes:

1. IRC: 37-2012 Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi, India, 2012.
2. IRC: 58-2011 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, The Indian Roads Congress, New Delhi, India, 2011.
3. IRC: SP: 62-2004 Guidelines for the Design and Construction of Cement Concrete Pavements for Rural Roads, The Indian Roads Congress, New Delhi, India, 2004.

Online Certification Courses:

1. www.nptel.ac.in.

Best faculty members from IIT:

1. Prof. Avijit Maji – IIT Bombay
2. Prof. Animesh Das- IIT Kanpur

BCEL 417: ADVANCED TRANSPORTATION ENGINEERING (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To introduce the advances in transportation engineering and to make the students conversant with traffic flow theory as well as analytical techniques in estimation of flow variables
2. To understand traffic safety, causes of accidents, interpreting accident data.
3. To understand the concepts of air transportation, including air traffic control and operation, and runway configuration and length

Course Outcome: **Student shall be able to**

CO1 Measure and calculate different traffic parameters like speed, flow, travel time and delay.

CO2 Apply appropriate statistical methods while dealing with different types of traffic data collected during traffic studies and must have a understanding of measures for traffic safety.

CO3 Carryout the geometrical design of the airport infrastructure

CO4 Implement different visual aids required at airport

Syllabus

Unit-I Objective and scope of traffic engineering, intelligent transport, tunnel, and airport engineering. Traffic Engineering: 3E's of traffic characteristics, road vehicle characteristics, Traffic on Indian roads. Traffic surveys: Speed, Journey time and delay studies, methods of measurement of spot speed headways gaps volume/ capacity surveys speed, volume density interrelations, measurements of running and journey speeds Origin Destination surveys necessity, surveys necessity, survey methods sample size, data analysis & Presentation, Highway capacity, level of service concepts. Traffic Flow measurement and automatic incident detection using video camera. Collision avoidance system.

Hrs-08

Unit-II Traffic Events: Statistical method for interpretation regression application of Binomial, Normal Poisson distributions, Discrete and continuous distribution to traffic flow, Test of significance –Chi-square & 't' test Traffic Safety: Driver error, vehicle & road surface Laws and enforcement traffic accident conditions in India Collection and interpretation of accident data and recording in Std. from skidding speed and weather effects on accidents, Analysis of accidents. Pedestrian cyclist & auto vehicle driver's safety. Traffic regulation 3R and 5E's of traffic management. Traffic signal control system. Dynamic traffic light signals.

Hrs-08

Unit-III Development of Air Transportation in India: Comparison with other transportation modes. Aircraft components and characteristics, Airport site selection. Modern aircrafts.

Airport obstructions: Zoning laws, Imaginary surfaces, Approach and Turning Zone, clear zone, Vert. Clearance for Highway & Railway. Runway And taxiway design: Windrose, cross wind component, Runway Orientation and configuration. Basic runway length and corrections, runway geometric design standards. Taxiway layout and geometric design standards. Exit Taxiway

Hrs-07

Unit-IV Airport layout, Airport classification. Terminal Area, Aircraft parking and parking system. Unit Terminal concept, Aprons, Hangers, International Airport layouts, phase development, helipads and heliports. Visual Aids: Airport marking and Lighting for runway, Taxiway and other areas. Air traffic control: Need, Network, control aids, Instrumental landing systems, Advances in Air-traffic control.

Hrs-07

Text Books:

1. S. K. Khanna, C.E.G. Justo, Highway Engineering, 8th Edition, Nem Chand & Bros, Roorkee, 2001

Reference Books:

1. Rangwala, Highway Engineering, 3rd Edition, Charotar Publishing House, 2004

2. L.R Kadiyali, Traffic Engineering And Transport Planning, 3rd Edition, Khanna Book Publishing, 2014

IS Codes:

1. IRC: 37-2012 Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi, India, 2012.
2. IRC: 58-2011 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, The Indian Roads Congress, New Delhi, India, 2011.
3. IRC: SP: 62-2004 Guidelines for the Design and Construction of Cement Concrete Pavements for Rural Roads, The Indian Roads Congress, New Delhi, India, 2004.

Online Certification Courses:

1. www.nptel.ac.in.

Best faculty members from IIT:

1. Prof. Avijit Maji – IIT Bombay
2. Prof. Animesh Das- IIT Kanpur

BCEL 418: Urban Transportation Planning (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To understand the basics principles of transportation.
2. To study the urban transportation planning & processes.
3. To use the laboratory concepts for solving the problems related urban transportation.

Course Outcome: Student shall be able to

- CO1** model a new Traffic Plan of its own.
- CO2** decide the traffic system and Forecasting.
- CO3** Assess the system characteristics and Network.
- CO4** Design the Traffic Network for the proposed Routes.

Syllabus

Unit-I Introduction and scope; Definition and basic principles; Transportation problems; Types of models; Planning methodologies; Conventional transportation planning process; Travel demand modelling and forecasting;

Hrs-06

Unit-II Urban Transportation Planning Process, Urban Travel and Transportation Systems Characteristics, Travel Demands Forecasting- trip generation, trip distribution, modal split and trip assignment.

Hrs-08

Unit-III Transport Behavior of Individuals and Households, Land use/ Transportation systems, ; Traffic Assignment - route building, capacity restraint, multipath, incremental and equilibrium assignment; Graph theory applications in transport network analysis;

Hrs-08

Unit-IV Laboratory Component: Solving case study problems in travel demand modelling with the help of transportation planning and econometric

packages. Developing computer programs for the calibration of travel demand, land-use and land use-transport models.

Hrs-08

Text Books:

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, McGraw Hill, New York, 1974.
2. Ortuzar, J. and Willumsen, L.G., Modelling Transport, Wiley, Chinchestor, 1994.

Reference Books:

1. Oppenheim, N., Urban Travel Demand Modeling: From Individual Choices to General Equilibrium, Wiley, New York, 1995.
2. Thomas, R., Traffic Assignment Techniques, Avebury Technical, Aldershot, 1991.
3. Bruton, M.J., Introduction to Transportation Planning,

Online Certification Courses:

1. <https://nptel.ac.in/courses/105107067/>
2. Swayam course by School of Planning & Architecture

BCEL 419 DEPARTMENT ELECTIVE –
ADVANCED SURVEYING (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0- 2)

Total Hrs: 18 Marks-50

Course Objectives:

1. To classify the various elements of curves
2. To understand the errors in triangulation and calculate base line.
3. To understand the various components of GPS and GIS and calculate heights in photogrammetry.

Course Outcome: Student shall be able to

C01 Take linear measurements, bearings measurements.

C02 Calculate elevation of points & Prepare contour & topographical maps.

C03 Take angular measurements.

C04 Determine horizontal and vertical distances of points at angular observations

Unit-I Curves: Classification & Elements, Setting of curves.

Unit-II Triangulation: Classification, figures, choice of station, phase of signals, towers, satellite station, reduction to center, field work, Reconnaissance, Indivisibility, angular measurement. Base line measurement and corrections, Base-net, extension of Base-net, errors in observation and adjustment, method of least square, weighted observation, figure adjustment (Triangle only), Trigonometric leveling, Axis single corrections.

Hrs-08

Unit-III Element of Photogrammetry: - Basic definition, terrestrial and aerial photography, scale of vertical photograph, Relief and relief displacements, height from parallel measurements, flights planning, photographs required, Applications of aerial Photos.

Field Astronomy: Elements of spherical trigonometry, Napier's rules of circular parts, celestial sphere, ecliptic, circumpolar stars, astronomical terms, Astronomical triangle ,co-ordinate systems.

Hrs-07

Unit-IV Remote sensing : Introduction ,definition, remote sensing system, advantages over conventional system, energy interaction in the atmosphere ,Indian remote sensing satellite series and their characteristics.

GIS & GPS: Components of geographical information system (GIS), advantages and disadvantages, global positioning system (GPS), Introduction, definitions, GPS receivers, antenna, advantages of GPS.

Hydrographic Surveying: necessity, controls, shore line surveys, gauges, sounding equipments and procedure of taking soundings, method of location of sounding, three point problem in hydrographic surveying, analytical and graphical methods, station pointer.

Underground Surveying: Surface alignment, correlation of surface and underground surveys; weisbach triangle, transferring levels underground.

Hrs-

07

Text Books:

1. T. P. Kanetkar & S.V.Kulkarni, Surveying and Leveling Part II, 5th Edition, Laxmi Publication Ltd, 2005
2. B. C. Punmia, Surveying Vol. II and III, 5th Edition, Laxmi Publication Ltd, 2005
3. C.P. Lo, Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, 2nd Edition, Prentice Hall, 2006, ISBN-13: 9780131495029
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004. ISBN: 978-0-471-05930-1
5. Guocheng Xu, GPS Theory, Algorithms and Applications, Publication Date: September 14, 2007 | ISBN-10: 3540727140 | ISBN-13: 978-3540727149 | Edition: 2nd

Reference Books:

1. D. Clark, Plane and Geodetic Surveying Vol II, 3rd Edition, New age international limited, 2005
2. Dr. A. M. Chandra, Surveying, 5th Edition, New age international limited, 2005

e- Learning Resources:

www.nptel.iitr.ac.in/iitroorki.
www.nptel.iitg.ac.in/iitGuahati.

BCEL 420 GIS AND Remote sensing (Elective)

(Lectures–Tutorial–Practical) / Week (2-1-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To study the data structure and learn history of GIS
2. To provide applications of GIS and basic concepts of photogrammetry.

3. To use GIS/GPS in Transportation, Real World Experiences

Course Outcome: **Student shall be able to**

- C01** Define GIS, type of data and data structure and learn history of GIS
- C02** Apply various commands for special analysis such as query, overlay and data analysis
- C03** Understand the applications of GIS and basic concepts of photogrammetric
- C04** To learn the concept of remote sensing, element, passive and active remote sensing
- C05** To understand GIS/GPS in Transportation, Real World Experiences

Syllabus

Unit-I GIS Definition – Map and map analysis – Automated cartography – History and development of GIS – Hardware requirement – Type of data – Spatial and non- spatial data – Data structure – Vector and raster – Files and data formats – Data compression.

Hrs-06

Unit-II Spatial analysis – Data retrieval – Query – Overlay – Vector data analysis – Raster data analysis – Modelling in GIS – Digital Elevation Model – DTM – Types of output data –Output devices – Sources of errors – Types of errors – Elimination – Accuracies

Hrs-05

Unit-III The Global Positioning system and its applications. Concepts and foundations of remote sensing - electromagnetic spectrum - EMR interaction with atmosphere, water vapour, ozone - Basic principles of photogrammetry – Spectral Signature and Spectral Signature curves

Hrs-09

Unit-IV Remote sensing platforms and sensors. Satellite system parameters, sensor parameters, earth resources and meteorological satellites, microwave sensors, Data Acquisition and interpretation - Visual Image Interpretation – Visual Image Interpretation Equipment

Hrs-05

Unit-V Digital Image Processing – Classification. Applications in Survey, mapping and monitoring of land use/land cover – Transportation planning - Infrastructure development - Natural resources management - Urban Planning, Environment - Coastal Zone Management – Air Quality - Development of Resources Information Systems.

Hrs-05

Text Books:

1. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication, 2004.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice-Hall India, 2006.

Reference Books:

1. Thomas. M. Lilles and and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

Online Certification Courses:

1. GIS AND Remote sensing Dr Arun kumar sarf IIT Roorkee.

Best faculty members from IIT:

1. Dr Arun kumar sarf IIT Roorkee.

Reference Books-

1. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication, 2004.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice-Hall India, 2006.

BCEL 421: Operation Research and Management (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. **To study operational research methodology and its application to engineering.**
2. **To introduce students to use quantitative methods and techniques for effective decisions–making.**

Course Outcome: **Student shall be able to**

- C01** Apply Operation Research methodology to solve industrial problems.
- C02** Formulate and convert the real world problem into a mathematical form and provide an optimum solution for implementation.
- C03** Apply the concept and knowledge of project management and able to build the network and analyze it for improvement in project or task.
- C04** Use the inventory and simulation tools to give creative solutions.

Syllabus

Unit-I Introduction & Linear Programming:

Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study.

Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis

Hrs-06

Unit-II Transportation Problems:

Types of transportation problems, mathematical models, transportation algorithms, Allocation and assignment problems and models.

Inventory

Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipment's that deteriorate with time, equipments that fail with time.

Hrs-08

Unit-III Project Management & Network Techniques

Phases of project management, guidelines for network construction, CPM and PERT, Shortest path model, minimum spanning Tree Problem, Max Flow problem and Min cost problem.

Hrs-09

Unit-IV Theory of Games & Quality Systems

Rectangular games, Minimax theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model. Elements of Queuing model, generalized poison queuing model, single server models.

Hrs-07

Text Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research- An Introduction" Pearson Education, 2003.
3. R. Panneerselvam, "Operations Research" PHI Learning, 2008.

Reference Books:

1. Operation Research by Hira & Gupta
2. Operation Research by J.K. Sharma
3. Operation Research by Ashkhedkar & Kulkarni

BCEL 422: NEW ENGINEERING MATERIALS & TECHNIQUES (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To study the mix design of concrete and fibers reinforced concrete.
2. To study the strain gauges static and dynamics strain measurement.
3. To understand the modern methods used in various construction works.

Course Outcome: Student shall be able to

- CO1** Understand concrete mix design and validation as per project needs
- CO2** Summaries the fibers reinforced concrete and their applications
- CO3** Understand the importance of Light weight concrete, foam concrete on modifying fresh, hardened and durability properties of concrete
- CO4** understand the importance of construction chemicals (admixtures) on properties of concrete

Syllabus

Unit-I Study of Indian standards and there specification for concrete ingredients, Principles of concrete mix design, methods of concrete mix design, design of high strength, high performance concrete, Steel fibers reinforced concrete, Properties, Aspect ratio, strength, Durability of fiber reinforced plastics, other types of fibers and their applications.
Concrete admixtures, accelerators, retreads, non-destructive testing and quality control of materials

Hrs-

08

Unit-II Stress-strain measurement, strain gauges static and dynamics strain measurement, Calculation of stresses from measurement of strain, deflections etc

Unit-III Light weight concrete, foam concrete, workability, durability, and composition, application, Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, durability, applications

Hrs-07

Unit-IV Modern trends in concrete manufacturing, placement techniques, methods of transportation, placing of concrete, Industrial waste materials in concrete, their influence on physical mechanical properties of concrete and durability of concrete

Text Books:

1. AM Neville, Properties of concrete, 4th Edition, ELBS, London, 2012

Reference Books:

1. M L Gambhir, Concrete Technology, 5th Edition, the McGraw-Hill Companies, 2013
2. M S Shetty, Concrete Technology, 5th Edition, S Chand & Co. Ltd., 2005
3. IS: 13925 Repairs and Seismic Strengthening of Buildings-Guidelines" Bureau of Indian Standard New Delhi-1984
4. SP: 25 Causes and Prevention of Cracks in Buildings, Bureau of Indian Standard, New Delhi.

BCEL 423: Earth & Earth Retaining Structure (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. Slope stability analysis of Earthen Embankment, and Design of Earth Retaining Wall
2. Design of Earth Retaining Structures for Soils with different properties

Course Outcome: Student shall be able to

- CO1** Identify different types of retaining walls
- CO2** Estimate lateral earth pressure for design of retaining walls
- CO3** Analyze and design simple retaining walls with basic analytical skills
- CO4** Analyze and design complex retaining walls
- CO5** Identify appropriate methods of analysis, design and construction of earth retaining walls

Syllabus

Unit-I Earth Pressure Retaining Walls

Rankines & Coloumb's earth pressure theories; Poncelets and Culman's graphical construction for active and passive pressures; Effects of wall movement, Wall friction, type of slip surface; Wall angle, backfill slope angle, surcharges & line loads on lateral earth pressure; Direction and point of earth force application

Hrs-06

Unit-II Stability of Earth Retaining Structures

Types of Walls: gravity, cantilever walls, walls with counterforts and relief shelves, their typical

dimensional details; Stability requirements for overtaking, sliding, bearing capacity failure, and overall stability against shear failure in backfill & foundation soil; application of geosynthetics in earth retaining structures

Unit-III Sheet Pile Retaining Structures

Sheet piles walls bulk heads: Types of sheet piles, constructional features cantilever & anchored walls, their suitability; Analysis for design of cantilever walls in cohesion less and cohesive soils, approximate analysis; Analysis for anchored sheet pile with free end & fixed end support condition; Blum's criteria; Deadman and anchors - location and design principles **Hrs-06**

Unit-IV Compacted Embankments

Compaction control in field compaction; consideration of placement moisture content during field compaction, over compaction; Effects of compactive effect on compaction of clayey and sandy soil; Effects of lifts in deep compaction, correction for excluded grain sizes in laboratory compaction; Tests Theories of Compaction: water film and lubrication concept, microstructure concept **Hrs-06**

Hrs-06

Unit-V Stability of Slopes

Friction circle methods, factors of safety, stability numbers and use of stability charts, base failure; Stability of earthdam slopes for steady seepage and sudden draw down; Approximate analysis for plain slip surface, Bishop's method of slope stability

Cofferdams

Types, suitability; stability analysis of cellular and diaphragm type cofferdams; TVA method; interlocked stresses

Text Books:

1. Arora K.R., Soil Mechanics and Foundation Engineering, 5th Edition, Standard Publishers Distributors, 2005
2. Punmia, B.C., Soil mechanics & Foundation, 16th Edition, Laxmi Publishers, 2005

Reference Books:

1. Gopal Ranjan, Basic and Applied Mechanics, 2nd Edition, New Age International, 2005
2. Das, B.M., Principal of Geotechnical Engineering, 7th Edition, Cengage International, 2010

BCEL 424 ENERGY CONSERVATION AND ENVIRONMENT (Theory) (Elective-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course Objective

1. **Know fundamentals of nonconventional energy and Energy Scenario.**
2. **Learn different non-conventional energies and Energy Conversion Methods.**
3. **Explain Financial and economic aspect of nonconventional energy.**

Course Outcome: **Student shall be able to**

CO1 Explain fundamentals of nonconventional energy and Energy Scenario.

CO2 Explain fundamentals and concepts of solar energy.

CO3 Describe biomass energy and biomass conservation technologies.

CO4 Use of non-conventional energy in accordance with area.

Unit-I Overview of Global and Indian Energy Scenario; Fundamental of energy- science and technology Resource, Principle of energy Conservation ; Various aspect of energy conservation; Flow of Energy Through Ecosystem, Renewable and Non- Renewable Energy Sources; Necessity of energy storage

Unit-II Solar energy basics : Solar constant, Solar Radiation at earth's Surface, Solar time; Solar radiation Geometry, Empirical equations for estimating solar radiation availabilities on horizontal surface for cloudy skies ; Measurement of solar Radiation, estimation of solar radiation. Physical Principles of the conversion of solar radiation into heat ; Solar Energy collectors : non-concentrating and concentrating, transitivity of cover systems, energy balance equation, collector efficiency ; Application of the solar energy, solar photovoltaic system **Hrs-08**

Unit-III Biomass: Energy from biomass, biomass resources ; Basic concern and issues , types of biogas plant; Operational Parameter of a biogas plant; Availabilities of raw materials and estimation of gas yield; biogas production from waste biomass; Energy plantation ; Energy farming ; biomass conversion technologies: Combustion, Gasification, anaerobic digestion, fermentation, pyrolysis; Biomass Energy Programme in India. **Hrs-08**

Hrs-08

Unit-IV Brief introduction to non- conventional energy: oceans and tidal, geothermal, hydro; Wind energy ; site selection consideration; basic principles of wind energy conversion; application of wind energy.

Text Books:

1. Lal Jayamaha Energy-Efficient Building Systems, McGraw Hill Publication.

Reference Books:

1. AA M Sayigh Solar Energy Applications in Buildings Academic Press
2. H P Garg, J Prakash, Solar Energy Fundamentals & Applications Tata McGraw Hill Publishing.

IS Codes Energy Conservation Building Code, 2007

e- Learning Resources:

www.nptel.iitr.ac.in/iitroorki
www.nptel.iitg.ac.in/iitGuahati

BCEL 425: Introduction to Structural Dynamics (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1.

2.

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

3.

Total Hrs: 30 Marks-50

Course Outcome: **Student shall be able to**

- CO1** Calculate the response for free and forced vibrations of SDOF system
- CO2** Evaluate response of SDOF systems under different types of loading
- CO3** Apply the various numerical schemes and methods to find the mode shapes of MDOF structures

Syllabus

Unit-I Sources of vibration, types of excitations, Spring action and damping; Degrees of freedom; Application of Newton's laws, D'Alembert's principle, Single degree of freedom systems; Mathematical model of physical systems; Free vibrations of undamped and viscously damped systems **Hrs-10**

Unit-II Coulomb damping, viscous damping. Response of viscously damped SDOF systems to harmonic excitation Equivalent viscous damping; structural damping, Response of an undamped SDOF to short duration impulse; unit impulse response

Unit-III Response of undamped system of rectangular, triangular and ramp loading; response to general dynamic excitation; Duhamel integral method

Unit-IV Multi-Degree Freedom System, stiffness and flexibility approaches, Lumped-mass matrix, free vibrations fundamental Frequencies and mode shapes, orthogonality of modes, numerical schemes to find mode shapes and frequencies **Hrs-10**

Text Books:

- 1. Dynamics of Structures, R.W. Clough and J. Penzian, 2nd edition, McGraw-Hill Inc, 1993
- 2. Chopra, A. K. (1995). Dynamics of structures (Vol. 3). New Jersey: Prentice Hall.

Reference Books:

- 1. Paz, M. (2012). Structural dynamics: theory and computation. Springer Science & Business Media.
- 2. Timoshenko, S. P., & Young, D. H. (1948). Advanced dynamics. McGraw Hill
- 3. Structural Dynamics Vibrations & Systems, Madhujit Mukhopadhyay, Ane Books India, 2006

Online Certification Courses:

- 1. Structural Dynamics, Ramancharla Pradeep Kumar, Earthquake Engineering Research Centre, IIIT Hyderabad (NPTEL)

Best faculty members from IIT:

- 1. Ramancharla Pradeep Kumar, IIIT Hyderabad
- 2. Dr. R. S. Jangid, IIT Bombay
- 3. Dr. O. R. Jaiswal, VNIT, Nagpur

BCEL 426 GEOLOGY AND EARTH SCIENCE

Course Objectives:

- 1. **To study the origin, development and ultimate fate of various surface features of the earth**
- 2. **To understand the nature of geographic distribution of rocks and engineering properties of rock on the earth**
- 3. **To study methods of determining intensity and magnitude of earthquakes**

Course Outcome: **Student shall be able to**

CO1 Use knowledge of rock & soil mechanics required for design of civil engineering structures

CO2 To study geological factors affecting the location, design, construction, operation and maintenance of engineering works

CO3 An ability to perform studies and opinions regarding geological hazards, erosion, flooding, dewatering and seismic investigations

CO4 To develop the ability to understand various aspects of earth science

Syllabus

Unit-I Introduction: Various branches of geology - Relevance of Geology in Engineering. Geologic time scale.

Physical Geology: Geomorphic processes-Rock weathering-Formation of soils soil profiles-soils of India – Geologic work and engineering significance of rivers and ocean.

Applications of geology: Engineering properties of rocks. Engineering considerations of structures of rocks. Rock as a construction material, Building stone, Road metal and ballast. Application of geology for location, design and construction of dams, hydraulic structures, bridges and tunnels. **Hrs-08**

Unit-II Structural Geology: Deformation of rocks, folds, parts of fold, its classification and nomenclature, Identification joints, its definition, nomenclature and classification, Definition, nomenclature and classification of fault, Recognition of fault and fold in the field and its effect on outcrops, Outliner and inliers, Problems on dip, strikes, thickness and depth of rock strata.

Mineralogy: Definition and classification of minerals, Isomorphism, polymorphism and pseudoorphism, General chemical and physical characters of the following mineral groups, Silica, Feldspar, olivine, Pyroxene, Amphibole, Mica, Feldspathoid and clay.

Hrs-08

Unit-III Petrology: Rock cycle, Magma and its composition, Igneous rocks: Formation of igneous rocks, Forms, textures and structures, Tabular classification of igneous rocks.

Sedimentary rocks: Weathering, Erosion, Transportation and Deposition of sediments,

Sedimentary Environments, Classification of sedimentary rocks.

Metamorphic rocks:

Definitions and agents of metamorphism, Types of metamorphism, Zones and grades of metamorphism, Ana taxis, Soils: soil profile and soil types. **Hrs-07**

Unit-IV Plate tectonics: Lithospheric plates-diverging, converging and transform boundaries-their characteristic features-midoceanic ridge, benioff zone and transform faults-significance of plate tectonic concept.

Earthquake: Elastic rebound theory-types of seismic waves-cause of earthquake intensity and magnitude of earthquake Locating epicentre and hypocenter-effect of earthquake-distribution of earthquake-earthquake resistant structures

Hrs-07

Text Books:

1. Singh Parbin, "Engineering and General Geology", 2009, S. K. Kataria & Sons
2. Kesavulu, "Textbook of Engineering Geology", 2009, Macmillan India Ltd

Reference Books:

1. Sengupta Supriya, "Introduction to Sedimentology" 1994, A. A. Balkema
2. Park R. G., "Foundation of Structural Geology," 2004 Routledge Publishing House
3. Arthur Holmes, Physical geology, 2nd Edition, Thomas Nelson, 1978

e- Learning Resources:

1. <https://swayam.gov.in/course/4397-earth-sciences-for-civil-engineering-part-i-ii>

Best faculty members from IIT:

1. Javed Malik - Indian Institute of Technology - Kanpur

BCEL 427 : Prefabricated structures (Theory)____

(Lectures–Tutorial–Practical) / Week (1-1-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To impart knowledge to students on modular construction, industrialised construction.
2. To design of prefabricated elements and construction methods.

Course Outcome: **Student shall be able to**

C01 Demonstrate the general design principles of prefabrication.

C02 Design the individual prefabricated units.

C03 Understand the concepts of types of beams.

C04 Examine the current technologies and systems of prefabrication.

Syllabus

Unit-I Introduction

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems –

Production – Transportation – Erection.

Hrs-07

Unit-II Prefabricated components

Behaviour of structural components– Construction of roof and floor slabs – Wall panels – Columns – Shear walls

Unit-III Design Principles

IS code specifications, Design considerations: Economy of prefabrication-assessment of handling and erection spaces

Joints and connections

Basic mechanism-compression joint-shear joint-tension joint Pin jointed connection-beam to column-column foundation connection

Hrs-08

Unit-IV Machinery and equipment

Plant machinery, casting yard

Current technology

Text Books:

1. Kim S. Elliot (2002), Precast concrete structures, B.H. Publishers, United Kingdom

Reference Books:

1. Promyslov, V. (1998), Design and Erection of reinforced concrete structures, MIR Publishers, Moscow.
2. Levit, M., (2000), Precast concrete materials, Manufacture properties and usage, Applied science Publishers, Moscow CBRI, Building materials and components, India, 1990

BCEL 428: PRESTRESSED CONCRETE STRUCTURES (Theory)

(Lectures–Tutorial–Practical) / Week (2-0-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To analysis the basic concepts of prestressing so that student understands the same
2. To evaluate the prestressed components based on Indian code provisions
3. To design the rectangular section

Course Outcome: **Student shall be able to**

CO1 introduce prestressing methods, principles and concepts

CO2 determine losses in prestress & anchorage zone stresses

CO3 compute shear strength and ultimate shear resistance capacity as per IS code

CO4 design of prestressed concrete beams, stresses at transfer, service load, limit state of collapse in flexure and shear

Syllabus

Unit-I INTRODUCTION AND ANALYSIS FOR STRESS

Basic concepts - terminology - system of prestressing, pretensioning, post tensioning, principle of prestressing, types of prestressing. Assumptions, analysis of prestress, concentric & eccentric tendon, resultant stresses, rectangle, I-section (symmetrical only), concepts of

prestressing, stress concept, strength concept and load balancing concept. **Hrs-08**

Unit-II LOSSES OF PRESTRESS AND ANCHORAGE ZONE STRESSES

Losses of prestress, types, losses due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, friction, anchorage slip. Anchorage zone stresses, stress distribution in end block, investigations on anchorage zone stresses, Indian code provision only.

Unit-III SHEAR STRENGTH

Behavior of prestressed concrete members under shear, Shear strength, principal stresses, Ultimate shear resistance, Indian Standard code provision.

Hrs-

07

Unit-IV DESIGN OF PRESTRESSED CONCRETE BEAM

Design of sections for flexure, stress condition, minimum section modulus, stresses at transfer, service loads, prestressing force, eccentricity, check for stresses, initial and final conditions, limit state of collapse in flexure, shear. (Rectangular Section only)

Text Books:

1. Krishnaraju .R, "Prestressed Concrete", Tata McGraw-Hill Education, New Delhi, 2006.
2. Pandit .G.S, Gupta .S.P, "Prestressed Concrete", CBS Publishers & Distributors, 2008.

Reference Books:

1. Lin T.Y, Design of, "Prestressed Concrete Structures", Asia Publishing House, Bombay 1995
2. Guyon .V, "Limit State Design of Prestressed Concrete", Vol.I & II Applied Science Publishers, London, 1992.
3. IS: 1343- 1980, "IS Code Of Practice For Prestressed Concrete", BIS, New Delhi, 1980.

Online Certification Courses:

1. Prestressed Concrete Structures, Dr. Amlan K Sengupta and Prof. Devdas Menon , Indian Institute of Technology Madras

BCEL 429 Bridge Engineering (Theory)

(Lectures–Tutorial–Practical) / Week (1-1-0-0)

Total Hrs: 30 Marks-50

Course Objectives:

1. To provide an exposure to essential of bridge engineering with focus on structural design
2. To design RCC bridge with substructure for IRC loadings.
3. To study specification of IRC standard live load

Course Outcome: Student shall be able to

C01 Develop appropriate bridge solutions given site, geometric, functional and aesthetic constraints and drawing on other professional disciplines as required.

C02 Complete detailed design of bridge structures in steel and concrete.

C03 Assess the whole life costs of bridge structures.

C04 Evaluate the substructures like pier, abutments, bridge slabs, etc

Syllabus

Unit-I Components of Bridges, Classification, Importance of Bridges, Investigation for Bridges, Selection of Bridge site, Economical span, Location of piers and abutments, Subsoil Exploration, Scour depth, Traffic projection, Choice of bridge type

Hrs-08

Unit-II Specification of road bridges, width of carriageway, loads to be considered, dead load, IRC standard live load, Impact effect

Hrs-08

Unit-III General design considerations, Design of slab culvert, Foot bridge. Introduction to Prestressed concrete bridge, Box Culvert and Fly over bridges

Hrs-

07

Unit-IV Evaluation of sub structures, Pier and abutments caps, Analysis of pier, Abutments. Type of foundations, Design of well foundation.

Hrs-07

Text Books:

1. Ponnuswamy, S, Bridge Engineering, 2nd Edition, Tata McGraw - Hill, New Delhi, 2007.
2. N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, New Delhi, 2006.

Reference Books:

1. Pietro Croce et al., Design of Bridges, Published by Czech Technical University in Prague, 2015
2. N. Krishna raju, Design of Bridges, Oxford and IBH Publishing, 2010.
3. Homayoun Abrishami, Design of Reinforced Concrete Bridges, University of Toronto,

Online Certification Courses:

1. Reinforced Concrete Road Bridges, Prof. Nirjhar Dhang, IIT Kharagpur (Nptel).

Best faculty members from IIT:

1. Prof. Nirjhar Dhang, IIT Kharagpur
2. Prof. A. K. Jain, IIT Delhi

BCEL 430: Forensic Civil Engineering (Theory)
(Elective)

(Lectures) / Week (2-0-0-2)

Total Hrs: 30 Marks-50

Course Objectives:

1. To provide basic steps in a forensic investigation
2. To introduce the Professional practice and ethics, Legal issues.
3. To Use Essential forensic engineering methods and techniques

4. To in the fields of Building Engineering, Aeronautical Engineering and Biomechanical Engineering

Course Outcome: **Student shall be able to**

- C01** Identify basic steps in a forensic investigation
- C02** Use Professional practice and ethics, Legal issues
- C03** Use Essential forensic engineering methods and techniques
- C04** Apply in the fields of Building Engineering, Aeronautical Engineering and Biomechanical Engineering

Syllabus

Unit-I Introduction: Introduction to forensic engineering, Forensic investigations tools and techniques, Failures - types, causes and mechanisms, Monitoring and instrumentation, Mitigation of failure.

Unit-II Professional practice and ethics, Legal issues, Repairs and remediation, Risk and risk assessment, Assessment of damage, Case studies.

Unit-III Case from Civil Engineering various structural failure mechanisms and practice setting hypotheses for structural failures.

Hrs-06

Unit-IV Case from Aerospace Engineering & Biomechanical Engineering

Failure mechanism fatigue in airplanes and test for occurred. Contamination of medical instruments and technical procedural aspect.

Hrs-08

Text Books:

1. Forensic Engineering: Civil Engineering Special Issue1 Paperback – Import, 1 Jan 2009 by Simon Fullalove
2. Forensic Structural Engineering Handbook Hardcover – Import, 1 Jan 2010 by Robert Ratay

Reference Books:

1. Proceedings, Conference on Forensic Civil Engineering, Association of Consulting Civil Engineers (I), August, 2013

Online Certification Courses:

1. SWAYAMCOURSE==
<https://swayam.gov.in/forensic-science/c/5/science>

Best faculty members from IIT:

1. Dr. [Anjan Kumar S](#) Email: sak@iitg.ac.in
Phone: 0361-258 3332, +91 8134960628 (M)

BCEL 431 THEORY OF ELASTICITY AND ELASTIC STABILITY (THEORY) (ELECTIVE-)

(Lectures–Tutorial–Practical) / Week (2-0-0-2)

Total Hrs: 30 Marks-25

Course Objective:

1. To introduce the errands of theory of elasticity and methods of solving the structural problems.
2. To introduce the basic concepts and the state of the art of static and dynamic stability of structures

Course Outcome: Student shall be able to

CO1 Analyze 2D/3D Stress and strain problems with different boundary condition.

CO2 Solve the torsional problems on different elements.

CO3 Analyze differential equations for beam-column.

CO4 Solve various forces on built-up beams.

Unit-I Analysis of stress and strain in 2 dimensions: Introduction, Types of forces, Components of stresses and strains, Stress-strain relation, Plane stress and plane strain, Strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function

Unit-II Analysis of stress and strain in 3 dimensions: Components of stress, Principal stresses, Stress invariants, Maximum shearing stress, Differential equation of Hrs-08

Hrs-07

Unit-III Bending of cantilever of narrow rectangular section loaded at end, bending of simply Supported beam with uniform load, torsion of non-circular sections, Differential equation for beams columns with concentrated loads, continuous lateral loads and couples for simply supported ends

Hrs-08

Unit-IV Energy method for elastic buckling of columns, approximate method, buckling of columns on elastic foundation, Effect of shearing force on critical load, buckling of built up columns

Hrs-07

Text Books:

1. Theory of Elastic Stability Timoshenko, S.P Tata Mc-Graw Hill Publishing Co. New Delhi, 1961, 2ND Edition

Reference Books:

1. Flexural Torsional Buckling of Structures Trahair, N.S.E & FM SPON, London, 1969
2. Theory of Beam-Columns-Space Behaviour and Design Chen, W.F Tata McGraw Hill International 1996, 2ND Edition
3. Principles of Structural Stability Theory Alexander Chajes Prentice Hall College Division 1974, 7TH Edition

IS Codes

e-Learning Resources:

<https://nptel.ac.in/courses/105108070/>

Online Certification Courses:

Best faculty members from IIT:

1. Prof. Amit Shaw, Associate Professor, Department of Civil Engineering, IIT Kharagpur.
2. Prof. Biswanath Banerjee, Assistant Professor. Department of Civil Engineering, IIT Kharagpur.



G H RAISONI COLLEGE OF ENGINEERING

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Department of Electrical Engineering

Institute Vision and Mission

Vision

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards with capabilities of accepting new challenges.

Mission

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stake-holders. Our strength is directed to create competent professionals. Our Endeavour is to provide all possible support to promote research and development activities.

Programme: UG in Electrical Engineering

Vision and Mission of Department

Vision

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards in electrical engineering with capabilities of accepting new challenges.

Mission

- To educate next generation of Engineers with strong knowledge base of electrical engineering
- To Produce technical manpower capable of addressing industry problems
- To pursue scholarly research in broad areas of electrical engineering

Program Educational Objectives:

Graduates shall able to

PEO1 Practice electrical engineering in Power System, drives & control.

PEO2 Contribute to technical and economic development of society

PEO3 Pursue higher education and work for research and development of society

Program outcome

Student shall able to

PO1: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO 2: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO 3: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations

PO 4: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO 5: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

PO 6: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO 7: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO 09: Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings

PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO 11: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO 12: Recognize the need for and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific outcomes

Graduates shall

PSO1 Demonstrate industrial practices learned through internship and solve the live-problems of industries.

PSO2 Utilize skills in transforming ideas into hardware project and to protect intellectual property rights.

PSO3 Propose innovative solutions in the area of Power Systems and Electric Drives.

B.TECH. ELECTRICAL ENGINEERING

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Int.	Ext.	
SEMESTER-I												
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	--	50
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	--	50
BEEL101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	--	75
BEEP101												
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	--	50
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	--	25
BITL101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	--	100
BITP101												
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	--	--	50
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	--	25
BECL101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	--	75
BECP101												
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	--	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	--	25
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	--	25
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	--	25
TOTAL		9	4	16	29	21	80	120	175	225	0	600

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int.	Ext.	
SEMESTER-II												
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	--	50
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	--	50
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	--	50
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	--	25
BFYL121	Applied Physics	1	1	2	4	3	10	15	25	25	--	75
BFYP121												
BECL102	Analog Circuits	1	1	2	4	3	10	15	25	25	--	75
BECP102												
BECP103	Embedded Programming	-	-	2	2	1	--	--	--	25	--	25
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	--	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	--	50
BHUL101	Communication Skills	-	2	2	4	3	10	15	25	50	--	100
BHUP101												
BHUP102	Ethics & Professional Competencies	-	-	2	2	1	--	--	--	25	--	25
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	--	25
TOTAL		4	5	26	35	22	50	75	125	350	0	600

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
SEM-III												
BFYL145	Mathematics-V (Laplace Transform & Fourier Transform)	1	1	-	2	2	10	15	25		-	50
BEEL206/ BEEP206	Network Theory	2	-	2	4	3	10	15	25	25	-	75
BEEL207/ BEEP207	Sensors & Actuators	2	-	2	4	3	10	15	25	25	-	75
BECL215/ BEC215	Electronics Devices & Circuits	2	-	2	4	3	10	15	25	25	-	75
BEEL208	Static machine (Three Phase Transformer)	1	-	-	1	1	10	15	25		-	50
BEEL209/ BEEP209	Rotary machine	1	-	2	3	2	10	15	25	25	-	75
BCSL208/ BCSP208	Database Management System	2	-	2	2	3	10	15	25	25	-	75
XXXXXXX	Open Elective –I	2	-	-	2	2	10	15	25		-	50
BAIP202	Skill development 1:	-	-	2	2	1	-	-	-	25	-	25
BHUP202	Reasoning	-	-	1	1	0.5	-	-	-	25	-	25
BHUP 203	Quants	-	-	1	1	0.5	-	-	-	25	-	25
Total		13	1	14	26	21	80	120	200	200	0	600

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
SEM-IV												
BFYL146	Math-VI (Fourier series and Partial differential equations)	1	1	-	2	2	10	15	25			50
BEEL210	Synchronous machine	1	-	2	3	2	10	15	25	25		75
BECL212	Signals and Systems	1	-	-	1	1	10	15	25			50
BEEL211	Elements of Electromagnetics	1	-	-	1	1	10	15	25			50
BECL213	Analog and Digital Communication	1	1	-	2	2	10	15	25			50
BMBP102	Entrepreneurship Development	-	-	2	2	1				25		25
BEEL212	Fundamentals of power Systems	2	-	-	2	2	10	15	25			50
BECL218	Embedded Systems Design	2	1	-	3	3	10	15	25			50
BEEP213	Skill Development 2 :	-	-	1	1	1				25		25
BHUP205	BEC (British Council)	-	-	4	4	2				50		50
BEEL214	Basic Power Electronics	2	-	2	4	3	10	15	25	25		75
BHUP204	Liberal Arts/Creative Arts (Hobby Module)	-	-	1	1	0.5				25		25
BHUP206	Aptitude 1	-	-	1	1	0.5				25		25
Total		11	3	13	27	21	80	120	200	200	0	600

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
SEM-V												
BFYL147	Math-VII (Z-Transform & Steady state Variable)	1	1	-	1	1	10	15	25			50
BEEL319/ BEEP319	Basic Control System	1	-	2	3	2	10	15	25	25		75
BEEL320/ BEEP320	Power System Analysis & dynamics	2	-	2	4	3	10	15	25	25		75
BEEL321	Electrical Installation & Design	1	-	-	1	1	10	15	25			50
BEEP322	Skill development-III : ETAP and Powerworld Simulator, Matlab, PSIM, etc.	-	-	2	2	1				25		25
BEEL323	Project Manangement: (Estimation and Costing)	-	-	2	2	1				25		25
BCSL217	Machine Learning Algorithms	2	-	-	2	2	10	15	25			50
MBP301	Financial Management for Engineers	0	-	1	1	0.5				25		25
BEEL324/ BEEP324	Drives	2	-	2	4	3	10	15	25	25		75
BHUP302	Aptitude 2	-	-	1	1	0.5				25		25
BEEP325	Internship(Social +Minor Project+ Technical report writing+ LATEX)	-	-	2	2	2				50		50
MBP104	Advanced Communication skill	-	-	4	4	2				50		50
Total		9	1	18	28	19	60	90	150	275	0	575

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
SEM-VI												
BFYL148	Math-VIII (Optimization)	1	1	-	2	2	10	15	25			50
BEEL326	Electric Vehicles	2	-	-	2	2	10	15	25			50
BEEL327	Non Linear Control Systems	1	-	-	1	1	10	15	25			50
BEEL328/ BEEP328	Switch gear and Protection	2	-	2	4	3	10	15	25	25		75
XXXXXX	Elective-III (Interdisciplinary)	1	-	-	1	1	10	15	25			50
BEEL329	Skill development-IV: (PLC/SCADA)	0	-	2	2	1				25		25
BEEL330/ BEEP330	High Voltage Engg.	2	-	2	4	3	10	15	25	25		50
BEEL331	Power System Dynamics	1	-	-	1	1	10	15	25			50
BHUP207	Soft Employability skill	0	-	1	1	0.5				25		25
BMEP319	GP VI (Product Design & IPR)	0	-	2	2	1				25		25
XXXXXX	Open Elective –II	2	-	-	2	2	10	15	25			50
XXXXXX	Elective-II (Interdisciplinary)	1	-	-	1	1	10	15	25			50
BHUP303	Aptitude 3	-	-	1	1	0.5				25		25
Total		13	1	10	24	19	90	135	225	150	0	575

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
SEM-VII												
BEEP417	Industry Internship	-	-	12	12	12	-	-	-	100	200	300
BEEP418	Project Phase-I	-	-	4	4	4	-	-	-	50	50	100
BEEL419	Open Elective /MOOCS + TQM	2	1	0	3	3	10	15	50	-	-	75
Total		2	1	4	7	19	10	15	50	150	250	475

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
SEM-VIII												
XXXXXX	Elective-I (Science)	2	-	-	2	2	10	15	25			50
XXXXXX	Elective-IV (Core)	2	-	-	2	2	10	15	25			50
XXXXXX	Elective-V	2	-	-	2	2	10	15	25			50
XXXXXX	Elective-VI	2	-	-	2	2	10	15	25			50
XXXXXX	Elective-VII	2	-	-	2	2	10	15	25			50
XXXXXX	Elective-VIII	2	-	-	2	2	10	15	25			50
BHUP304	Career Development Practices	-	-	2	2	1	-	-	-	50	-	50
BEEL421	Open Elective /MOOCS + TQM- II	1	-	-	1	1	5	5	15		-	25
BEEP422	Project Phase-II	-	-	4	4	4				50	50	100
Total		13	0	6	19	18	65	95	165	100	50	475
TOTAL 1st SEMESTER TO 8th SEMESTER		73	16	109	195	160	505	755	1265	1650	300	4500

Pool of Electives
Battery Technology
Supercapacitors
Charging Station
Utilization of Non Conventional Energy Sources
Mechtronics
Power Semiconductor Based Drives
Digital Signal Processing
Analysis of Special Machines
Application of Sensor and Actuators in Electric Vehicle
Advanced Electricsl Drives and Control
Advanced Power Electronics
Digital Control
Digital Design
Energy Efficient Systems (Optimization of Electricity)
FACTS

III SEM (EE)

Mathematics –V

Laplace Transform & Fourier Transform (2 Credit)[30Hrs]

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper
							Theory			Practical	Total		
		Th.	Tu	Pr.	Total		TA E	CA E	ES E	Int. .		Ext. .	
	SEM-III												
BFYL 145	Mathematics-V (Laplace Transform & Fourier Transform)	1	1	0	2	2	10	15	25			50	1.5

Course Objectives:

- Understand the mathematical descriptions in Laplace Transform & Fourier Transform
- Analyze problems, recognize appropriate methods of solution, solve the problems, and find the solutions.

Course Outcomes

Upon successful completion of the course, students will be able to:

- Understand and use Laplace transform to solve engineering problems.
- Apply the concept of Laplace transform to solve applications based problems in field of engineering
- Calculate Fourier Transforms for the variety of simple functions.

CO Mapping with PO and PSO:

C O S	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PS O1	PS O2	PS O3
C O 1	3	3	0	0	0	0	0	0	0	0	0	2	3	1	
C O 2	3	3	0	0	0	0	0	0	0	0	0	2	3	1	
C O 3	3	3	0	0	0	0	0	0	0	0	0	2	3	1	
C O 4	3	3	0	0	0	0	0	0	0	0	0	2	3	1	
C O 5	3	3	0	0	0	0	0	0	0	0	0	2	3	1	
C O 6	3	3	0	0	0	0	0	0	0	0	0	2	3	1	

UNIT 1: LAPLACE TRANSFORM: (10HRS)

Definition and their simple properties, Transform of derivatives and integrals, Evaluation of integrals by L.T. Inverse L.T. & its properties, Convolution theorem, Laplace transforms of periodic function & unit step function,

UNIT 2: APPLICATIONS OF LAPLACE TRANSFORM:(10HRS)

Applications of Laplace transform to solve ordinary differential equations. Applications of Laplace Transform in control System: Analogues system, Closed loop system and open loop system, Transfer function . And problems based on it. Laplace transform of signals: Unit step , Ramp, Parabolic, impulse , Dirac Delta

UNIT 3 : FOURIER TRANSFORMS: (10HRS)

Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity

Text Books:

- Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.
- Advanced engineering Mathematics by Erwin Kreyszig, 8th edition Wiley India
- Control System by Nagrath & Gopal**

Reference Books:

- Advanced Mathematics for Engineers and Scientists ; Spiegel, M. R, McGraw-Hill
- Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd

Quantifiers - Predicate calculus including theory of inference.

SUBJECT 3: ELECTRONIC DEVICES AND CIRCUIT

SCHEME:E&TC

Sub code : - BECL211/BEC211

Third Term											Course Category
A Name of the Course	Teaching Scheme	Credits	Evaluation Scheme			Duration of Paper					
			Theory	Practical	Total Marks						

e	T h	T u	P r	H o u r s		T A E	C A E	E S E	I n t	E x t		H o u r s	
Ele ct r o n i c D e v i c e s & C i r c u i t s	2	-	2	4	3	1 0	1 5	2 5	2 5		75	2	Pr o g r a m C o r e

COURSE OBJECTIVES:

1. To gain knowledge of transistor small signal analysis.
2. To study need different types of amplifiers and oscillator.
3. To familiarize the students with the analysis of unipolar devices
4. To use appropriate experimentation techniques to evaluate circuit performance.

COURSE OUTCOMES:

On successful completion of the course, Students shall be able to:

CO1: Understand the concept of compensation techniques, Low frequency and High frequency analysis.

CO2: Understand the concepts of feedback and apply the concepts for improvement of performance of amplifier and oscillator

CO3: Understand, analyze and design different types of power amplifiers and use methods for reduction of distortions

CO4: Understand the operation of the Field Effect Transistor (FET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and design FET circuits

CO5: Apply concepts of transistors & amplifier Circuits

CO6: Design simple circuits containing non-linear elements.

CO3	3 0	2 0	2 0	2						2	2	2	2	3	2	
CO4	3 0	2 0	2 0	2						2	2	2	2	3	2	
CO5	3 0	2 0	2 0	2						2	2	2	2	3	2	
CO6	3 0	2 0	2 0	2						2	2	2	2	3	2	

SYLLABUS:

Unit I: Transistor Biasing & Small Signal Analysis (9 Hours)

Review of Transistor, Transistor current equations, Thermal Runaway, Transistor Biasing & Stability, Compensation Methods, Two-port Devices & the Transistor Hybrid model, analysis of a transistor amplifier circuit using h parameters, comparison of transistor amplifier configuration, Miller's Theorem, the alpha cut-off frequency, the hybrid pi (II) common – emitter transistor model.

Unit II: Feedback Amplifiers & Oscillators (8 Hours)

Types of Feedback, Advantages & Disadvantages of Negative Feedback, Topology, Classification of Oscillators, Stability, Barkhausen Criteria, Design of RC, LC and Crystal Oscillators, Numerical

Unit III: Power Amplifier (7 Hours)

Classification A, B, AB, C, Efficiency, Push Pull Configuration (A, B, AB) Complementary symmetry, Second Harmonic and Cross over Distortion., Design of Power Amplifiers (Class A and Class AB)

Unit IV: Unipolar Devices (6 Hours)

Field Effect Transistor, MOSFET, NMOS, PMOS Principles of operation and characteristics, Biasing arrangement, small signal analysis of CG, CB and CD

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	PO 1.... 12											PSO 1	PSO 2	PSO 3
CO1	3 0	2 0	2 0	2					2	2	2	2	3	2
CO2	3 0	2 0	2 0	2					2	2	2	2	3	2

TEXT BOOKS:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Electronic s Devices and Circuits	S Salivahana, N Suresh Kumar	Tata Mcgraw-Hill	2008	3

2	Integrated Electronics	Jacob Millman	Tata Mcgraw-Hill	2009	2
3	Electronic Devices & Circuits	Sanjiv Gupta Sanjay Gupta	Dhampat Rai Publication	2012	3

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Electronics devices and Circuits and Theory	Robert L. Boylestad, Louis Nashelsky	Pearson India	2009	10
2	Microelectronics Circuits	A.S. Sedra & K. C. Smith,	Oxford University Press	2013	7
3	Electronics Devices and Circuits	Nagrath I J	Phi Learning Pvt Ltd	2009	3

Sensors & Actuators (3 Credit) [36Hrs]

Sub. Code	Name of the Course	Teaching Scheme				Cr edi ts	Evaluation Scheme						Duration of Paper
							Theory			Pract ical		T o t a l	
		Th .	T u	P r .	T o t a l		TA E	CA E	ESA E	I n t .	E x t .		
	SEM-III												
BE EL2 07/ BE EP 207	Sensors & Actuators	2	1	0	3	3	10	15	25			50	1.5

Course Objective

- To make students understand the construction, working principle and application of various transducers used for different parameters such as flow measurement, strain measurement, pressure and vacuum measurement, force, torque and power measurement
- To solve industrial problems related to monitoring, co-ordination, measurement and control using various instrumentation used in application industry.

Course Outcome

The students should be able to

CO1: To gain knowledge of analog and digital instrumentation system.

CO2: To identify suitability of measuring instrumentation for desired parameter.

CO3: To illustrate the use of different transducers

CO4: To design integrate and innovate system for motion measurement.

CO5: To design measuring instruments for industrial applications relating to temp measurement

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Unit I: Basics of Instrumentation (6 Hrs)

Classification, Analog & Digital instruments, comparison of Analog & Digital instruments, advantages of digital instruments, classification of analog instruments. Indicating type instruments, recording type instruments.

Unit II: Measuring Instruments (10Hrs)

Ammeters, Voltmeters, principle of moving coil, moving iron & Dynamometer type instruments, extension of range using series and shunts, errors due to extension of range. Digital Voltmeters:- Types of DVM, Ramp type DVM, integrating type DVM. Measurement of active and reactive power in polyphase circuits using dynamometer type instruments. General theory, extension of range using C.T. & P.T. Errors in instrument transformers, applications of instrument transformers for metering & protection. TOD Meters.

Unit III: Generalized Instrumentation Systems (6Hrs)

Active and passive transducers, Digital and analog mode of operation. Motion Measurement: - Relative and absolute motion measurement, measurement of velocity and acceleration. Electrical transducer for motion measurement, LVDT, piezoelectric transducer, variable inductance transducer, measurement of shaft torque and power.

Unit IV: Motion measurement: (8 Hrs)

Relative and absolute motion measurement of displacement, velocity and acceleration; Pressure sensing elements – manometers, elastic elements, Bourdon tube, diaphragm, bellows; electrical type, McLeod gauge, Pirani gauge; Flow sensing type – head meters (orifice, venturi), area meters, rotameters, electromagnetic flowmeter, Coriolis flow meter, Ultrasonic flowmeter; pH measurement

Unit V: Temperature Measurement & Miscellaneous Measurements (6Hrs)

Laws of thermo - electric circuits. Thermocouples cold junction compensation thermistors. Brief treatment of principles used in the measurement of liquid level, flow press and PH. Introduction to Hall Effect sensors.

Text Books:

1. A.K. Sawhney., A course in Electrical & Electronics measurement and instrumentation, 11th Edition, Dhanpat Rai And Son Publication, 1996
2. Rajput, Electrical Measurements, 1st Edition, S.Chand , 2009

Reference Books:

1. W.D. Cooper, Prentice Hall, Electronic Instrumentation and measurement Technique, 2nd Edition, P.H.I. Publication, 2007
2. Rangan, Instrumentation Devices and System, 2nd Edition, Tata Mcgraw Hill, 2008
3. Doebelin, Ernest, Measurement System application & Design, 5th Edition, Mc Graw Hill, 2004

Static Machine (Three Phase Transformer) (1 Credit) [14 Hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme							
							Theory			Practical		Total Marks		
							Th	Tu	Pr	Total Hours	TA		CA	ESE
SEMESTER-III														
BE EL 208	Static machine (Three Phase Transformer)	1	0	0	1	1	10	15	25					50

Course Objectives:

1. Understand 3 ph. Transformers.
2. Analyse static machines.

Course Outcomes:

The students should be able to

CO1: Analyze the construction, principle, performance of 3-phase transformers, autotransformer.

CO2: Estimate the parallel operation of three phase transformer, conversion of three phase to two phase.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

UNIT-I: 3-Phase Transformer & Autotransformer (8 Hrs)

Basics of Autotransformers, 3 Phase Transformer principle and operation, Polarity test, various connections and vector groups, online tap changers, Distribution and Power Transformer and All day efficiency.

Unit II Parallel operation of Transformer (6 Hrs)

Three phase to two phase conversion (Scott Connection), parallel operation of three phase transformer, Basics of methods of cooling, temperature rise test, maintenance of transformer, and insulation of transformer, Protection of transformer, Commissioning tests performed on transformer.

Text Books:

1. P.K. Mukherjee, Electrical Machines, 2nd Edition, Dhanpatrai Publications, 1996
2. Dr. P.S. Bimbhra, Electrical Machines, 2nd Edition, Khanna Publications, 1995

Reference Books:

1. I.S. Nagrath & Dr. D.P. Kothari, Electrical Machines, 1st Edition, Tata Mc Graw Hill, 1997
2. A E Fitzgerald, Charles Kingsley , Stephen Umans, Electrical Machinery, 6th Edition, Mc Graw Hill, 2003

Rotary Machine (1 Credit)[15hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total Marks
							TA	CA	ES	Int	Ex	
		Th	Tu	Pr	Total Hours	E	E	E				
SEMESTER-III												
BEEL209 / BEEP209	Rotary machine	1	0	2	3	2	10	15	25	-	25	75

Course Objectives:

1. To develop familiarity with DC Machines, 1 ph. & 3 ph. Induction machines.
2. To study starting, breaking & reversal of AC & DC Machines.

Course Outcomes:

The students should be able to

CO1: To impart knowledge on construction, principle, performance, control and applications of DC Motors.

CO2: To impart knowledge on understand the construction, principle, performance, control and applications of three phase induction motor.

CO3: Ability to troubleshoot connects, run, control and test 3 ph Induction motor.

CO4: To understand operating principle and performance analysis of special machines.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit-I: D.C. Machines (7 Hrs)

Basic principle of electromagnetic energy conversion, generalized torque expression, Armature reaction & commutation, Types of winding, Compensating winding, interpoles, Characteristics of shunt, series & compound motor and generator, speed control of d.c. shunt & series motor

Unit-II: Three Phase Induction Motor(3 Hrs)

Determination of machine parameters, No load test, blocked rotor test, equivalent circuit, losses, efficiency, operating characteristics & influence of machine parameter on the performance of motor, Introduction of I2 and I3 (industrial)motors.

Unit-III: Speed control of 3 phase I.M(3 Hrs)

Speed control of I.M. by pole changing, frequency control, Speed control of wound I.M. by varying rotor resistance, varying supply voltage, braking, regenerative braking, plugging, dynamic braking, Crawling & cogging.

Unit-IV: Single phase induction moto(2 Hrs)

Double field revolving and cross field theory, Types of single phase induction motor, Permanent magnet brushless motors: construction, principle and types torque

Text Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
3. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

NETWORK THEORY (3 Credit) [40 Hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total Marks
		Th	Tu	Pr	Total Hours		TA	CA	ESE	Int	Ext	
SEMESTER-III												
BE EL2 06/	Network Theory	2	1	0	3	3	10	15	25			50

Course Objective:

1. This course introduced features of object oriented programming.
2. The course provide carrier opportunities in implementation of various applications as object oriented concepts plays dominant role in software development.

Course Outcome:

Upon successful completion of the course, students shall be able to–

CO 1: Articulate the principles of object oriented programming using C++

CO 2: Understand function overloading, constructor overloading, operator overloading, polymorphism & its uses in programming.

CO3: Implement inheritance concepts and its use for application development

CO4: Analyze of dynamic memory allocation and its use for software development

CO5: Implement concept of file handling in real life problems

CO6: Implement a project for real world problems

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:**Unit-I: Principles of Object Oriented Programming - [03 Hrs]**

Introduction to OOPS: Differences between C and C++. A look at procedure Oriented programming, object oriented programming paradigm, basic concepts of OOP, Headers & Name Spaces

Unit-II: Functions & Polymorphism - [04 Hrs]

Functions, Types of Functions, Constructor, Destructor, Function overloading & Ambiguity, Operator Overloading, Function Overriding, Friend Function

Unit-III: Inheritance & Virtual Functions - [04 Hrs]

Inheritance and the access specifiers, Types of Inheritance, Pointers and references to derived types, Virtual Functions

Unit-IV: Pointers & Dynamic allocations-**[03 Hrs]**

Static & Dynamic allocation using new and delete, * and ->* operators, Creating conversion functions, this pointer.

Text Books:

1. Object Oriented Programming in C++ - Robert Lafore, edition, Galgotia publications
2. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH

Reference Books:

1. Let's C++ by Y. Kanetkar, BPB publications
2. Object oriented programming with C++, E Balagurusamy, 4th edition, TMH
3. Object-Oriented Programming with C++, SouravSahay, Oxford University Pres

Course Name : Signals & Systems

Course Code : BECL212

Scheme of the Course:												
Name of the Course	Teaching Scheme					Evaluation Scheme					Duration of Paper	Course Category
						Theory	Practical					
	Theory	Tutorial	Practical	Total Hours	Credits	TAE	CAE	ESF	Int.	Ext.	Total Marks	Hours
Signal & Systems	1	1	-	2	2	10	15	25	-	-	50	2

Course Objectives:

1. To introduce the fundamentals, characteristics, concept techniques of signals & systems.

2. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide
3. Development of the mathematical skills like fourier series, fourier transforms, Random theory to solve problems involving convolution, filtering, modulation and sampling
4. To define channel capacities and properties using Shannon's Theorem and calculate the information content

Course Outcomes:

Student shall be able to

- CO1. Students will be able to represent & classify signals, Systems & identify LTI systems
- CO2. Students will be able to derive Fourier series & Fourier transform for different signals
- CO3. Students will be able to analyze the Continuous Time systems by performing Convolution
- CO4. Students will be understand Discrete time systems and LTI systems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1...	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Course Contents

Introduction to Signals and Systems:

[07 Hours]

Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system analysis from these examples. Formalizing signals: energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. Formalizing systems: system properties: linearity:

additivity and homogeneity, shift-invariance, causality, stability, Realizability. Examples

Continuous Time Fourier Transform:

[07Hours]

Representation of Aperiodic Signal, Fourier Transform for Periodic Signals, Properties of CTFT, Convolution and multiplication property of continuous FT, Systems characterized by Linear Constant Coefficient Differential Equations. Convolution Property. Sampling Theorem, Effect of Under Sampling, and Sampling of Discrete -Time Signals

Continuous time and discrete time Linear shift-invariant (LSI) systems:

[08 Hours]

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Parseval's Theorem. The idea of signal space and orthogonal bases of signals. Time de main and Frequency domain aspects of ideal and non-ideal filters

Discrete Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT):

[08 Hours]

Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations Laplace Transform for continuous time signals and systems: the notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.

Text Books:

Sr. No	Title	Author Name	Publisher	Year of Publication	E d i t i o n
.					

1	Signals and Systems	(Alan V Oppenheim, Alan S Willsky, S Hamid Nawab)	Prentice Hall India	2009	2
2	Signals and Systems,	S. Haykin and B. VanVeen,	Wiley	1998	

Reference Books

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Digital Signal Processing, Principles Algorithms, and Applications	John G. Proakis, Dimitris G. Manolakis	PHI	2007	4
2	Signal Processing	James H. McClellan	Pearson/Prentice Hall	2006	1
3	Signals and System, Third Edition, 2008	P. Ramesh Babu, R. Ananda Natrajan,	Scitech	2008	3

convolution, filtering, modulation and sampling

4. To define channel capacities and properties using Shannon's Theorem and calculate the information content from its probability distribution.

Course Outcomes:

On successful completion of the course, Students shall be able to:

CO1: Students will be able to represent & classify signals, Systems & identify LTI systems

CO2: Students will be able to derive Fourier series for continuous time signals.

CO3: Students will be able to find Fourier transform for different signals

CO4: Students will be able to analyze the Continuous Time systems by performing Convolution.

CO5: Students will be understand Discrete time systems and LTI systems.

SEMESTER IV

SUBJECT 1: SIGNALS AND SYSTEMS

Subject Code : BECL212

First Term													Course Category
A Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Duration of Paper		
						Theory			Practical	Total Marks	Hours		
	Th	Tu	Pr	Total Hours		TA	CA	ESE	Int.			Ext.	
Signal and system	1	1	0	2	2	10	15	25	25	25	100	2	Core

Course Objectives:

1. To introduce the fundamentals ,characterstics, concept techniques of signals & systems.
2. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide
3. Development of the mathematical skills like
fourier series, fourier transforms, Random theory to solve problems involving

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I: (8 Hours)

Representation Of Aperiodic Signal, Fourier Transform For Periodic Signals, Properties Of CTFT, Properties Of CTFT, Convolution Property ,Representation Of Aperiodic Signal, Fourier Transform For Periodic Signals, Properties Of CTFT, Properties Of CTFT, Convolution Property. Sampling Theorem, Effect Of Under Sampling, and Sampling of Discrete -Time Signals.

Unit II: (8 Hours)

CONTINUOUS TIME FOURIER TRANSFORM:

Representation of a periodic Signals by continuous FT, FT of periodic signals, convolution and multiplication property of continuous FT, systems characterized by Linear Constant Coefficient Differential Equations.

Unit III: TIME AND FREQUENCY CHARACTERIZATION OF SIGNALS AND SYSTEMS:

Magnitude and phase representation of FT, Magnitude and phase response of LTI systems, Time domain and Frequency domain aspects of ideal and non ideal filters.

Unit IV: DISCRETE TIME FOURIER TRANSFORM (DTFT) and DISCRETE FOURIER TRANSFORM (6 Hours)

(DFT): Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations

TEXT BOOKS:

S. r. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Signals and Systems	(Alan V Oppenheim, Alan S Willsky, SHamid Nawab) 2nd Edition	Prentice Hall India	2009	2
2	Signals and Systems,	S. Haykin and B. Van Veen,	Wiley	1998	

REFERENCE BOOKS:

S. n	Title	Author Name	Publisher	Year of Publication	Edition
1	Digital Signal Processing, Principles Algorithms, and Applications	John G. Proakis, Dimitris G. Manolakis	PHI	2007	4
2	Signal Processing	James H. McClellan	Pearson / Prentice Hall	2006	1
3	Signals and System, Third Edition, 2008	P. Ramesh Babu, R. Ananda Natrajan,	Scitech	2008	3

ELEMENTS OF ELECTROMAGNETICS (1 Credit) [14 Hrs]

Subject Code : BEEL211

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total
		Th	Tu	Pr	Total		TAE	CAE	ESE	Int	Ext	Marks
					Hours							
SEMESTER-IV												

Elements of Electromagnetics		1	0	0	1	1	10	15	25		50

Course Objective:

1. To introduce the electric & magnetic fields in detail.
2. To study the laws related to electric and magnetic fields
3. To know applications of Electromagnetic in electrical engineering applications

Course Outcomes:

Upon successful completion of the course, students shall be able to

CO1: Apply Knowledge of science to design of electrical systems involving electric fields

CO2: Apply Knowledge of engineering to design of electrical systems involving electric fields

CO3: Understand the design of electrical system involving magnetic fields

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes										Programme Specific Outcomes		
	PO 1.... 12										PSO 1	PSO 2	PSO 3
CO1	3.0	2.0	1.0	1	2	0	1				1	3	2
CO2	3.0	2.0	1.0	1	2	0	1				1	3	2
CO3	3.0	2.0	1.0	1	2	0	1				1	3	2
CO4	3.0	2.0	1.0	1	2	0	1				1	3	2
CO5	3.0	3.0	1.0	1	2	0	1				1	3	2
CO6	3.0	3.0	1.0	1	2	0	1				1	3	2

Unit I: Coulomb's law & Gauss's law, Energy and Potential of charge system (7Hrs)

Coulomb's law, electric field intensity, field often, point charges, field due to continuous volume charge distribution, field of line charge, field of sheet charges, concept of flux density. Gauss's law, Application of Gauss's law, divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient,

Unit-II: Steady Magnetic Field and Magnetic Forces (8Hrs)

Biot Savarts law, Ampere's Circuital Law, Stokes theorem, Magnetic flux density, Scalar and Vector Magnetic potentials, force on moving charge, Magnetization and permeability, Magnetic circuit. Maxwell equations

Text Books:

1. William H. Hayt, Jr., John A. Buck, Engineering Electromagnetic, 7th Edition, Tata McGraw Hill Publishing Company Limited, 2006

2. Matthew N. O. Sadiku, Elements of Electromagnetic, 5th Edition, Oxford University Press, 2010

Reference Books:

1. A. T. Turgut, Fundamentals of Electromagnetic Fields, 2nd Edition, Denett & Co, 2006

2. Rajeev Bansal, Handbook of Engineering Electromagnetic, 1st Edition, CRC Press, 2004

Mathematics-VI

Fourier series and Partial differential equations

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper
							Theory			Practical		Total	
		Th	Tu	Pr.	Total		TA E	CA E	ES E	Int .	Ext.		
		SEM IV											
BFYL 146	Mathematics-VI Fourier Series and Partial differential equations	1	1	0	2	2	10	15	25			50	1.5

Course Objectives:

- To introduce Partial Differential Equations and Fourier Series and its applications in the field of Electrical Engineering.
- To develop skills to use Partial differential equations and its applications in the field of Electrical engineering.

Course Outcomes :

Upon successful completion of the course, students will be able to:

- Understand and use Fourier Series to solve engineering problems.
- Apply the concept of Partial differential equations in field of engineering.
- Obtain Fourier series expansion of periodic functions
- Understand and solve Partial differential equations in engineering.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

FOURIER SERIES : (12hrs)

Dirichlet's conditions, fourier series of Trigonometric and exponential functions, Fourier series and its convergence. Fourier series of even and odd functions. Fourier half-range series. Fourier series of discontinuous functions, Parseval's identity. Harmonic analysis.

PARTIAL DIFFERENTIAL EQUATIONS: (18hrs)

Formation - Solution of standard types of first order equations - Lagrange's equation - Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

Method of separation of variables, Applications of PDE to transmission line.

Text Books:

- Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.
- Advanced engineering Mathematics by Erwin Kreyszig, 8th edition Wiley India

Reference Books:

- Advanced Mathematics for Engineers and Scientists ; Spiegel, M. R, McGraw-Hill
- Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa

Synchronous machine (2 Credit) [30 Hrs]

Subj ect Cod e	Name of the Course	Teaching Scheme				Cred its	Evaluation Scheme					
							Theory			Practical		Total Mark s
		Th	Tu	Pr	Total Hour s		TAE	CA E	ES E	Int Ex t		
SEMESTER-IV												
BE EL 21 0	Synchronous Machine	1	1	0	2	2	10	15	25			50

Course Objectives:

1. To introduce synchronous machines to students.
2. To lay firm foundation of electrical machines for understanding its behavior in power- system.

Course Outcomes:

The students should be able to

CO1 Understand the construction, principle of 3-phase synchronous machines, able to identify different types of synchronous machine.

CO2 Analyze load characteristics of synchronous machine and able to solve the problems on regulation and performance.

CO3 Demonstrate the parallel operation of synchronous generator and able to find various performance parameters of synchronous generator.

CO5 Analyze the transient behavior and performance of synchronous machine in power system.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I: Three Phase Synchronous Generators (7 Hrs)

Introductions, constructional features of cylindrical and salient pole rotor machines, introduction to armature winding and field

windings, MMF of armature and field windings, induced EMF.

Unit- II: Steady State Operation of Three Phase Synchronous Generators (7Hrs)

Phasor diagram, steady state performance of three phase synchronous generators, Voltage Regulation, Measurement of load angle, Slip test.

Unit III: Synchronizing of Generator with another Generator (6Hrs)

Parallel operation, experimental determination of parameters X_d , X_q/X_s , short circuit ratio, losses and efficiency.

Unit-IV: Synchronizing Machines on Infinite Bus (10Hrs)

Phasor diagram, expression for torque, load / torque angle, synchronous motor operation, effects of variable excitation and power input on generator operation and effect of variable excitation and load on motor operation, Reactive Power supplied/absorbed by the generator, AVR and its significance.

Text Books:

1. Dr.P.S.Bhimbra, Electrical machinery, 7th Edition, KHANNA Publisher, 2008
2. Ashfaq Husain, Electric Machine, Dhanpat Rai publication, 2012

Reference Books:

1. Dr. P.K. Mukherjee and S. Chakravarti, Elect. Machinery, Dhanpatrai Publications, 2011
2. Fitzgerald and Kingsley and Kusco, Elect. Machinery, Tata Mc Graw Hill, 2010

Basic Power Electronics (3 Credit) [40 Hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
		Th	Tu	Pr	Total Hours		Theory			Practical		Total Marks
							TA E	CA E	ES E	Int	Ext	
SEMESTER-IV												
BE EL 214	Basic Power Electronics	2	1	0	3	3	10	15	25			50

Course Objectives:

- 1) To introduce different power electronic switches and other devices etc along with their performance characteristics and applications.

- 2) To introduce different types of power electronic convertors, their control and performance aspects for various applications.
- 3) To study single phase and three phase bridge inverters.

Course Outcomes:

The students should be able to

CO1 Analyze the circuit involving solid state power electronics devices.

CO2 Select components for designing the circuitry for power convertors

CO3 Use Solid state Power electronics devices for control, conversion and protection of SCR

CO4 Design Single phase and Three phase AC-DC convertors.

CO5 Examine Close loop control of DC-DC converter.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	1	1	3	2	2	0	1	0	2	2	2	2	2	3	2
CO2	1	1	3	2	2	0	1	0	2	2	2	2	2	3	2
CO3	1	1	3	2	2	0	1	0	2	2	2	2	2	3	2
CO4	1	1	3	2	2	0	1	0	2	2	2	2	2	3	2
CO5	1	1	3	2	2	0	1	0	2	2	2	2	2	3	2
CO6	1	1	3	2	2	0	1	0	2	2	2	2	2	3	2

Error! Not a valid link.Syllabus:

Unit I: SCR and its characteristics (7 Hrs)

Characteristic and basic working principle of SCR, SCR turn on & turn off times, ratings, series and parallel connections of SCRs, Triac and its applications, Triggering circuits, protection of SCR gate circuit protection, over voltage and over current protection, snubber circuit design.

Unit II: Static controllable switches(7 Hrs)

Characteristic and basic working principle of MOSFET, GTO, IGBT, Basic Driving Circuits and protection mechanism.

Unit III: Line commutated converter(8 Hrs)

Working principle of single phase and three phase line commutated converters, effect of source inductance, principle operation of dual converters and Cycloconverter.

Unit IV: Inverters (8 Hrs)

Single phase and three phase bridge invertors (voltage source inverter), Six step operation, SPWM, Determination of Harmonic content, THD, current source inverter, Basic series resonant Inverter.

Unit V: DC-DC Converters (10 Hrs)

Buck, Boost, Buck-Boost, Cuk Converters, Continuous and discontinuous mode of operation, Flyback, Forward, and PushPull Converters, classification of chopper circuits (A, B, C, D, E). Advanced Topics.

Text Books:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

Reference Books:

1. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
2. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

Embedded Systems Design (3 Credit) (40 Hrs)

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
		Th	Tu	Pr	Total Hours		Theory			Practical		Total Marks
							TA	CA	ES	Int	Ext	
SEMESTER-IV												
BECL218	Microcontroller & Embedded Systems	2	1	0	3	3	10	15	25			50

Course Objective

1. To make students understand the use of embedded system to effectively automate the system under consideration.

2. Students should understand the working of these systems and should be able to determine hardware and software interfacing with real time systems.

3. To deploy hardware, coding, protocols and interfacing for achieving control tasks assigned in industries.

Course Outcome

The students should be able to

CO1. Select Appropriate Microcontroller, Techniques & understand the Embedded System.

CO2. To learn interfacing and programming of Microcontrollers for Embedded Applications.

CO3. To develop Arduino based boards for applications.

CO4. To Understand various industrial sensors and interfacing with embedded boards

CO5. To get knowhow of ARM processors.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus: Unit1: (8 Hrs)

Embedded Systems: Introduction to embedded Systems, Requirements /Components of Embedded Systems, Design Process in Embedded System

Microcontrollers: Introduction to microcontrollers, 8051 architecture, Addressing modes and instruction set, Assembly language programming, Introduction to Embedded C Programming

Unit 2: (8 Hrs)

Programming: Interrupts and serial communications, Serial I/O, Programming in embedded C, Programming Tools, Interfacing with 8051: ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display, Applications using microcontrollers.

Unit 3: (8 Hrs)

Advance Microcontroller: Introducing the Arduino Board, Installing and familiarizing the Arduino IDE, Interfacing the Arduino

Uno into Keypad and 7-Segment, Interfacing the Arduino Uno into Keypad and LCD

Unit 4: (8 Hrs)

Interfacing various sensors like PIR, TMP35, gas sensor, Ultrasonic sensor, LDR and WiFi ESP8266 module with Arduino.

Unit5: (8 Hrs)

ARM Processors: Brief history of ARM, ARM Architecture, Addressing modes, Instruction sets, Arm Thumb and instruction sets, Memory concepts, ARM Programming Overview of components of an embedded system with ARM architecture as an example (CPU, memory, buses, peripherals etc.), CPU internals. Hands on with a single board computer (LPC1768). Software issues: processes and their management, memory overview

Text Books:

- 1) Mazidi M. A., Mazidi J. G., “ 8051 Microcontroller & Embedded Systems”, 2nd edition Pearson Education, 2008
- 2) Kenneth Ayala, “Microcontroller & Embedded Systems using Assembly & C.”, 2nd edition Cengage Delmar Learning, 2010

Reference Books :

- 1) Ayala, Kenneth J, “Microcontroller Architecture, Programming & Application.”, 2nd edition Prentice Hall 1996
- 2) Dhananjay Gadre, “The AVR Microcontroller”, 2nd edition, Tata McGraw-Hill, 2003
- 3) Subrata Ghoshal, “8051 Microcontroller-Internals, Instructions, Programming & Interfacing”, 1st Pearson , 2010

FUNDAMENTALS OF POWER SYSTEMS (2 Credit) [30 Hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Total Marks
							Theory			Practical		
		Th	Tu	Pr	Total Hours		TA E	CA E	ES E	Int	Ext	
SEMESTER-IV												

BE EL2 12	Fundamentals of power Systems	2	0	0	2	2	1 0	1 5	2 5			30

Course Objectives:

1. To introduce Per unit system, cables, distribution system, transmission systems and different models represents Load flow studies.
2. To introduce elementary distribution schemes.
3. To study concepts of real and reactive power control

Course Outcomes

CO1: Understand the structure of electrical power systems

CO2: Understand the representation of power systems elements

CO3: Apply knowledge to the elementary distribution schemes

CO4: Understand the voltage regulation and efficiency of power transmission lines

CO5: Analyses the load Flow Studies

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I: (10 Hrs)

Structure of electrical power system, brief exposure to generation, transmission and distribution aspects, elementary consideration of economic bulk power supply system, idea about substation, concept of real, reactive and complex power, voltage and frequency dependence of loads, Per Unit Representation of parameters.

Unit II: (7 Hrs)

Feeders and distributors, Various distribution network topologies (Ring, Radial, etc)LT and HT cables, insulators

Unit III: (7 Hrs)

Voltage regulation of power transmission lines, Different models of Transmission line (T and π) and determination of power transfer capability in a symmetric bus (two bus system).

Unit-IV: (6 Hrs)

Types of buses and introduction to load flow analysis,

Text Books:

Power System Engineering by Kothari D. P
Nagrath I. J

Electrical Power Systems by Wadhawa C. L

Reference Books:

Power System Analysis - John J Grainger and William D Stevenson

Modern Power system Analysis - Nagrath and Kothari

Power System Analysis - NagoorKani

Power Sytem Analysis – HadiSaadat

Computational methods of electric power systems - Mariessa L Crow

Course Name : Communication Electronics

Course Code : BECL202

Scheme of the Course:													
Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper	Course Category
						Theory			Practical		Total Marks		
	Theory	Tutorial	Practical	Total Hours		TAE	CAE	ESE	Int.	Ext.			
Communication Electronics	2	-	2	4	3	10	15	25	25	-	75	2	Core

Course Objectives

To understand the basic concept of communication systems.

To understand the concept of analog modulation techniques.

To understand theory of analog pulse modulation techniques.

To understand working of radio receivers.

To understand the classification of multiplexing and multiplexing hierarchy.

Course Outcomes:

Student shall be able to

- Understand the fundamentals of
- CO1** communication systems and interpret the presence of noise in communication systems.
- CO2** Perform and analyze Amplitude Modulation and Frequency modulation.
- CO3** Analyze FDM and TDM systems.
- CO4** Understand the fundamentals of analog pulse modulation techniques.
Design and conduct experiments, using
- CO5** modern communication tools necessary for various engineering applications.
Understand the basics of Television and
- CO6** Satellite systems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Course Contents

:

UNIT 1 Introduction to Analog Communication: [08 Hours]

Review of signals and systems, Frequency domain of signals, Review of probability and random process. Base Band Signals and their bandwidth requirements. Noise in Communication systems, Gaussian and white noise characteristics.

UNIT 2 Analog Modulation Techniques [08 Hours]

Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Envelope detector, Angle Modulation and their types, Reactance tube and FET modulators, Armstrong method, FM discriminator, Super heterodyne Receiver, Performance characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection.

Pulse Modulation Techniques [04 Hours]

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM). Differential pulse code modulation. Delta modulation. Noise considerations in PCM.

Multiplexers [04 Hours]

FDM, TDM, Multiplexing Hierarchy, Digital Multiplexers, Basic concept of Television System, Introduction to satellite systems

Text Books:

S r. N o.	Title	Author Name	Publisher	Year of Publication	Edition
1	Electronics Communication System	Kennedy, Davis	Tata McGraw-Hill	2010	4
2	Communication Electronics	Roddy & Coolen	PHI	2010	4
3	Communication Electronics Principles and Applications	Frenzel	Tata McGraw-Hill	2011	3
4	Communication Engineering	U. A. Bakshi, A. P. Godse	Technical Publications	2009	3

Reference Books:

S r. N o.	Title	Author Name	Publisher	Year of Publication	Edition
1	Modern Digital & Analog Communication Systems	B. P. Lathi	Oxford Press Publication	1998	3
2	Digital Communication	Simon Haykin	Wiley and sons	2003	3
3	Digital Communication	John G. Proakis	Tata McGraw-Hill	2002	3
4	Digital Communication	Shanmugham	Wiley student	2009	4

SEMESTER V

Mathematics-VII

Z Transform & Numerical Methods

Sub. Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper
							Theory			Practical		Total	
		Th	Tu	Pr.	Total		TA E	CA E	ES E	Int .	Ext.		
	SEM-V												
BFYL 147	Mathematics-VII Z Transform	1	0	0	1	1	10	15	25			50	–

omes	PO 1.... 12												P S O 1	P S O 2	P S O 3
CO1	1 . 0	3 . 0	1 . 0	1	2	0	0	0	0	2	2	2	2	3	
CO2	1 . 0	3 . 0	1 . 0	1	2	0	0	0	0	2	2	2	2	3	
CO3	1 . 0	3 . 0	1 . 0	1	2	0	0	0	0	2	2	2	2	3	
CO4	1 . 0	3 . 0	2 . 0	1	2	0	0	0	0	2	2	2	2	3	
CO5	1 . 0	3 . 0	2 . 0	1	2	0	0	0	0	2	2	2	2	3	
CO6	1 . 0	3 . 0	2 . 0	1	2	0	0	0	0	2	2	2	2	3	

Syllabus:

Unit I Introduction to need for automation and automatic control ,use of feedback, broad spectrum of system application, Mathematical modeling,(Electrical & Electromechanical) diff. Equations., transfer functions, block diagram, signal flow graphs, application to elementary systems, simplifications, effect of feedback on parameter variations, disturbance signal. Time response of system, first order and second order system, standard inputs, concept of gain and time constants, Steady state error, type of control system, approximate methods for higher order system.

Unit II Stability of control systems, conditions of stability, characteristics equations, RouthHurwitz criterion, special cases for determining relative stability, Root location and its effect on time response, elementary idea of root locus, effect of addition of pole and zero on proximity of imaginary axis.

Unit III Frequency response method of analyzing linear system, Nyquist and Bode Plots, Stability and accuracy analysis from frequency response, open loop and close loop frequency response, Nyquist Criterion, Effect of variation of gain and addition of pole and zero on response plot, stability margin in frequency response. Design by state variable feedback: Review of state variable representations. Solution of State equations. Controllability & Observability

Text Books:

1. B. C. Kuo, Automatic Control Systems, 3rd Edition, Prentice Hall India, 1975
2. Nagrath, Gopal, Control System Analysis. 5th Edition, New Age International, 2010

Reference Books:

1. M.Gopal, Control Systems, Principles & Design, 3rd Edition, TMH Publishers, 2010
2. Norman S. Nise, Control Systems Engineering, 5th Edition, John Wiley & Sons, 2008

Electrical Installation Design (1 Credit) [21 Hrs]

Subj ect Cod e	Name of the Cours e	Teaching Scheme				Cre dits	Evaluation Scheme					
		Th	Tu	Pr	Total Ho urs		Theory			Practi cal		To tal Ma rks
							TA E	CA E	ES E	In t	Ex t	
SEMESTER-V												
BEE L321	Electri cal Install ation & Desig n	1	0	0	1	1	1 0	15	2 5			50

Course Objective:

1. To explain how the Regulations and Codes are intended to be applied in practice, with the emphasis on design and specification of electrical installation.
2. Acquire knowledge of standard clearances, design and estimation methods of service connections and its safety aspects.

Course Outcome

The students should be able to

1. To understand specifications, methods, components used for different electrical installations, the design & Construction of different types of underground Cables
2. Learn about the design and installation of illumination systems, the configuration and function of common equipment found in a substation
3. Understand the fundamental principles for the design and installation of associated protective systems relating to electrical installations and understand the fundamental transformer testing and recognizes the limits of acceptance of each test.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	1	1	2	2	0	3	2	1	0	0	0	1	2	3	2
CO2	1	1	2	2	0	3	2	1	0	0	0	1	2	3	2
CO3	1	1	2	2	0	3	2	1	0	0	0	1	2	3	2
CO4	1	1	2	2	0	3	2	1	0	0	0	1	2	3	2
CO5	1	1	2	2	0	3	2	1	0	0	0	1	2	3	2
CO6	1	1	2	1	0	3	2	1	0	0	0	1	2	3	2

Syllabus:

Unit-I:-

General awareness of IS Codes (IS 3043, IS 732, IS 2675, IS 5216-P1- 2, IS 2309), The Indian Electricity Act 1910, The Indian Electricity supply Act 1948, Indian Electricity

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
		Th	Tu	Pr	Total Hours		Theory	Practical	Total	TA	CA
							E	E	E	Int	Ext
SEMESTER-V											
BEEL324/ BEEP324	Drives	2	0	2	4	3	10	15	25	25	75

Rules 1956, The Electricity Regulatory Commission Act 1998, Electricity Act 2003, Bureau of Energy Efficiency (BEE) and its labeling. National Electric Code (NEC) - scope and safety aspects applicable to low and medium (domestic) voltage installations, Electric services in buildings, Classification of voltages, standards and specifications

Unit-II:-

Safety aspects applicable to low and medium voltage installations. General aspects of the design of electrical installations for domestic dwellings (low and medium voltage installations)–connected load calculation, sub circuit determination, selection of main distribution board, sub distribution board, MCB, ELCB, MCCB and cables for subcircuits. Pre-commissioning tests of domestic installations. Design of earthing system for an HT consumer, Dimensions and

drawings of typical earth electrodes (1) Pipe Earthing, (2) Plate Earthing.

You Tube Video Lecture :
<https://www.youtube.com/watch?v=CH23wcN0b6g>
https://www.youtube.com/watch?v=TTh8eT_g9yI

Text Book:

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing, S.K. Kataria & Sons; Reprint 2013 edition (2013).
2. K. B. Raina, S. K. Bhattacharya, Electrical Design Estimating Costing, NEW AGE; Reprint edition (2010).
3. M.K.Giridharan, Electrical Systems Design, M/s I K International Publishers, New Delhi, 2nd edition, 2016

Reference Books:

1. Pabla, Electric Power Distribution system, 4th Edition, Tata Mac graw Hill, 1998
2. Soni Gupta Bhatnagar, Electric Power, 9th Edition, Dhanpat Rai, 1997
3. Uppal, Electrical power system, 15th Edition, Khanna publication, 2009
4. Wadhwa, Electrical Power System Engineering, 2nd Edition, New age Pub., 1995
3. J.B. Gupta, Electrical Installation estimating.

DRIVES (2 Credit) [30Hrs]

Course Objectives:

1. To introduce the fundamentals, classification, selection, control of Modern Drives .
2. To study electric traction system & recent drives used in industries .

Course Outcomes:

The students should be able to
 CO1 Understand the fundamentals of different types of electric drives
 CO2 Discuss the properties and characteristics of mechanical drives.
 CO3 Interpret the performance parameters of electric drives in traction.
 CO4 Categorize modern drives used in industries.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I: Introduction to Electric Drives(8 Hrs)

Definition, classification, and speed-torque characteristics of common drive motors, Braking, Starting and speed control of electric motors.

Unit II: Mechanical characteristics of drives (6 Hrs)

Selection of Motor, power losses, heating, cooling of electric motors

Unit III: Electric Traction Drives (8Hrs)

Motors used in AC/DC Traction, performance and desirable characteristics, requirements and suitability of motor for traction duty. Control of DC traction motor, starting and braking of traction motor.

Unit IV: Industrial Drives (8 Hrs)

Brief idea about recent drives commonly used in industries. Digital control of electrical motors, Block diagram arrangement, comparison with other methods of control. Advanced topic on the subject

Text Books:

1. Grigsby L.L., Electric power generation transmission & distribution, 1st Edition, CRC Press, 2010
2. Soni, Gupta and Bhatnagar, A course in Electrical Power, 9th Edition, S. K. Kataria & Sons, 2010
3. H. Partab, Modern Electrical Traction, 1st Edition, Dhanpat rai, 1992
4. H. Partab, Art and Science of Utilization of Electrical Energy, 3rd Edition, Dhanpat rai, 1995
5. V.Subramanyam, Electric Drives, 2nd Edition, PHI publication, 2002

Reference Books:

1. Sharkawi , Fundamentals of Electrical Drives, 1st Edition, Coli publications, 2002

2. Dubey G.K., Fundamentals of electrical drives, 2nd Edition, Narosa Publications, 2000

POWER SYSTEMS ANALYSIS

Sub ject Cod e	Nam e of the Cour se	Teaching Scheme				Cre dit s	Evaluation Scheme					
							Theory			Practi cal		Tot al M ark s
		T h	T u	P r	To tal Ho urs		T A E	C A E	E S E	I n t	E x t	
SEMESTER-V												
BEE L320 / BEE P32 00	Power Syst em Anal ysis	2	0	2	4	3	10	15	25	25		75

Course Objectives -

1 To introduce the techniques to control the system voltage, voltage regulation, real and reactive power, power quality, efficiency, practical stability limits during healthy and faulty conditions .

Course Outcome

CO1: Analyze the formation of symmetrical components

CO2: Locate the symmetrical faults in power system

CO3: Locate the unsymmetrical faults in power system

CO4: Travelling waves and insulation coordination

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I (07 Hrs)

Symmetrical Component transformation: Three phase power in unbalanced circuit in terms of symmetrical component, Sequence impedances of Generator, Transformer, Transmission line & Passive loads, Phase shift in Star I delta three phase transformer (Yd 1, Yd 11 connection.).

Unit II : (08 Hrs)
Symmetrical fault analysis: Without & with pre fault load current. Selection of Circuit Breakers ratings, current limiting reactors

Unit-III : (07 Hrs)
Unsymmetrical fault Analysis: L-G, L-L-G, L-L, open conductor's faults analysis using symmetrical components.

Unit IV : (08 Hrs)
Traveling waves and Insulation coordination: Traveling waves on transmission lines, Classification of lines attenuation and distortion of traveling waves, reflection and transmission of waves, behavior of rectangular waves at transition points. Introduction to insulation coordination, associated terms, impulse wave-form. Introduction to BIL, Reduced BIL and SIL.

Text Books

Power System Engineering by Kothari D. P
Nagrath I. J
Electrical Power Systems by Wadhawa C. L

Reference Books:

Power System Analysis - John J Grainger and William D Stevenson
Modern Power system Analysis - Nagrath and Kothari
Power System Analysis - NagoorKani
Power Sytem Analysis – HadiSaadat
Computational methods of electric power systems - Mariessa L Crow

Mathematics-VIII Optimization

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total Marks
		Th	Tu	Pr	Total Hours		TA	CA	ESE	Int	Ext	
SEMESTER-VI												

BFYL 148	Mathematics-VIII Optimization	1	1	0	2	2	10	15	25			50

Course Objectives:

1. To introduce the basic methods of optimization in engineering.
2. To develop skills to provide solution to various problems in the field of engineering.
3. To develop analytical skills to provide solution to simple transportation problems and assignment problems in the field of engineering.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Apply basic concepts of Optimization Techniques.
2. Use the concept of mathematical modeling and apply various optimization techniques to real life problems.
3. Apply the various techniques to Transportation problems & Assignment problem in job scheduling or route selection.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Optimization Techniques L-T-P-C 1-1-0-2

Unit -I: Introduction to Optimization Techniques(10hrs)

Linear programming, mathematical model formulation ,Solutions by Graphical method , Simplex method ,Big M method , two phase method.

Unit –II (10hrs)

Dual problem – duality theory - dual simplex method – revised simplex method.

Unit –III(10hrs)

Transportation problem ,Assignment problem-travelling salesman problem.

Text Books:

1. Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.
2. Linear Programming: methods and application by Saul I Gass.
3. Linear Programming: theory and application by Catherine Lewis.

Non Linear Control System (1 Credit)[15 Hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical	Total Marks	
		Th	Tu	P	Total Hours		TA	CA	EE	Int	Ext	
SEMESTER-VI												
BEE L327	Non Linear Control Systems	1	0	0	1	1	10	15	25			50

Course Objective

1. To provide to the students a solid background in analysis and design of nonlinear control systems.
2. The ability to understand the characteristics of various types of nonlinearities present in physical systems.
3. The ability to carry out the stability analysis of non-linear control systems.

Course Outcome

The students should be able

CO1 : To learn about non-linear system in depth and introduction to behavior of non linear system.

CO2 : To determine performance of non-linear system using conventional classical approach.

CO3 : To determine performance of non-linear system using modern control approach.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes	Programme Specific Outcomes		
	PO 1.... 12	PSO 1	PSO 2	PSO 3

CO1	1	2	2	3	1	0	0	0	0	0	0	0	2	3	2
CO2	1	2	3	3	2	0	0	0	0	0	0	0	2	3	2
CO3	1	2	2	3	2	0	0	0	0	0	0	1	2	3	2
CO4	1	2	2	3	1	0	0	0	0	0	0	0	2	3	2
CO5	1	2	2	3	1	0	0	0	0	0	0	0	2	3	2
CO6	1	2	2	3	2	0	0	0	0	0	0	2	2	3	2

Syllabus:

Unit – I Non Linear Control Systems: Types of non linearities. Characteristics of Non Linear Control System. Inherent & intentional non-linearities. Describing function method for Analysis. Describing function of some common Nonlinearities. Stability analysis. Limit cycles & stability of limit cycles.

Unit-II Phase Plane Method: Singular points, nature of singular points. Construction of trajectory by Isoclines & Delta method: Computation of time.

Unit III State variable approach for non- linear systems, case studies of non linear systems using state variables, controllability and observability of non linear systems using state variables.

Video Lecture : Dr. Arun D. Mahindrakar, IIT Madras

Link : <https://nptel.ac.in/courses/108106024/>

Text Books: 1. Nagrath & Gopal, Control system Analysis, 3rd Edition, New Age International, 2010

2. J.J. Dazzo & Houpis, Linear System Analysis, 4th Edition, Mc. Graw Hill, 1995

3. Ogata, Modern Control Engineering, 5th Edition, Prentice Hall, 2009

4. M Gopal, Modern Control Theory, 2nd Edition, New Age International, 1993

Reference Books: 1. Sarkar .B.N., Advanced control system, 2nd Edition, PHI, 2013

3. B.C. Kuo, Automatic control system, 7th Edition, PHI, 2010

High Voltage Engineering (3 Credit)[30 Hrs]

Subject	Name of the	Teaching Scheme	Credi	Evaluation Scheme

t Code	Course					ts	Theory			Practical		Total Marks
		Th	Tu	Pr	Total Hours		TA AE	CA AE	ES SE	Int	Ext	
SEMESTER-VI												
BEE L330 / BEE P330	High Voltage Engineering	2	0	2	4	3	10	15	25	25		50

Course Objectives:

- 1.To introduce the conduction and electrical breakdown phenomena in liquids, solids, gases or vacuum.
2. To introduce Generation of high voltage, high current and their measurement.
3. To introduce testing units required for the installation of electrical equipments

Course Outcomes

1. Understand the breakdown mechanism in di-electric
- 2 Analyze the lightning and switching over voltages along with protection and analyze the traveling waves & should able to select proper insulation coordination
- 3 Develop & Design the systems for generation of high voltage and current and apply the knowledge of high voltage engineering for measurement of high voltage and current
4. Perform the non-destructive and high voltage test of electrical apparatus by experimentation.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	1 . 0	1 . 0	2 . 0	3	2	1	1	1	2	2	2	2	3	2	
CO2	1 . 0	1 . 0	2 . 0	3	2	1	1	1	2	2	2	2	3	2	
CO3	1 . 0	1 . 0	2 . 0	3	2	1	1	1	2	2	2	2	3	2	
CO4	1 . 0	2 . 0	2 . 0	3	2	1	1	1	2	2	2	2	3	2	
CO5	1 . 0	2 . 0	2 . 0	3	2	1	1	1	2	2	2	2	3	2	
CO6	1 . 0	2 . 0	2 . 0	3	2	1	1	1	2	2	2	2	3	2	

Error! Not a valid link.Syllabus:

Unit I [08 Hours]

Breakdown mechanism in Di-electric : Ionization process; Townsend's criterion for B.D. Break down in electro-negative gases, Time-lag for B.D.; Streamer theory for B.D in gases, Paschen's law; B.D in non-uniform field. Corona discharges and introduction of corona post B.D. phenomenon and applications, Practical considerations in using gases for insulation purpose; vacuum insulation, Liquid as insulators, conduction & B.D. in pure and commercial liquids. Intrinsic, electromechanical & thermal B.D., B.D. of solid di-electrics in practice; B.D. in composite dielectrics.

Unit II [07 Hours]

Lightning and switching over voltages: Mechanism of lightning, types of strokes, parameter and characteristics of lightning strokes, characteristics of switching surges, power frequency over voltages. Control of overvoltage due to switching. Protection of lines by ground wires, protection by lightning Arrester, gap type and gapless L.A., selection of L.A. ratings, surge-absorbers.

Traveling waves and Insulation coordination: Traveling waves on transmission lines, Classification of lines attenuation and distortion of traveling waves, reflection and transmission of waves, behavior of rectangular waves at transition points. Introduction to insulation coordination, associated terms, impulse wave-form. Introduction to BIL, Reduced BIL and SIL.

Unit 3 [08 Hours]

Generation of high voltage and currents: Generation of High D.C voltages by rectifiers, voltage doubler and multiplier, circuits (Derivations of expression not required), electrostatic machines, Generation of high AC voltages by Cascaded transformers, Resonant transformers, generation high frequency AC high voltage. Generation of impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, wave shape control, Marx circuit, tripping and control of impulse generation, generation of switching surges, generation of impulse current.Measurement of high voltage

and current: Measurement of high AC and DC voltage by micro ammeter, generating voltmeter, resistance and capacitance potential divider, series impedance voltmeter, CVT, Magnetic type potential transformers, electrostatic voltmeter. Peak reading AC voltmeter, Sphere gap arrangement. Measurement of impulse voltage by potential dividers and peak reading voltmeters. Measurement of High AC/DC current, measurement of high frequency and impulse current by resistive shunt (Bifilar strip shunt only)

Unit IV [7 Hours]

Non destructive and high voltage testing of electrical apparatus: Non- destructive testing, Measurement of DC Resistivity, measurement of Dielectric constant and loop-factor (*low* and power frequency only), Schering bridge for high charging circuits, high dissipation factor, three terminal measurement, transformer ratio arm bridges, partial discharge measurements by straight detectors & by balance detectors, calibration of detectors, discharge detection in power cables. High voltage testing. Testing of insulators, bushings, Isolators, circuit breakers, cables, transformer, lightning arresters and power capacitors. Recent trends in industrial testing & introduction to partial discharge. Advanced topic on the subject.

Text Books :

1. M.S. Naidu and V Kamaraju, High Voltage Engineering, 3Edition, Tata Mc Graw Hill, 1995
2. C.L.Wadhwa, High Voltage Engineering, 3rd Edition, New Age International, 2010
3. Arrilaga, High voltage direct current, 2nd Edition, New York IEEE, 2002
4. Begamudre, Extra high voltage Ac transmission Engineering, 3rdEdition, New age, 2002

Reference Books:

1. D. Ruber, High voltage circuit breaker and design and application, 2nd Edition, Dakker, 1997.
2. Ray S., An introduction to high voltage engineering, 2nd Edition, PHI, 2004

POWER SYSTEMS DYNAMICS

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total Marks
		Th	Tu	Pr	Total Hours		TA E	CA E	ES E	Int	Ext	
SEMESTER-VI												
BE EL3 31	Power System Dynamics	2	0	0	2	2	10	15	25			50

Course Objectives:-

- 2.To make students familiar with stability system
- 3.To study economics operations of power system.

Course Outcomes

- CO1: Understand the concept of stability in terms of power system
 CO2: Identify the solutions for economic operation of power system
 CO3: Understand the need of grounding system
 CO4: Power system security analysis

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I:(08 Hrs) : Stability of Power System- Steady state, Dynamic and Transient stability: definition. Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently. Power angle equation, Steady state stability studies, Basic introduction to Voltage Stability aspects.

Transient stability studies: -Swing curve, Equal Area criterion for transient stability, Application of equal area criterion for different disturbances, Solution of swing equation by point by point method, Methods of improving transient stability.

Unit II : (06 Hrs)

Economic operation of power system: Introduction, Distribution of load between units within the plant Optimum generation scheduling considering transmission losses. Representation of transmission loss using loss formula co-efficient, Derivation of loss formula co-efficient, Lambda iteration method, simulation of co-ordination equation on digital computer, Basic introduction to Power sector restructuring.

Unit III : (06 Hrs)

- Grounding of Neutral in power system.
- Shunt & series compensation- Generalized equation, shunt reactor compensation of very long line with intermediate switching station, series capacitor compensation at line center, shunt reactors at both ends and series capacitor in middle of line.

Unit IV : Power system security, contingency analysis and various state of a system
Advanced topic on the subject

Text Books:

- Power System Dynamics- K.R. Padiyar, B.S. Publications
- Power System Dynamics Control – Prabha S. Kundur, IEEE Press, New York

Reference Books:

- Power System Stability – E.W. Kimbark, IEEE press, N.Y, Vol.
- Power System Control and Stability – Vol. – I – Anderson & Foud, IEEE Press, New York.
- Power System Voltage Stability – C. W. Taylor., McGraw Hill International student edition.
- Distributed Generation Islanding – implication on power system dynamics performance. – R.A. Walling, N. W. Miller, Power Engineering Society, Summer Meeting, 2002, IEEE Publication, 25 July 2002, Vol. I, PP 92-96.

SWITCHGEAR & PROTECTION

Subject Code	Name of the Course	Teaching Scheme	Credits	Evaluation Scheme		
				Theory	Practical	Total

		Th	Tu	Pr	Total Hours		TA E	CA E	ES E	Int	Ext	Marks
Sem VI												
BEE L328 / BEE P328	Switch Gear & Protection	2	0	2	4	3	10	15	25	25		75

Course Objectives:-

- To introduce the construction, working and applications of different relays & protective schemes like distance protection, differential, over current & overvoltage protection .
- To study different types of circuit breaker used and practical application
- Introduction to static and numerical relays

Course Outcomes

- CO1: Understand different types of protective relays
CO2: Identify different types of overcurrent relays for protection of transmission line
CO3: Apply different protective schemes for transformer generator and busbar
CO4: provide solution for abnormal condition in the system

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	1	1	2	1	2	2	2	2	2	2	3
CO2	2	2	3	2	1	1	2	1	2	2	2	2	2	2	3
CO3	2	2	3	2	1	1	2	1	2	2	2	2	2	2	3
CO4	2	2	3	2	1	1	2	1	2	2	2	2	2	2	3
CO5	2	2	3	2	1	1	2	1	2	2	2	2	2	2	3
CO6	2	2	3	2	1	1	2	1	2	2	2	2	2	2	3

Syllabus:-

Unit I

(7Hrs)

General philosophy of Protective Relaying ,
Medium voltage Line Protection: Over current
relaying, directional- over current relay.

Unit II (7Hrs)

High Voltage Line Protection: Distance relays,
carrier distance Schemes. Unit carrier schemes,
numerical relays

Unit III (8 Hrs)

Equipment Protection: Principles of differential
relaying, protection of generators, transformers
and bus Bars by differential relaying and other
relays. Protection Induction Motors against
overloads, short circuits. Thermal relays.

Unit IV (6 Hrs)

Switchgear: Circuit breakers. Arc interruption
theory, recovery and restricting voltages,
RRRV, breaking of inductive and capacitive
currents, C.B, ratings, different media of arc
interruption overview of oil circuit breakers,
construction and operation of Air blast, SF6
and vacuum breakers, Advances in industrial
power system protection

Text Books:

1. Power System Dynamics- K.R. Padiyar, B.S. Publications
2. Power System Dynamics Control – Prabha S. Kundur, IEEE Press, New York

Reference Books:

1. Power System Stability – E.W. Kimbark, IEEE press, N.Y, Vol.
2. Power System Control and Stability – Vol. – I – Anderson & Foud, IEEE Press, New York.
3. Power System Voltage Stability – C. W. Taylor., McGraw Hill International student edition.
4. Distributed Generation Islanding – implication on power system dynamics performance. – R.A. Walling, N. W. Miller, Power Engineering Society, Summer Meeting, 2002, IEEE Publication, 25 July 2002, Vol. I, PP 92-96.

Conventional Energy Sources

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
		Th	Tu	Pr	Total		Theory			Practical		Total Marks
							TA	CA	ES	In	Ext	

					Ho urs			E	E	t		
SEMESTER-VI												
	Convent ional Energy Sources	1	0	0	1	1	1 0	15	25			50

Course Objectives:

- 1) To introduce conventional as well as nonconventional methods of generation of electricity.
- 2) To study parameters related to site selection, awareness about important components of the systems.
- 3) To study the procedure to calculate the cost of generation

Course Outcomes

- CO1: Understand various sources of energy that can be converted into electrical energy
CO2: Design & Operate thermal power station
CO3: Develop & analyze the performance of hydro power station

CO Mapping with PO and PSO:

Course Outcomes ▼	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:-

Unit-I: Sources of Electrical Energy (08 Hrs)

Coal oil and natural gas water power, nuclear fission and fusion. Their scope and potentialities for energy conversion. Generation different factors connected with a generating station, connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity and utilization factor, load curve, load duration curve, load survey base load and peak load station, advantages of interconnection.

Unit-II: Thermal Stations : (06 Hrs)

Choice of site, location, size and number of units, general layout, major equipment, essential and non-essential auxiliaries, electric supply to auxiliaries, cost of generation, effect of different factors costs.

Unit- III: (06 Hrs)

Hydrology, stream flow, flow duration curve, mass curve reservoir capacity, type of hydroplants and their field of use, pumped storages plants and their utility, surge tanks, governing characteristics of turbine and hydro generators.

Nuclear Station: - Principle of Nuclear energy, materials, types of nuclear reactors, breeder reactors, location, material for moderator and control rods, cost economics

Text Books:

1. Conventional Sources of Energy by B.A.Khan
2. Non-Conventional Energy Resources by G. S. Sawhney

Reference Books:

1. Power System Stability – E.W. Kimbark, IEEE press, N.Y, Vol.
2. Power System Control and Stability – Vol. – I – Anderson & Foud, IEEE Press, New York.
3. Power System Voltage Stability – C. W. Taylor., McGraw Hill International student edition.
4. Distributed Generation Islanding – implication on power system dynamics performance. – R.A. Walling, N. W. Miller, Power Engineering Society, Summer Meeting, 2002, IEEE Publication, 25 July 2002, Vol. I, PP 92-96.

SEMESTER VII**PROJECT PHASE-I (4 Credit)****Course Objective:**

1. To Provide opportunity for working on a real time project, prepare a prototype and present conclusions in the form of reports.
2. To Provide opportunity for selection of Projects considering their usability to the industry and society without endangering the environmental aspects.

Course Outcomes :

Upon successful completion of the course, students shall be able to

1. Hands-on experience on real time systems
2. Boost of confidence

CO Mapping with PO and PSO:

Course	Programme	Programme

Outcomes	Outcomes		Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

INDUSTRY INTERNSHIP(12 Credit)**Course Objectives:**

1. To expose students to industry environment
2. To get practical orientation relevant to subjects
3. To provide solutions to industrial and social need

Course Outcome:

At the end of the course the student shall be able to:

- CO1: Understand the working culture of industry
 CO2: Identify and solve industrial problem with analytical approach
 CO3: -Provide solution in specific domain
 CO4: -Work in a multidisciplinary group
 CO5: -Provide hands on experience on real time systems
 CO6: -Boost technical confidence

- A group of 04 student (Maximum) should identify an industry of good standing on their own in consultation with guide.
 - Students are expected to complete topic identification and synopsis during this project seminar.
 - All formalities related to industry Identification, topic identification and synopsis must be completed during 1st month of phase1.
 - Period of industrial project will be of 24 week starting from last date of even semester exam every year.
 - Student must report to his project guide every month.
 - Student will be required to present from time to time (minimum.4 times during project); their progress report for project evaluation in person.. Under exceptional circumstances: the student may be allowed to present through video-conferencing. However this is not applicable to final Seminar
 - Evaluation of the project will be according to the sheet
3. Ability to work in a multidisciplinary group.

4. Ability to consider the industry, social and environmental requirement
5. Present conclusions effectively before the

SEMESTER-VIII EHVAC & HVDC TRANSMISSION

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme						Total Marks
							Theory			Practical			
		Th	Tu	Pr	Total Hours		TA E	CA E	ESA E	Int	Ext		
SEMESTER-VIII													
	EHVAC & HVDC TRANSMISSION Elective -II	2	0	0	2	2	10	15	25			50	

Course Objectives:

1. Understand the effect of electrostatic and electromagnetic field on EHVAC lines,
2. Understand Comparison between AC and DC Transmission.
3. Understand Control of power in HVDC lines, filters, circuit breakers and HVDC substations

Course Outcomes

- CO1: Understand the power handling capabilities of EHVAC lines
- CO2: Analyse the effect of electrostatic and electromagnetic field on EHVAC lines
- CO3: Compare between AC and DC Transmission station
- CO4: Design circuit breaker and substation model

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	1 . 0	1 . 0	2 . 0	3	3	1	2	1	0	0	0	1	3	2	3
CO2	1 . 0	1 . 0	2 . 0	3	3	1	2	1	0	0	0	1	3	2	3
CO3	1	1	2	3	3	1	2	1	0	0	0	1	3	2	3

	0	0	0												
CO4	1	1	2	3	3	1	2	1	0	0	0	1	3	2	3
CO5	1	1	2	3	3	1	2	1	0	0	0	1	3	2	3
CO6	1	1	2	3	3	1	2	1	0	0	0	1	3	2	3

Syllabus:-

Unit I

Power handing capacities of EHV AC Transmission lines. Voltage gradients : Electric field of point charge . sphere gap-line charge, single and three phase lines and bounded conductors-Maxwell's potential co-efficient , Mangolelt Formula

Unit II

Electrostatic and electromagnetic fields of EHV Lines, Electric shock and threshold current :Capacitance of long object , calculation of electromagnetic field of A.C. Lines (3-ph Single and double circuit line only) Effect of high electrostatics field , measurement of electrostatic ground wires, electrostatic interference Corona : Types critical disruptive voltages : Factor affecting corona , Methods for reducing corona power loss, corona current wave form charge voltage diagram audible noise and radio interference.

Unit III

Comparison of EHV AC and HVDC Systems Conversion from AC to DC Rectifiers, conveters conversion from AC to DC Invertors Kinds ofDC Link. Earth electrode and earth returns : Introduction OBJECTIVE, location and configuration, resistance of electrodes means of reducing earth electrode resistance troubles caused by earth electrode resistance trouble caused by earth Current and remedies.Multiterminal HVDC System : Introduction 2 pole transmission. MTDC System with series and parallel connected convertors advantages and parallel connected converters, Advantages and applications configurations and types.

Unit IV

Power flow control in HVDC System: constant current constant voltage, constant ignition and excitation angle control, control characteristic. Parallel operation of AC and DC links (Synchronous and Asynchronous links)

Text Books:

1. S. Rao., EHV AC and HVDC transmission Engineering and practice, 3rd Edition, Khanna publications, 1999
2. C. L. Wadhwa, Electrical power systems, 4th Edition, CBS publication, 2005

Reference Books:

1. Begamudre, EHV AC Transmission, 2nd Edition, New Age publications, 1990
2. K.R. Padiyar, —HVDC Power Transmission Systems, 2nd Edition, New Age publications, 2010

Advanced Power Electronics (2 Credit) [30 Hrs]

Course Objectives:

1. This subject deals with the modern power semiconductor switches, converters, their control and application in residential, commercial & industrial etc
2. To study DC to DC switch mode converter.
3. To introduce resonant converter

Course Outcomes:

Upon successful completion of the course, students shall be able to-

CO1 Study overview and Protection of semiconductor devices

CO2 Study Single phase and Three phase line commutated converters.

CO3 Design three phase Inverter and also study harmonic analysis

CO4 Study Close loop control of DC-DC converter

CO5 Study comparison between PWM and resonant converter

CO6 Study Role of FACTS devices in Power electronics along with designing UPS and intelligent Controllers

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Unit I Static Controllable Switches (5 Hrs)

Overview of power semiconductor device structure, characteristics, rating and protection (Thyristor, BJT, MOSFET, IGBT, MOS

controlled Thyristor etc.) comparison of controlled switches .

Unit II Line Commutated Converters (5 Hrs)

Single phase and three phase line commutated converters – fully controlled, semi controlled, and dual phase cycloconverters. Performance with resistive and inductive loads. Converters with improved performance. Single phase Cycloconverters. Three phase cycloconverters. Reduction of output harmonics.

Unit III Soft Switch Inverters (5 Hrs)

Inverters, type (Hard/soft switch inverter, Voltage source inverter current source inverter). Operation with different types of loads, Performance parameters Harmonic elimination, control of output, voltage using different switching techniques.

Unit IV DC to DC Switch Mode Converters (5 Hrs)

Basic concepts, analysis of switch on and Off transients types, DC to DC converters comparison, soft switching, close loop control .

Unit V Resonant Converters (5 Hrs)

Comparison of PWM and resonant converters, classification, Basic resonant circuit concepts , Analysis and design of SRC (series), PRC (parallel), SPRC(series - parallel) resonant converters , DC-DC as well as AC-DC resonant converter, application for induction heating and reduction in THD and P.F. improvement .

Unit VI Power Modulators (5 Hrs)

Different methods to control the output voltage. Electric utility application, various types of SVCs (static var compensator), Power conditioners and uninterruptible power supplies, protection of supply, Introduction to recent intelligent controllers. Advanced topic on the subject

Text Books:

1. Ned Mohan Tora M. Undeland, William P. Robbins, Power Electronics, 2nd Edition, John Wiley & Sons, 1995
2. M.H. Rashid, Power Electronics Circuits and Application, 7th Edition, Prentice Hall of India,

Reference Books:

1. C.V. Lander, Power Electronics, 3rd International Edition, Mc-Graw Hills, 2002
2. P.C. Sen, Modern Power Electronics, 3rd Edition, A.H.Wheeler Publication Co., 2009
3. M. D Singh, K B. Kanchandani, Power Electronics, Tata McGraw Hill International

Advanced Drives (2 Credit) [30 Hrs]

Subj ect Cod e	Name of the Course	Teaching Scheme				Cre dits	Evaluation Scheme					
		T h	T u	Pr	Tot al Ho urs		Theory			Pract ical	Tot al	
							T A E	C A E	E S	Int E xt	E Ma rks	
SEMESTER-VIII												
	Advanced Drives	2	0	0	2	2	10	15	25			50

Course Objectives

1. This Subject deals with modern drives controls techniques such as vector & scalar.
2. To study V/F control.
3. To study DTC control for industrial application

Course Outcomes

Upon successful completion of the course, students shall be able to-

- CO1 Understand dynamics of drives.
- CO2 Understand variable frequency control of drives.
- CO3 Understand synchronous servomotor drive in industries.
- CO4 Understand modern control techniques for ac drives.
- CO5 Understand digital control of AC/DC drives and special motors used in industries.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:**Unit I Dynamics of Electrical Drives (05 Hrs)**

Classification of electric drives – Basic elements of an electric drive. Dynamic condition of electric System. Stability consideration of electric drives.

Unit II AC Drives (05 Hrs)

Variable frequency control of AC motor. Cycloconverter control of slip frequency, Forced commutated inverter drive, analysis. Performance and stability of synchronous and asynchronous drives.

Unit III Synchronous Motor Drives (07 Hrs)

Synchronous servomotor drives with sinusoidal waveform, with sinusoidal waveforms, with trapezoidal waveforms, Load commutated inverter drives.

Unit IV Advanced Control Strategies (07 Hrs)

Control of AC/DC machines. State variable approach. Scalar control method / Vector control method, comparison, Space vectors, stator space current, stator voltage space vector, stator flux linkages space vector, transformation of space vector coordinates from one reference frame to another.

Unit V Digital control of drives (06 Hrs)

Adaptive control principles. Digital control of drives. Application of microprocessor / computers to Electric AC / DC Drives. Switched reluctance motor control, Study of recent drives controllers. Advanced topic on the subject

Text Books:

1. Vedam Subramanyam, Electrical Drive, 2nd Edition, Tata Mc Graw Hill, 1996
2. Rakosh das Begamudere, Electro Mechanical Energy convection with dynamics of Machines, 2nd Edition, Wiley Eastern, 1998

Reference Books:

1. Paul, C, Krause, Analysis of Electric Machinery, 2nd Edition, IEEE Press, 2002
2. B.K. Bose, Power Electronics and AC Drives, 2nd Edition, Pearson Education, 2002
3. Joseph Vithyathil, Power Electronics, principles and application, 3rd Edition, McGraw Hill, 1995

4. Mohan Undeland, Power Electronics, converters, Application and design, 3rd Edition, Robbins John Wiley, 2008
5. G.K. Dubey, Fundamentals of Electrical Drives, 2nd Edition, Narosa Publication, 2002

Electric Vehicle (2 Credit) [30 Hrs]

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical	Total Marks	
		Th	Tu	Pr	Total Hrs		TA	CA	ES	Int		Ext
SEMESTER-VIII												
	Electric Vehicle	2	0	0	2	2	10	15	25			50

Course Objectives:

1. Electrical Vehicles need strong sources, efficient power-drives & excellent co-ordination within the vehicle.
2. This course introduces modern subsystems for efficient operation of vehicles.

Course Outcome:

Upon successful completion of the course, students shall be able to-

CO1 Understand basics of battery technology.

CO2 Understand scheme of HEV and full electric vehicle.

CO3 Analyse need of different motor drives for electric vehicle.

CO4 Apply new topologies to electric vehicle.

CO5 Evaluate performance parameters of electric vehicle.

CO6 Create improved systems for electric vehicle.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	2	1	3	1	2	3	1	0	0	0	1	2	3	2	3
CO2	3	2	3	1	2	3	1	0	0	0	1	2	3	2	3
CO3	3	2	3	1	2	3	1	0	0	0	1	2	3	2	3
CO4	3	2	3	1	2	3	1	0	0	0	1	2	3	2	3

	0	0	0												
CO5	3	2	3	1	2	3	1	0	0	0	1	2	3	2	3
CO6	3	2	3	1	2	3	1	0	0	0	1	2	3	2	3

Error! Not a valid link.Syllabus:

Unit I Introduction to Electric Vehicles (04 Hrs)

Electric vehicles (EV) development, past, present and future, comparison with IC engine driven vehicles.

Unit II Storage Units (05 Hrs)

Batteries, fuel cells, ultracapacitors. Power converters in EV. Different types of motors used in EV and their torque-speed characteristics, motor control techniques,

Unit III Vehicle Control (05 Hrs)

High performance and efficiency-optimized control, sensorless control. Electric vehicles modeling and their Characteristics.

Unit IV Electric drive-trains (05 Hrs)

Basic concept of electric traction - introduction to various electric drive-train topologies - power flow control in electric drive-train topologies - fuel efficiency analysis

Unit V Electric propulsion unit (05 Hrs)

Introduction to electric components used in electric vehicles - Configuration and control of DC Motor drives - Configuration and control of Induction Motor drives - Configuration and control of Permanent Magnet Motor drives - Configuration and control of Switched Reluctance Motor drives - Drive system efficiency

Unit VI Hybrid Electric Vehicle (05 Hrs)

Fuel cell Vehicles, Hybrid Electric Vehicles (HEV), series, parallel and series-parallel (split) systems, Recent industrial power electronic applications. Advanced topic on the subject

Text Books:

1. Sandeep Dharmaja, Electric Vehicle Battery Systems, 1st Edition, Newnes, 2001
2. K.T.Chau, Zheng Wang, Chaos in Electrical Drive Systems: Analysis, Control & Applications, 1st Edition, John Wiley and Sons, 2011

Reference Books:

1. Chung Chow Chan, K.T.Chau, Modern Electric Vehicle Technology, 1st Edition, Oxford University Press, 2001
2. Springer Books, Electrical Vehicle Integration into Modern Power Networks
3. A.T.P.So George C.Barney waterstones.com, International Journal of Elevator Engineering, United Kingdom
4. John Lowry, John Wiley and Sons, Electrical Vehicle Technology Explained-James Larminie, 1st Edition, 2003

Modern Digital Control System

First Term												Course Category	
A Name of the Course	Teaching Scheme			Credits	Evaluation Scheme						Duration of Paper		
					Theory			Practical	Total Marks				
	Th.	Tu.	Pr.	Total Hours		TA	CA	ES	Int.	Ext.		Hours	
Modern Digital Control System	2	0	0	2		8	12	30			50	2	Elective

Course Objectives:

1. To familiarize with data sampling
2. To understand basic digital system.
3. To prepare for various engineering applications.

Course Outcomes:

On successful completion of the course, Students shall be able to:

- CO1: understand digitisation of analog system
 CO2: Demonstrate the knowledge z transform
 CO3: analyze discrete time control system
 CO4: design discrete time state space equation

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

UNIT – I SAMPLING AND RECONSTRUCTION

Introduction, Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

UNIT-II THE Z – TRANSFORMS

Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms

UNIT-III Z-PLANE ANALYSIS OF DISCRETE-TIME CONTROL SYSTEM Z-

Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane.

UNIT – IV STATE SPACE ANALYSIS

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations

Text Books:

Sr . No.	Title	Author Name	Publisher	Year of Publication	Ed ition
1	Digital Control Engineering,	M. Gopal,	Wiley Eastern,	1988.	
2	Computer Controlled Systems,	K.J Astrom , B Witten mark,	Prentice - Hall India	1994	2nd edition

Reference Books:

Sr . No.	Title	Author Name	Publisher	Year of Publication	Ed ition

1	Digital Control	R. Isermann	Narosa Publications,	1993.	, Vol 11

SMART GRID TECHNOLOGIES AND APPLICATIONS

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					
							Theory			Practical		Total Marks
		Th	Tu	Pr	Total Hours		TA E	CA E	ES E	Int	Ext	
SEMESTER-VIII												
	Smart Grid and Technologies Elective-III	2	0	0	2	2	10	15	25			30

Course objectives:-

- 1) To ensure the students aware of the current state-of-the-art on design, operation and control of smart grid
- 2) To acquire knowledge on the components in smart grids and their functions

Course Outcome

CO1: Understand the concept of smart grid, their comparison over conventional grid & international policies

CO2: To implement smart metering & vehicle to grid applications.

CO3: Analyse Smart Substation & PMU's (Phasor Measurement Unit)

CO4: To practice power quality issues & audit.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I (07 Hrs)

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart

Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid . CDM opportunities in Smart Grid

Unit II (08 Hrs)

Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers. Information and Communication Technology for Smart Grid: □ Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

Unit III (08 Hrs)

Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

Unit IV (07 Hrs)

Power Quality Management in Smart Grid: □ Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit. Advanced topic on the subject

Textbook

Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid (Wiley - IEEE)

by Stephen F. Bush

Smart Grids: Infrastructure, Technology, and Solutions (Electric Power and Energy Engineering)

by Stuart Borlase

ADVANCED POWER SYSTEM STABILITY

Subject Code	Name	Teaching Scheme	Credits	Evaluation Scheme

	of the Course						Theory			Practical		Total Marks
		Th	Tu	Pr	Total H		TA E	CA E	ES E	Int	Ext	
SEMESTER-VIII												
ADVANCED POWER SYSTEM STABILITY Elective		2	0	0	2	2	10	15	25			30

Course Objectives

1. To introduce fault analysis of large power system
2. To study methods of stability.
3. To study effects of grounding on stability.

Course Outcomes

Upon successful completion of the course, students shall be able to

1. Understand the advanced methods of ensuring power system stability during fault conditions
2. To find the stability under major disturbances.
3. To understand the effect of grounding on stability
- 4 Understand the behavior of rotor in synchronous generators, the effect of change in load on rotor angular velocity and acceleration.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes		Programme Specific Outcomes	
	PO1....	PO12	PSO1...	PSO3
CO1	1/2/3/-		1/2/3	
CO2.....				
CO6				

Syllabus:

Unit I (07 Hrs)

Fault analysis of large power system, Calculation of three phase balanced and unbalanced faults.Methods of Symmetrical components, Fault levels in a typical system. Power in symmetrical components

Unit II (07 Hrs)

Transient stability : - A) Consideration of rotor angle, b) Consideration of time. Review of classical method, dynamic and transient stability investigations and simulation of single

machine infinite bus and multi machine system, Solution by step by step method for swing equation.

Unit III (07 Hrs)

Effects of grounding on stability, effects of various disturbance, parameters and controls on stability, prevention of stability pull out.Role of automatic voltage regulator (AVR) on improving stability

Unit IV (07 Hrs)

Effect of excitation control and turbine Governing, Augmentation of stability of conventional methods, Recent software for power system analysis.Advanced topic on the subject

Test Book

1. Power System Dynamics Control – Prabha S. Kundur, IEEE Press, New York

Reference Book

1. “Power System Dynamics and Stability” by P Sauer and M A Pai
 2. “Power System Dynamics, Stability and Control” by K R Padiyar
- “Handbook of Electrical Power System Dynamics: Modeling, Stability, and Control” by Mohammad Shahidehpou

Flexible AC Transmission System

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
		Th	Tu	Pr	Total H		Theory			Practical	
					ours		TA	CA	EE	Int	Ext
SEMESTER-VIII											
Flexile AC Transmission System Elective		2	0	0	2	2	10	15	25		30

Course Objectives

- To introduce various Power Electronics controllers used in the Power Systems for the fast real and reactive power control.

Course outcomes

CO1:-Understand the operation FACTS and transmission interconnections

CO2:-Study the objectives of shunt compensation.

CO3:-Study the objectives of series compensation.

CO4:-Determining IPFC, UPFC and sub-synchronous resonance

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1.... 12												PSO 1	PSO 2	PSO 3
CO1	1 . 0	2 . 0	2 . 0	3	3	0	1	0	0	0	0	2	2	3	2
CO2	1 . 0	2 . 0	2 . 0	3	3	0	1	0	0	0	0	2	2	3	2
CO3	1 . 0	2 . 0	2 . 0	3	3	0	1	0	0	0	0	2	2	3	2
CO4	1 . 0	2 . 0	2 . 0	3	3	0	1	0	0	0	0	2	2	3	2
CO5	1 . 0	2 . 0	2 . 0	3	3	0	1	0	0	0	0	2	2	3	2
CO6	1 . 0	2 . 0	2 . 0	3	3	0	1	0	0	0	0	2	2	3	2

Syllabus:

Unit I

(7 Hrs)

FACTS Concept and General System Consideration: Transmission Interconnection, Flow of Power in an AC System, factors affecting the Loading Capability, Power Flow and Dynamic Stability Consideration of Transmission interconnection, Importance of controllable, Parameters, FACTS Controller. Voltage-Sourced Converters: Basic Concept of Voltage-Sourced Converters, Single-Phase Full-Wave Bridge Converter Operation, Single-Phase Leg, Operation, Square-Wave Voltage Harmonics for Single Phase Bridge, Three-Phase Full-Wave Bridge Converter, Sequence of Valve Conduction, Process in. Each Phase-Leg, Transformer connection for 12-PluseOperation, Three Level Voltage Sourced Convert, Pulse-Width Modulation Converter, Generalized Technique of Harmonic Elimination and Voltage Control,

Unit II

(06 Hrs)

Static Shunt Compensators: SVC and STATCOM: OBJECTIVES of shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators SVC and STATCOM, Comparison Between STATCOM and SVC, Static Var System.

Unit-III

(07 Hrs)

Static Series Compensators: GCSC, TSSC, TCSC and SSSC: OBJECTIVES of series Compensation,

Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators, External (System) Control for Series Reactive Compensators.

UNIT IV

Static Voltage and Phase Angle Regulators ; TCVR and TCPAR: OBJECTIVES of Voltage and Phase Angle regulators, Approaches to Thyristor -Controlled Voltage and Phase Angle Regulators (TCVR and TCP ARS), Switching Converter-Based Voltage and Phase Angle regulator, Hybrid Phase Angle Regulators.

Combine Compensators (UPFC, IPFC): The Unified Power Flow Controller (UPFC}, Interline Power Flow Controllers Generalized and Multifunctional FACTS Controllers, Sub synchronous Resonance, NGH-SSR Damping Scheme,

Books

1. Song, Y.H. and Allan T. Johns, „Flexible ac transmission systems (FACTS)“, Institution of Electrical Engineers Press, London, 1999.
2. Hingorani ,L.Gyugyi, „, Concepts and Technology of flexible ac transmission system“, IEEE Press New York, 2000 ISBN –078033 4588.
3. R .Mohan Mathur and Rajiv K.Varma , „Thyristor - based FACTS controllers for Electrical transmission systems“, IEEE press, Wiley Inter science , ISBN no . 0-471-20643-1,2002.
4. K.R.Padiyar, „FACTS controllers for transmission and Distribution systems“ New Age international Publishers 1st edition -2007.



G H RAISONI COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to Rashttrasant Tukadoji Maharaj Nagpur University, Nagpur)

Accredited by NAAC with 'A+' Grade

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GHRCE/HoD/Dept./Scheme/UG/PG/02/01/02

DEPARTMENT OF MECHANICAL ENGINEERING

Institute Vision and Mission:

VISION

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and create technical manpower of global standards with capabilities of accepting new challenges.

MISSION

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stake-holders. Our strength is directed to create competent professionals. Our endeavor is to provide all possible support to promote research and development activities.

Programme: UG in Mechanical Engineering

VISION

To be recognized internationally for quality education and research in mechanical engineering with excellence in the fields of design, manufacturing and thermal sciences.

MISSION

To prepare professionally competent and broadly educated mechanical engineers by developing analytical and research abilities, encouraging culture of continuous learning and by adopting new technologies to solve complex problems.

MISSION

- To prepare professionally competent and broadly educated mechanical engineers
- To develop analytical and research abilities
- Encouraging culture of continuous learning
- Adopting new technologies to solve complex problems.

PROGRAM EDUCATION OBJECTIVES:

The Programme educational objectives (PEOs) of the programme are designed to produce competent engineers who shall:

1. Apply knowledge of computer aided analysis, design, modeling and simulation to provide solutions to industrial problems in diverse domains.
2. Pursue professional career by developing products and services to address social, technical and business challenges and needs.
3. Be engaged in creative efforts and research under collaborative and multidisciplinary environments using modern tools and processes.

Programme Outcomes:

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:**
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

Engineering Graduates shall be able to:

1. Demonstrate industrial practices learned through internship and solve industrial problem using technical knowhow acquired.
2. Apply skill in disciplinary area of renewable energy, automotive, agriculture and heat transfer.
3. Utilize skill in developing innovative prototype concepts enabling to protect intellectual property rights

B.TECH.MECHANICAL ENGINEERING

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.	
SEMESTER-I											
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	--	50
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25
BECL101 BCEP101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25
TOTAL		9	4	16	29	21	80	120	175	225	600

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.	
SEMESTER-II											
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75
BMEP101	Engineering Graphics	-	-	2	2	1	--	--	--	25	25
BCEL101 BCEP101	Engineering Mechanics	1	-	2	3	2	10	15	--	25	50
BECP103	Embedded Programming	-	-	2	2	1	--	--	--	25	25
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100
BHUP102	Ethics & Professional Competencies	-	-	2	2	1	--	--	--	25	25
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25
TOTAL		4	4	28	36	22	50	75	100	375	600

Subject Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			Th.	Tu.	Pr.	Total Hours		TAE	CAE	ESE	Int.	Ext.	
SEMESTER-III													
BFYL116	Integral Transforms	Offline	1	1	-	2	2	10	15	25	-	-	50
BMEL222	Solid Mechanics	Offline	2	-	-	2	2	10	15	25	-	-	50
BMEL211 BMEP211	Fluid Mechanics and Machinery	Offline	2	-	2	4	3	10	15	50	-	25	100
BMEL212	Basics Thermodynamics	Offline	1	1	-	2	2	10	15	25	-	-	50
BMEL213 BMEP213	Basics of Manufacturing Process	Offline	2	-	2	4	3	10	15	50	-	25	100
BMEL214 BMEP214	Materials &Nano Science	Offline	2	-	2	4	3	10	15	25	-	25	75
BMEP215	Computer Aided Machine Drawing	Online	0	-	2	2	1	-	-	-	-	25	25
BAIL101	Open Elective 1	Online	2	-	-	2	2	10	15	25	-	-	50
BAIP202	Skill Development 1	Viva - Voice	-	-	2	2	1	-	-	-	25	-	25
BHUP202	Reasoning	Online	-	-	1	1	0.5	-	-	-	25	-	25
BHUP204	Liberal Arts/Creative Arts (Hobby Module)	Viva - Voice	-	-	1	1	0.5	-	-	-	25	-	25
TOTAL			12	2	12	26	20	70	105	225	75	100	575

Subject Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
								TAE	CAE	ESE	Int.	Ext.	
SEMESTER-IV													
BFYL117	Fourier series and Partial differential equations	Offline	1	1	-	2	2	10	15	25	-	-	50
BMEL216	Kinematics of Machines	Offline	2	-	-	2	2	10	15	25	-	-	50
BMEL217	Strength of Material	Offline	1	1	-	2	2	10	15	25	-	-	50
BMEL218	Applied Thermodynamics	Offline	2	-	-	2	2	10	15	25		-	50
BMEL219 BMEP219	Machining Process	Offline	2	-	2	4	3	10	15	50	-	25	100
BMEL220 BMEP220	Sensor, Actuators & Measurement	Offline (Activity Based)	1	-	2	3	2	10	15	50	-	25	100
BMEP221	Industrial safety practice Through Case Study (Industry visit ,Report Writing& Mini Project)	Practical Based	-	-	2	2	1	-		-	25	-	25
BMEP224	Skill Development – 2	Viva - Voice	-	-	2	2	1	-	-	-	25	-	25
BCSP208	Data Base	Practical Based	-	-	2	2	1	-	-	-	25	-	25
BMBP102	EDP	Viva - Voice	-	-	2	2	1	-	-	-	25		25
BHUP206	Aptitude 1	Online	-	-	1	1	0.5	-	-	-	25	-	25
BHUP203	Quant	Online	-	-	1	1	0.5	-	-	-	25	-	25
BHUP205	Business English Certification	Viva - Voice			4	4	2	-	-	-	-	25	25
TOTAL			9	2	18	29	20	60	90	200	150	75	575

Subject Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			Th.	Tu.	Pr.	Total Hours		TAE	CAE	ESE	Int.	Ext.	
SEMESTER-V													
BFYL118	Statistics& Probability	Offline	1	-	-	1	1	10	15	25	-	-	50
BME321 BMEP321	Dynamics of Machines	Offline	2	-	2	4	3	10	15	50	-	25	100
BME322	Energy Conversion	Offline	2	-	-	2	2	10	15	50	-	-	75
BME3XX	Elective 1	Offline	2	-	-	2	2	10	15	50	-	-	75
BME3XX	Elective 2	Offline	2	-	-	2	2	10	15	25	-	-	50
BME3XX	Elective 3	Offline	2	-	-	2	2	10	15	25	-	-	50
BMEP323	Product Design and Packaging	Offline	-	-	1	1	0.5	-	-	-	25	-	25
BMEP324	Internship (2 Week Social Internship Minor Project)	Offline	-	-	2	2	2	-	-	-	25	-	25
MBP104	Advanced Communication Skills and Employability	Viva - Voice	-	-	4	4	2	-	-	-	50	-	50
BMEP325	Skill Development 3	Viva - Voice	-	-	2	2	1	-	-	-	25	-	25
BAIL203	Machine Learning Algorithms	Online	2	-	-	2	2	10	15	25	-	-	50
BHUP302	Aptitude 2	Online	-	-	1	1	0.5	-	-	-	25	-	25
MBP301	Financial Management for Engineers	Offline	-	-	1	1	1	-	-	-	25	-	25
TOTAL			13	0	13	26	21	70	105	250	175	25	625

Subject Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Evaluation Scheme						
								Theory		Practical			Total Marks	
								TAE	CAE	ESE	Int.	Ext.		
SEMESTER-VI														
BFYL119	Optimization techniques	Offline	1	-	-	1	1	10	15	25	-	-	50	
BMEL326	Design of Machine elements	Offline	3	-	-	3	3	10	15	50	-	-	75	
BMEL327 BMEP327	Thermal Engineering	Offline	2	-	2	4	3	10	15	50	25	-	100	
BMEL328 BMEP328	Heat Transfer	Offline (Activity Based)	2	-	2	4	3	10	15	25	50	-	100	
BMELXX	Elective 4	Offline	2	-	-	2	2	10	15	25	-	-	50	
BMEP329	Design of Mechanical System	Practical Based	-	-	2	2	1	-	-	-	25	-	25	
BMEP330	Hybrid Vehicle design	Practical Based	-	-	2	2	1	-	-	-	25	-	25	
BMEP331	Project Management	Offline	-	-	1	1	1	-	-	-	25	-	25	
XXXXXXX	Open Elective 2	Online	2	-	-	2	2	10	15	25	-	-	50	
BHUP207	PDP and Grooming Soft Employability skill	Viva - Voice	-	-	1	1	0.5	-	-	-	25		25	
BHUP303	Aptitude 3	Online	-	-	1	1	0.5	-	-	-	25	-	25	
BMEP319	Product Development & IPR	Viva - Voice	-	-	2	2	1	-	-	-	25	-	25	
BMEP332	Skill Development 4	Viva - Voice	-	-	2	2	1	-	-	-	25	-	25	
TOTAL			12	0	15	27	20	60	90	225	250	-	600	

Subject Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			Th.	Tu.	Pr.	Total Hours		TAE	CAE	ESE	Int.	Ext.	
SEMESTER-VII													
BMEL411	MOOCs	Online	8	-	-	8	4	10	15	50	-	-	75
BMEP408	Six Month Industry Internship	Viva - Voice	-	-	24	24	12	-	-	-	100	200	300
BMEP409	Major Project phase I	Viva - Voice	-	-	8	8	4	-	-	-	50	50	100
TOTAL			8	-	32	40	20	10	15	25	150	250	475

Subject Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			Th.	Tu.	Pr.	Total Hours		TAE	CAE	ESE	Int.	Ext.	
SEMESTER-VIII													
BMELXX BMEPXX	Elective 5	Offline	2	-	2	4	3	10	15	50	25	-	100
BMELXX	Elective 6	Offline	2	-	-	2	2	10	15	25	-	-	50
BMELXX	Elective 7	Offline	2	-	-	2	2	10	15	25	-	-	50
BMELXX	Elective 8	Offline	2	-	-	2	2	10	15	25	-	-	50
BMELXX	Elective 9	Offline	2	-	-	2	2	10	15	50	-	-	75
BMEPXX	Major Project Phase II	Viva - Voice	-	-	4	4	4	-	-	-	50	50	100
BHUPXX	Career Development Practice	Activity Based	-	-	2	2	1	-	-	-	25	-	25
TOTAL			10	0	8	18	16	50	75	175	100	50	450

SEMSTER-III**BFYL116: Integral Transform**

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	P	Total Hours		TA	CA	SE	Cont. Evaluation	Ext	
1	1	-	2	2	10	15	25	--	---	50

Course Objectives:

3. To understand the concept of Laplace transform & Fourier Transform.
4. To understand basic concept of control system.

Course Outcomes:

1. To understand properties of Laplace Transform.
2. To apply the concept of Laplace transform to solve problems on unsteady state heat transfer
3. To apply Laplace transform in Control system.
4. To solve the problems of Fourier transform in Mechanical Engineering

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	--	---	--	---	--	---	-
CO2	H	M	---	---	---	--	--	--	-
CO3	H	M	--	---	---	---	--	--	--
CO4	H	M	--	---	---	---	--	--	--

Contents:**UNIT-I****[6 hrs]****Laplace Transform: (CO1)**

Definition of Laplace transform and its properties
Laplace transform of periodic function. Unit Step functions.

UNIT-II**[9 Hrs]****Applications of Laplace transform: (CO2)**

Inverse Laplace transform Convolution theorem ,
Application of L.T. to solve ordinary differential equations.

UNIT-III**[5 Hrs]****Application of integral transform in Control system: (CO3)**

Analogous system, Transfer function, Stability of system, Routh's criterion

UNIT-IV**[10 Hrs]****Fourier Transform: (CO4)**

Definition, Fourier integral theorem, Fourier sine & cosine integrals, finite Fourier sine & cosine transforms, Parseval's identity, convolution theorem.

Text Books:

3. Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.
4. Advanced engineering Mathematics by Erwin Kreyszig, 8th edition Wiley India.

Reference Books:

1. Advanced Mathematics for Engineers and Scientists ; Spiegel, M. R, McGraw-Hill
2. Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd

Online Courses:-

1. Advanced Engineering Mathematics Prof. P.N. Agrawal, IIT, https://onlinecourses.nptel.ac.in/noc19_ma11/preview

SEMESTER-III**BMEL222: Solid Mechanics**

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	P	Total Hours		TA E	CA E	ES E	Cont. Evaluation	
2	–	–	2	2	10	15	25	-	50

Course Objectives:

1. To understand the fundamentals of Mechanics.
2. To understand the concept of friction and its importance.
3. To facilitate the concept of stresses induced in beam.
4. To learn importance of principle stresses and strain in engineering.

Course Outcomes:

Upon successful completion of the course, the students will be able to:

1. Define and illustrate the concept of center of gravity and moment of inertia in context with engineering applications.
2. Illustrate and apply the concept of friction in engineering applications and allied areas.
3. Identify and resolve the stresses induced in the beams and other frame structures.

- Develop and formulate the principle stresses and strain in engineering applications.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	H	M	L	M	M	-	-
CO2	M	H	H	M	L	L	L	-	-
CO3	H	H	H	M	L	M	H	-	-
CO4	M	M	M	H	H	L	M	-	L

Course Content

Unit I (CO1)

[4 Hrs.]

Introduction to Mechanics, Centre of Gravity and Moment of Inertia: Determination of Areas and Volumes, Centre of Gravity and Centroids, Centroid of a Line, First Moment of Area and Centroid, Second Moments of Plane Area, Moment of Inertia from First Principles, Moment of Inertia of Composite Sections, Theorems of Pappus-Guldinus, Centre of Gravity of Solids,

Unit II (CO2)

[4Hrs.]

Friction: Coefficient of Friction, Laws of Friction, Angle of Friction, Angle of Repose and Cone of Friction, Problems on Blocks Resting on Horizontal and Inclined Planes, Application to Wedge Problems, Application to Ladder Problems, Belt Friction.

Unit III (CO3)

[4 Hrs.]

Columns and Struts: Failure of long and short column, slenderness ratio, assumptions made in Euler's column theory, end conditions for column. Expression for crippling load for various end conditions of column. Effective length of column, limitations of Euler's formula, Rankine formula, Johnson's parabolic formula.

Unit IV (CO4)

[3 Hrs.]

Principle Stresses and Strains: Stresses on Inclined Planes Principle Stresses and Planes, Principle Stresses in Beams, Principle Strains.

Advance topic on the subject

Text Books:

- Mechanics of Solids, Stephen H. Crandall, M.S. Shivakumar, Tata McGraw Hill Publishers, 2012.
- Mechanics of Solids, Dr. H. J. Shah, Charotar publishing house Pvt. Ltd., 1st edition 2008.

Reference Books:

- Engineering Mechanics of Solids, Egor P. Popov, Prentice Hall Publishers, Second edition, 2013.

- Strength of Materials, S. P. Timoshenko, East West Press, 5th edition, 2011.

SEMSTER-III

BMEL211 Fluid Mechanics and Machinery

Teaching Scheme				C r e d i t s	Evaluation Scheme					
T h	T u	P r	To tal Ho ur s		Theory			Practical		To tal Ma rk s
					T A E	C A E	E S E	Cont. Eval uation	E xt	
2	-	2	4	3	10	15	50	--	25	100

Course Objectives:

- To understand the basic fluid properties like density, specific gravity etc
- To understand type of fluid flows, continuity equation, venturimeter, orificemeter.
- To understand the concept of boundary layer
- To study various techniques of dimensional analysis
- To learn and understand the working principles of fluid machineries and to study their design aspects, performance characteristics.

Course Outcomes:

Upon the successful completion of course, student will be able

- To measure pressure using various pressure measuring instruments.
- To determine flow rate using various flow measuring devices and its nature.
- To evaluate different hydraulic losses in fluid flow systems.
- To analyze performance of different fluid machineries.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	M	M	L	M	H	H	--
CO2	H	M	H	M	M	M	H	H	--
CO3	M	H	H	M	L	M	H	H	--
CO4	L	H	M	H	H	M	H	H	--

Contents:

UNIT- I

[8hrs]

Properties of Fluid:(CO 1)

Properties of fluid, Pressure measurement

UNIT- II

[7hrs]

Fluid Flow: (CO 2)

Types of fluid flows, Kinematics of fluid flow, Continuity equation, Euler's and Bernoulli's theorem and equation, Flow measurement.

UNIT-III [8 hrs]

Flow through Pipes:(CO 3)

Laws of fluid friction (Laminar and turbulent), Darcy's equation and Chezy's equation for frictional losses. Minor losses in pipes Hydraulic gradient and total gradient line. Hydraulic power transmission through pipe, Energy Gradient.

UNIT-IV [8 hrs]

Hydro Turbines:(CO 4)

Theory of impulse & reaction turbines, Principle, Constructional features, analysis and governing. Specific speed. Cavitation in Turbines. Positive and dynamic displacement pumps.

Dimensional analysis and model Testing

Text Books:

1. Kumar D.S.; Fluid Mechanics and Fluid Machines, 4th Ed; S. K. Kataria& Sons, 1992
2. Bansal R.K.; Fluid Mechanics and Fluid Machines, 7th Edition; Laxmi Publications, 2002

Reference Books:

1. LalJagdish; Hydraulic machines, 6th Ed; Metropolitan Book Co. Pvt. Ltd., 1984
2. Massey B.S.; Mechanics of Fluids, 6th Edition; Van Nostrand Reinhold Co., 1989
3. R.K. Rajput, A Text book of Fluid Mechanics and Hydraulic Machines, S. Chand, 4th edition 2013
4. Modi& Seth, Fluid Mechanics & Fluid Machinery, Standard Book House 2002.
5. K.Subramanya, Hydraulic Machines, Tata McGraw Hill Publication Co., New Delhi, 1st Ed., 2013.

Online Courses

1. Fluid Mechanics Prof.S.K.Som, IIT Kharagpur NPTEL <https://nptel.ac.in/courses/112105171/>
2. Fluid Machinery, Prof. Gautam Biswas, S.Sarkar, S.K.Som, IIT Kanpur, NPTEL <https://nptel.ac.in/courses/112104117/>
3. Fluid Machines S.K. Som, IIT Kharagpurswayam<https://swayam.gov.in/courses/3680-fluid-machines>
4. Fluid Dynamics and Turbomachines, Dhiman Chatterjee, IIT Madras swayam<https://swayam.gov.in/courses/3683-fluid-dynamics-and-turbomachines>
5. Fundamentals of Fluid Power, James D. Van De Ven University of Minnesota courser <https://www.coursera.org/learn/fluid-power>

SEMSTER-III

BMEL212: Basic Thermodynamics

Teaching	Cre	Evaluation Scheme

Scheme				dit s	Theory			Practic al		To tal Ma rk s
T h	T u	P r	To tal Ho ur s		T A E	C A E	E S E	Co nt. Ev al ua tio n	E xt	
1	1	-	2	2	1 0	1 5	2 5	--	--	50

Course Objectives:

At the end of this course, student shall be able to

1. Identify the unique vocabulary associated with thermodynamics through the precise definition of basic concepts.
2. Explain the basic concepts of thermodynamics such as system, state, state postulate, equilibrium, process, cycle, energy, and various forms of energy.
3. Review concepts of temperature, temperature scales, pressure, absolute and gage pressure.
4. Introducing basics of ideal and real gases, steam formation, basic laws of thermodynamics, and their applications.

Course Outcomes:

At the end of this course, student shall be able to

1. Explain fundamental concepts of thermodynamics and thermodynamic systems.
2. Apply gas laws to thermodynamic processes.
3. Outline the first law of thermodynamics and compute the work involved, heat transfer in given processes.
4. Analyze second law of thermodynamics and their application to a wide range of systems with calculations of the efficiencies of heat engines and other engineering devices.

CO Mapping with PO and PSO:

Cour s Out comes	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 1 2	PS O 1	P S O 2	PS O3
CO1	H	M	M	L	M	H	--	H	--
CO2	M	H	M	L	M	M	--	H	--
CO3	H	M	M	L	M	M	--	H	--
CO4	H	M	M	M	M	M	--	H	--

Contents:**Unit I (CO1) Basic concepts and properties [6 Hrs]**

Introduction, thermodynamic system, control volume, macroscopic and microscopic approaches, properties and state of a system, point and path functions, thermodynamic equilibrium, processes and cycles, quasi-static process, properties such as specific volume, pressure, temperature, zeroth law of thermodynamics, temperature scales, thermodynamic heat and work.

Unit II (CO2) Ideal Gas [6 Hrs]

Concept, Laws of ideal gas, Equation of state, universal gas constant

Unit III (CO3) First law of thermodynamics [8 Hrs]

Energy of systems, classification of energy, law of conservation of energy, first law applied to closed system undergoing a cycle, Joule's experiment, specific heat at constant volume and constant pressure, change in internal energy and heat transfer during various non-flow processes. First law applied to flow processes: steady-state steady flow process, mass balance and energy balance in steady flow process, steady flow energy equation and its application

Unit IV (CO4) Second law of thermodynamics [7 Hrs]

Second Law of Thermodynamics :- Introduction, Thermal energy reservoirs, Kelvin-Planck & Clausius statements, Heat engines, Refrigerator & Heat pump, Perpetual motion machines, Reversible & Irreversible processes, Carnot cycle, Entropy, Thermodynamic temperature scale.

Text Books:

1. Basic and Applied Thermodynamics, 4th Edition, Nag P. K., Tata McGraw-Hill, 2014
2. Thermodynamics: An Engineering Approach, 5th Edition, YunusCengel and Michael Boles, 2014.

Reference Books:

1. Fundamental of Engineering Thermodynamics, 7th Edition, R. Yadav, Central publication house, 2012
2. Fundamentals of Thermodynamics, 5th Edition, Richard E. Songtag, Claus Borgnakke and Gordon J. Van Wylen, John Wiley and Sons, Inc.
3. Engineering Thermodynamics, 2nd Edition, Jones J.B. and Hawkins G.A., John Wiley and Sons.

4. Fundamentals of Engineering Thermodynamics, Moran M.S. and Shapiro H.N., John Wiley and Sons, 1988

Online Courses

1. Basic Thermodynamics, Prof. S. K. Som, IIT, Kharagpur NPTEL
<https://nptel.ac.in/courses/112105123/>
2. Basic Thermodynamics, Prof. K. Srinivasan, IISc Bangalore NPTEL
<https://nptel.ac.in/courses/112108148/>
3. Laws of thermodynamics, S. K. Som, IIT Kharagpur, swayam
<https://swayam.gov.in/courses/3813-laws-of-thermodynamics>
4. "Introduction to Thermodynamics: Transferring Energy from Here to There" Margaret Wooldridge University of Michigan coursera
<https://www.coursera.org/learn/thermodynamics-intro>
5. Basic Thermodynamics, Alison
<https://alison.com/topic/learn/46491/thermodynamics-learning-outcomes>
6. Basic Thermodynamics, Uday N. Gaitonde, IITBombayedx
<https://www.edx.org/course/thermodynamics-iitbombayx-me209-1x-1>

SEMESTER III**BMEL213: Basics of Manufacturing Process**

Teaching Scheme					Evaluation Scheme				
					Theory			Practical	Total Marks
T	U	P	Total Hours		T A E	C A E	E S E	Cont. Evaluation	
2	-	2	4	3	10	15	25	--	75

Course Objectives:

1. To understand basic material properties for bulk material shaping
2. To provide details of different joining processes for large scale manufacturing
3. To outline the basics of welding processes and its concepts.
4. To understand the basic concepts of powder metallurgy and its applications in engineering sector.

Course Out Comes:

Upon the successful completion of the course students will be able to

1. Design gating system and select appropriate casting method depending on the product to be manufactured.

2. Apply the basics of manufacturing processes such as forging, rolling, extrusion, wire drawing techniques.
3. Select various welding operation in engineering applications.
4. Apply knowledge of powder metallurgy and suggest composite materials as per requirement.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	M	H	H	M	H	-	H
CO2	H	M	M	H	M	H	-	M
CO3	H	L	H	M	H	H	-	L
CO4	H	L	M	L	M	M	-	L

Contents:

Unit I (CO1) (8 Hrs.)

Casting process: Introduction, pattern making: types, materials used, pattern making allowances, colour codes, core making - types, core material and its properties. Classification of Casting, Rate of Solidification, Principle of gating system, Riser, Runner, Casting Inspection and Testing, Casting Defects.

Molding: types of sand moulds, molding sand composition, molding sand properties, molding machines, Die Casting.

Unit II (CO2) (7 Hrs.)

Forming processes, advantages and drawbacks. Hot and cold rolling, forging, extrusion, wire drawing, embossing etc. Shot peening, Sheet metal working process, Punches and dies, Different Sheet metal operations, Metal spinning, Incremental Sheet metal forming, Die less forming.

Unit III (CO3) (7 Hrs.)

Joining processes: introduction to welding processes, Types of welding, arc welding (TIG, MIG, Submerged Arc, Metal Arc), Gas Welding, Resistance welding, Friction welding, Laser, plasma and electron beam welding, defects and inspection of welded joints, electrodes, weldability of metals, welding equipments, fixtures. Introduction to soldering and brazing processes.

Unit IV (CO4) (8 Hrs.)

Processing of plastics, general properties and applications of thermosetting and thermo plastics. General plastic processes: extrusion, injection moulding, compression moulding, transfer moulding, blow moulding, calendaring.

Powder metallurgy: powder manufacture and conditioning, production of sintered structural components. self-lubricating bearing, cemented carbides, ceramics, sintered carbide cutting tools.

Text Books:

1. 'Manufacturing Technology (foundry Forming and Welding)', P.N. Rao, TMH education, 2006
2. Manufacturing Science', Ghosh and Malik, Affiliated East-West Press Private Limited, 1996
3. Workshop Technology (Volume – I), HajraChoudhary, "Workshop Technology" Media Promoters and Publishers, 2007

Reference Books

- 1: 'Workshop Technology Vol I-III', W.A.J Chapman, Oxford and IBH Publishing Company Private Limited, 1988
- 2: Manufacturing Processes' M Begman 'Processes and Materials of Manufacture', R Lindberg, CBS Publication and Distributors, 2002
- 3: 'Workshop Technology (Volume I & II)', Bawa H.S, Tata McGraw Hill, 1995
- 4: 'Workshop Technology Vol. I & II', B.S. Raghuvanshi, Dhanpat Rai Publications, 2009

Online Courses:

1. Manufacturing Process-1 Prof. Inderdeep Singh, IIT Roorkee nptel <https://nptel.ac.in/courses/112107145/>
2. Manufacturing Process-2 Prof. A.B. Chattopadhyay, IIT Kharagpur nptel <https://nptel.ac.in/courses/112105126/>

SEMESTER III

BMEL214: Materials and Nano Science

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	P	Total Hours		TAE	CAE	ESE	Cont. Evaluation	Ext	
2	-	2	4	3	10	15	25	--	25	75

Course Objectives:

1. To introduce various materials used in manufacturing metallic components
2. To introduce & correlate between science and Engineering of metallic materials
3. To introduce various techniques for enhancing the inherent characteristics of nano materials
4. To introduce the quantitative measurement of nanomaterial properties

Course Outcomes:

Upon the successful completion of the course students will be able to

1. Relate basic knowledge to Alloys Iron-Carbon phase diagram
2. To classify various heat treatment processes and handle various Material Testing methods.

- To apply theoretical knowledge about various types of nanomaterial and its application.
- Distinguish proper characterization of Nano Materials methods to find material structure and acquire sufficient theoretical knowledge about properties of nanomaterials for industrial applications

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PO 7	PS O1	PS O 2	PS O3
CO1	H	L	L	L	M	H	L	L
CO2	H	M	L	M	H	M	L	L
CO3	H	M	H	H	M	M	H	H
CO4	H	M	M	H	M	M	H	L

Contents:

Unit- I (CO1)

[8Hrs]

Phase Diagrams and Ferrous Materials

Alloys and solid solutions, Binary phase diagrams Isomorphous systems, Partial miscibility, Metallic systems, completely miscible in liquid state and completely immiscible in solid state. Allotropy of Iron. Iron –Iron carbide equilibrium diagram, Alloying, different alloying elements and their effect, Designation of steels. Cast iron, type of cast iron, Maurer Diagram, Microstructure, Properties and Application of each type.

Unit- II (CO2)

[8Hrs]

Heat Treatment and Testing of Materials

Introduction, Basic heat treatments such as annealing, normalizing, hardening and tempering, procedure, TTT diagram, Hardenability, Jominy end quench test.

Surface Treatments, Need of testing, Mechanical testing, Tensile test, Impact test, Rockwell, Brinell hardness test, Non-destructive testing methods.

Unit- III (CO3)

[8Hrs]

Non-Ferrous material and Nanoscience

Brief introduction to different nonferrous materials and study of Aluminium and its alloy, Copper and its alloys, high temperature smart materials, Introduction to nano materials, Nanorevolution of the XX century, Properties at nanoscale, Carbon based nano materials and other nanomaterials, Nano composites.

Unit- IV (CO4)

[8 hrs]

Synthesis and Characterization of Nanomaterials

Top-down, Bottom-up, Wet Deposition techniques, Self-assembly (Supramolecular approach), Molecular design, Microwave Synthesis of

materials, TEM, SEM and SPM technique, Fluorescence Microscopy and Imaging.

Advance topic on the subject

Text Books:

- Introduction to Physical Metallurgy by S. H. Avener, McGraw Hill Publication,, 2001
- Engineering Physical Metallurgy & Heat Treatment, Lakhtin Y.; 6th Ed; Mir Publishers, 1998.

Reference Book

- Hari Singh Nalwa, 'Nanostructured Materials and Nanotechnology', Academic Press, 2002
- Pradeep T., 'Nano: The Essentials', McGraw Hill Publishing Co. Ltd., 2007
- Mick Wilson et al, 'Nanotechnology', Overseas Press (India) Pvt. Ltd., 2005.
- Charles P. Poole, Jr., Frank J. Owens,

Online Courses

- Introduction to Material science and Engineering, Prof. Rajesh Kumar, IIT Delhi nptel <https://nptel.ac.in/courses/113102080/>
- Introduction to Material science and Engineering, Prof. RanjitBauri, IIT Madras nptel<https://nptel.ac.in/courses/113106032/>
- Material Science, Prof. Satish V. Kailash, IIScBangalore, nptel <https://nptel.ac.in/courses/112108150/>
- Phase Diagrams in Materials Science and Engineering, Prof. Krishanu Biswas, IIT Madras, swayam <https://swayam.gov.in/course/1308-phase-diagrams-in-materials-science-and-engineering>
- Surface Engineering of Nanomaterials, Prof. Kaushik Pal, IIT Roorkee, swayam <https://swayam.gov.in/course/3548-surface-engineering-of-nanomaterials>

SEMESTER III

BMEP215: Computer Aided Machine Drawing

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	EE	Cont. Evaluation	
-	-	2	2	1	-	-	-	-	25

Course Objectives

- To get awareness and importance of computer aided machine drawing and To familiarize with the latest developments in mechanical engineering drawing.

2. Ajeet Singh, Tata McGraw-Hill Education and Publication 2nd Edition 2012.

Reference Book:

1. Sham Tickoo Professor of Mechanical Engineering Technology Purdue University Calumet, Hammond, Indiana, USA, CATIA V5-R2014 for Designer, CADCIM Technologies 525 St Andrews Drive Schererville, Indiana 46375.
2. K.L. Narayana, P. Kanniah, K. Venkata Reddy, Production Drawing, New Age International Publication 2009.
3. N. D. Bhat, Charotar Publishing House, 26th Edition 1991.

BFYL 117: Fourier series and Partial Differential Equations

Sr.No.	Experiment Name
01	Introduction of Various Icon, ,shortcut Keys and practices
02	To Prepare Two 2-D Geometrical Modal in given sheet
03	To Prepare Two 2-D Geometrical Modal in given sheet
04	To Prepare 2-D Geometrical Model By using DRAWING constraint
05	To prepare the 3D geometrical model using all constraint
06	To prepare the 3D geometrical model using all constraint
07	To prepare the 3D geometrical model using all constraint
08	Prepared two component by using Part Modeling command
09	Introduction of Assembly by using various tool bar, manipulation,
10	Preparation of Assembly by considering all parameter one
11	Preparation of Assembly by considering all parameter any one problem
12	Preparation of Drawing by generative drawing ,
13	Preparation of Production drawing by using ASME Y14.5 – 2009

1. Dr. K L Narayana, Dr. P. Kannaih , K. Venkata Reddy New Age International (P) Ltd. 4th Edition year of publication 2012.

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	Pr	Total Hours		TA	CA	SE	Cont. Evaluation	Ext	
1	1	-	2	2	10	15	25	--	--	50

1. To introduce Fourier Series and its applications in the field of Mechanical Engineering
2. To develop skills to use Partial differential equations and its applications in the field of Mechanical Engineering

1. To Understand and use Fourier series to solve engineering problems.
2. To apply Fourier series expansion of periodic functions in field of Mechanical engineering.
3. To apply the concept of partial differential equation in solving problems.
4. To develop skills to use Partial differential equations and its applications in heat transfer.

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 1 2	PS O 1	P S O 2	PS O3
CO1	H	M	--	---	--	---	--	---	-

CO2	H	M	---	---	---	--	--	--	-
CO3	H	M	--	---	---	---	--	--	--
CO4	H	M	---	---	---	---	--	---	--

Contents:

UNIT-I [6 hrs]

Fourier series : (CO1)

Representation of periodic function in terms of sine & cosine series.

UNIT-II [6 hrs]

Fourier series: (CO2)

Even and odd functions, Half range series Fourier series for discontinuous function

UNIT-III [8 Hrs]

Partial differential: (CO3)

Partial differential equation of 1st order & 1st deg

UNIT-IV [10 Hrs]

Applications of Partial differential: (CO4)

Higher order PDE, Method of separation of Variables Applications of PDE in heat transfer.

Text Books:

- Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.
- Advanced engineering Mathematics by Erwin Kreyszig, 8th edition Wiley India

Reference Books:

- Advanced Mathematics for Engineers and Scientists, Spiegel, M. R., McGraw-Hill
- Advanced Engineering Mathematics, Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International Ltd.

Online Courses:-

- Transforms Calculus and its Applications in Differential equations, Prof AdrijitGoswami, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc19_ma04/preview

SEMESTER-IV

BMEL216: Kinematics of Machines

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	EE	Cont. Evaluation	
2	—	—	2	2	10	15	25	-	50

Course Objectives:

- To understand basic concepts of different mechanisms and its applications to various fields.
- To develop competency in graphical methods in solving problems of quantitative kinematic analysis of mechanism.

3. To make students conversant with Concepts of cam mechanism.

4. To make students conversant with basic concepts of gears, its applications and torque analysis.

Course Outcomes:

Upon successful completion of the course, students will be able to:

- Apply the basic concepts of different mechanisms.
- Identify the exact problems solving techniques of quantitative kinematic analysis of mechanism.
- Develop an appropriate application of Cam and follower mechanism.
- Select the gears & gear trains for real life application by choosing the proper velocity ratio.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L	H	L	H	-	H	-	M
CO2	H	H	M	M	M	L	H	-	-
CO3	M	L	H	L	H	M	M	-	-
CO4	M	H	H	L	H	M	H	-	-

Course Content

Unit I: CO-1

[8 Hrs.]

Basic concept of mechanism, link, kinematic pairs, kinematic chain, mechanism, machine, simple and compound chain, Degree of freedom, estimation of degree of freedom of mechanism by Kutzbach theory and Grubber's criterion, classification of four bar chain [class – I & class – II], inversion of Kinematic chain,

Unit II : CO-2

[6Hrs.]

Quantitative kinematic analysis of mechanism: Displacement, Velocity and Acceleration analysis of planer mechanism by graphical method, Coriolis component of acceleration Velocity by I-Centre Method, Kennedy's Theorem,

Unit III : CO-3

[6Hrs.]

Concepts of cam mechanism, comparison of cam mechanism with linkages. Types of cams and followers and its applications. Synthesis of cam for different types of follower motion like constant velocity, uniform acceleration & retardation, SHM, cycloid etc.

Unit IV: CO-4

[10Hrs.]

Concept of motion transmission by toothed wheels, comparison with cams and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of

conjugate action, kinematics of involutes gear tooth pairs during the contact duration, highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for involutes profile teeth. Kinematic analysis of simple, epicyclic and double epicyclic gear trains.

Text Books:

1. Theory of mechanisms and machines by Amitabha Ghosh and Ashok Kumar Mallik, East West Press pvt. Ltd. New Delhi, Third edition, 2017.
2. Theory of Machines, S.S. Ratan, McGraw Hill Publications, New Delhi, 2011.

Reference Books:

1. Mechanism and Machine Theory by J.S. Rao & Dukki Patti, new age publication, Second edition, 1992.
2. Theory of Machine by Thomas Bevan, Pearson Education India, CBS publication, Second edition, 1992.
3. Theory of mechanisms and machines, Shigley J.E. and John Joseph Uicker, McGraw Hill Publications, 2003.

SEMESTER-IV

BMEL217: Strength of Materials

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	P	Total Hours		TA	CA	ES	Cont. Evaluation	
1	1	–	2	2	10	15	25	-	50

Course Objectives:

1. To teach fundamentals of simple and principle stresses and strains.
2. To imbibe concept of shear force and bending moment with practical exposure and applications.
3. To facilitate the concept of bending and its theoretical analysis.
4. To learn torsion of shaft

Course Outcomes:

Upon successful completion of the course, the students will be able to:

1. Apply the concepts of various stresses and strains and their relative for various engineering applications.

2. Make use of concepts of shear force and bending moment diagrams in various design of machine elements.
3. Estimate the slope and deflection of beams.
4. Measure the stresses induced in shafts.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	H	H	M	L	M	-	-
CO2	L	L	H	M	L	L	M	-	-
CO3	M	H	H	M	M	M	M	-	-
CO4	M	H	H	M	H	L	M	-	-

Contents:

Unit I (CO1)

[8 Hrs.]

Concept of simple stresses and strains: Introduction, stress, strain, types of stresses, stress – strain diagram for brittle and ductile materials, elastic limit, Hook's law, modulus of elasticity, Modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, Longitudinal strain and stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain, Bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus.

Unit II (CO2)

[7 Hrs.]

Shear force and bending moment: Types of beam (cantilever beam, simply supported beam, overhung beam etc., Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force.

Unit III (CO3)

[8 Hrs.]

Deflection of beams: Derivation of differential equation of elastic curve with the assumptions made in it. Deflection and slope of cantilever, simply supported, subjected to concentrated load UDL, Relation between slope, deflection and radius of curvature, Macaulay's method & Double integration method.

Unit IV (CO4)

[8 Hrs.]

Torsion of circular shafts: Derivation of torsion equation with the assumptions made in it. Torsional shear stress induced in the shaft, when it is subjected to torque, Strength and rigidity criteria for design of shaft, Torque transmitted by solid and hollow circular shaft.

Tutorial: Based on above syllabus

Text Books:

1. Strength of Materials, F.L. Singer, Harper Pollins Publisher, 4th edition.
2. Strength of Materials, S. Ramamrutham and R. Narayanan, Dhanpat Rai & Sons Publisher, 4th edition, 2016.

Reference Books:

1. Mechanics of Solids, Dr. H. J. Shah, Charotar publishing house Pvt. Ltd., 1st edition 2008.
2. Mechanics of Materials, Dr. Kripal Singh, Standard publications, Delhi, 7th edition 2013.

Online Courses:

1. Mechanics of Materials II: Thin-Walled Pressure Vessels and Torsion, Dr. Wayne Whiteman, PE, Woodruff School of Mechanical Engineering, (COURSERA)
<https://www.coursera.org/learn/mechanics2>
2. Mechanics of Materials III: Beam Bending, Dr. Wayne Whiteman, PE, Woodruff School of Mechanical Engineering, (COURSERA)
<https://www.coursera.org/learn/beam-bending>
3. Mechanics of Materials IV: Deflection, Buckling, Woodruff School of Mechanical Engineering, (COURSERA)
<https://www.coursera.org/learn/materials-structures>
4. Advance Strength of Material, Prof. S Maiti, NPTEL Video
<https://nptel.ac.in/courses/112101095/>

SEMSTER-IV

BMEL218: Applied Thermodynamics

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	Pr	Total Hours		TA	CA	ESE	Cont. Evaluation	Ext	
2	-	-	2	2	10	15	25	--	--	50

Course Objectives:

At the end of this course, student shall be able

1. To understand the basic concept of entropy.
2. To understand the various gas power cycle.
3. To study the properties of steam and analysis of steam using steam table, Mollier chart.
4. To study vapor power cycle with the help of P-V, T-S and H-S diagrams

Course Outcomes:

At the end of this course, student shall be able to

1. Understand concept of entropy.
2. Compare various gas power cycle.

3. Determine properties of steam.
4. Analyze performance of vapor power cycle with the help of P-V, T-S and H-S diagrams

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 9	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	H	M	H	H	--	H	--
CO2	M	H	H	M	H	H	--	H	--
CO3	M	H	H	L	H	H	--	H	--
CO4	M	M	H	L	M	M	--	H	--

Contents:

Unit I Entropy (CO 1)

[8 Hrs]

Entropy, clausius inequality, Entropy, Principle of increase of entropy, change in entropy for Closed & Steady flow open systems, Second law analysis of engineering systems - Availability, Reversible work & Irreversibility.

Unit II (CO 2) Gas power cycles [8 Hrs]

Gas power cycles: Otto cycle, Diesel cycle, Semi-diesel, Sterling cycles, their efficiency and mean effective pressure calculations, Dual cycle, Ericsson cycle.

Unit III (CO 3) Properties of steam [8 Hrs]

Properties of steam, Phase change process of pure substance, Sensible heat and latent heat, specific volume and entropy of steam, dryness fraction of steam, throttling of steam, determination of dryness fraction, steam tables and their use, T-S and H-S diagram.

Unit IV (CO 3) Vapors power cycles [6 Hrs]

Rankine and modified Rankine cycle, work done and efficiency, specific steam consumption, comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram.

Advance topic of the subject

Text Books:

1. Basic and Applied Thermodynamics, 4th Edition, Nag P. K., Tata McGraw-Hill, 2014
2. Thermodynamics: An Engineering Approach, 5th Edition, Yunus Cengel and Michael Boles, 2014

Reference Books:

1. Fundamental of Engineering Thermodynamics, 7th Edition, R. Yadav, Central publication house, 2012
2. Fundamentals of Thermodynamics, 5th Edition, Richard E. Songtag, Claus

Borgnakke and Gordon J. Van Wylen,
John Wiley and Sons, Inc.

3. Engineering Thermodynamics, 2nd Edition, Jones J.B. and Hawkins G.A., John Wiley and Sons.
4. Fundamentals of Engineering Thermodynamics, Moran M.S. and Shapiro H.N., John Wiley and Sons, 1988

Online Courses

Applied Thermodynamics, Prof. U S P Shet, T. Sunderajan, J M Mallikarjun, IIT Madras, NPTEL
<https://nptel.ac.in/courses/112106133/>

Semester : IV

BMEL219: Machining Processes

Teaching Scheme				Cr ed it	Evaluation Scheme					
Th	Tu	Pr	Total Hour		Theory			Practical		Total Marks
					TA E	CA E	ES E	Cont . Eval uation	Ext	
2	-	2	4	3	10	15	50	--	25	100

Course Objectives:

1. To develop an insight into metal cutting principles.
2. To provide details of the construction of conventional metal cutting machine tools.
3. To provide details of manufacturing operations for gears and super finishing processes.
4. To select machining parameters for optimum utilization of resources and time for high productivity and dimensional accuracy.

Course Outcomes:

Student should be able to -

1. Select tool based on the material and desirable properties
2. Experiment with different operations on Lathe machine.
3. Demonstrate various milling operations.
4. Select the process and machine based on finishing requirement.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3
CO1	H	M	M	H	M	H	-	L
CO2	H	M	M	H	M	H	-	M
CO3	H	L	L	M	L	H	-	L

CO4	H	M	L	M	L	H	-	M

Contents:

Unit-I: (CO 1)

(6hrs)

Introduction to Machining Parameters:

Introduction to machining, tool materials and their properties nomenclature and tools geometry of single point cutting tool, cutting tool material, Cutting fluids and lubricants. Cutting parameters, cutting force, surface roughness, Merchant's circle, tool wear and tool failure, tool wear mechanism, Tool life equation, Chip morphology, Heat generation and friction in metal.

Unit II: (CO 2)

(08Hrs)

Lathe : Introduction, type, construction of simple lathe, mechanism and attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling.

Unit III: (CO 3)

(08Hrs)

Milling: Introduction, specifications, types, column and knee type milling machine, fixed bed type milling machines, production milling machines, special purpose milling machines such as thread milling machines, profile milling machine, Gear Milling/Hobbing machines. Mechanisms and Attachments for Milling. Cutting parameters, types of milling operations, types of milling cutters, Tool geometry and their specifications.

Unit IV: (CO 4)

(08Hrs)

Grinding operations, grinding wheel, specifications and selection of grinding wheel, cylindrical and centreless grinding operation, surface grinding, tool and cutter grinding, time estimation for grinding operations, Glazing, loading, truing, dressing and selection of grinding wheel, Broaching and its types, Drilling, types of Drilling machine, Drill Nomenclature, Reaming, Super finishing processes such as honing, lapping, polishing, buffing and Burnishing. Jigs and Fixture

Text Books:

1. Manufacturing Technology, (Metal Cutting and Machine Tools), P.N. Rao
2. Manufacturing science, Ghosh and Malik

Reference Books:

1. Workshop Technology (Volume – II) By HajraChoudhary
2. Manufacturing Engineering and Technology by S. Kalpakjian and S R Schmid
3. Technology of machine Tools – Krar and Oswald
4. Manufacturing Processes – M Begman

Online Courses

1. Advanced machining Processes, Prof. Manas Das, IIT Guwahati, nptel <https://nptel.ac.in/courses/112103202/>
2. Introduction to machining and machining fluids, Prof. Mamillaravi Sankar, IIT Guwahati, nptel <https://nptel.ac.in/courses/112103245/>
3. Mechanics of Machining, Prof. Uday S. Dixit, IIT Guwahati, nptel <https://nptel.ac.in/courses/112103248/>
4. Metal Cutting and Machine Tools, Prof. Asimava Roy Choudhury, IIT Kharagpur, nptel <https://nptel.ac.in/courses/112105233/>
5. Fundamentals of manufacturing processes, Prof. Dwivedi D.K., IIT Roorkee, swayam <https://swayam.gov.in/course/3797-fundamentals-of-manufacturing-processes>
6. Advanced machining Processes, Prof. V.K. Jain, IIT Kanpur, nptel <https://nptel.ac.in/courses/112104028/>

SEMESTER IV

BMEL220: SENSOR, ACTUATORS & MEASUREMENT

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
								Cont. Evaluation	Ext	
Th	Tu	Pr	Total Hours		TA	CA	EE			
1	-	2	3	2	10	15	25	--	25	75

Course Objectives:

1. To understand the basic concept of sensors, actuators, and measurement system, along with its functional element.
2. To understand the performance characteristics, and working of measuring instruments

Course Outcomes:

5. Student should be able to choose Sensors, actuators, and measuring instrument in any application.
6. Student should be able to develop skill to select proper sensors, measuring instruments for measurement of various engineering parameters.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes		
	PO	PO	PO	PO	PO	PSO	PS	PSO3

	1	2	3	5	6	1	O2	
CO1	H	M	M	H	H	H	M	L
CO2	H	L	M	L	M	H	M	L

Contents:

Unit-I : (CO 1) (8hrs)

Sensors, Actuators and Measurement system:

Sensors, Basic requirements of a sensor, Classification of sensors, significance of measurement system, generalized measurement system, Static and Dynamic characteristics, Photo resistors, Photodiodes, Phototransistors, Photoconductors, and Encoder.

Displacement Sensors: Linear, Rotary, Potentiometer, Capacitive and Inductive type, position sensors, photoelectric sensor,

Temperature sensors: Thermocouples, Thermistors, Thermo diodes, Thermo transistors, Bimetallic Strip, Resistance Temperature Detector, radiation and optical pyrometer, Infrared Thermography.

Unit-II (CO2) (8hrs)

Various Measurements:

Strain Measurement:-

Types of strain gauges, strain gauge circuits, calibration, temperature compensation,

Pressure Measurements:-

Basic methods of pressure measurement, dead weight gauges and manometers, elastic transducers and force balance transducers, strain gauge pressure cell, High pressure measurement Bridgman type, low pressure measurement - McLeod, Krudsen, ionization, thermal conductivity gauges.

Force measurement:-

Force measurement using transducer, pneumatic and hydraulic load cells, strain gauge load cells, piezoelectric load cells, torque measurement, dynamometer

Flow Measurements: Dall tube, Rotameter, anemometer, positive displacement flow meters, turbine meter, and electro-magnetic flow meter.

Miscellaneous Measurement

Vibration Measurements, Humidity measurement, speed Measurement, liquid level Measurements.

Advance topic on the subject

Text Books:

1. Erenest O. Doebeling, 'Measurement Systems', McGraw Hill, 2nd edition, 2014
2. T.G. Beckwith & N.L. Bulk, 'Mechanical Measurements', Addison Werlly, 3rd edition 2012.

Reference Books:

1. J.P.Holman, 'Experimental Methods for Engineers', McGraw Hill, 2nd edition 2013.
2. NakraChoudhari, 'Instrumental Measurement & Analysis', Tata McGraw Hill, 3rd edition 2011.
3. Ramgan, Sharma & Mani, 'Instrumentation', Tata McGraw Hill, 3rd edition, 2013
4. D.S. Kumar, 'Mechanical Measurement & Control', Metropolitan Book Company, 4th edition 2014.

Online Courses

1. Mechanical Measurements and Metrology, Prof. S.P. Venkateshan, IIT Madras, [nptelhttps://nptel.ac.in/courses/112106138](https://nptel.ac.in/courses/112106138)
2. Principles of Mechanical Measurement, Prof. R. Raman, IIT Madras, [nptelhttps://nptel.ac.in/courses/112106140](https://nptel.ac.in/courses/112106140)
3. Robotics, Prof. Dilip Kumar, Pratihari, IIT Kharagpur, [nptelhttps://nptel.ac.in/courses/112105249](https://nptel.ac.in/courses/112105249)
4. Robotics: Advanced Concepts and Analysis Prof. AshitavaGhosal, IIScBangalore, [nptelhttps://nptel.ac.in/courses/112108093](https://nptel.ac.in/courses/112108093)
5. Mechanism and Robot Kinematics, Prof. AnirvanDasgupta, IIT Kharagpur, [swayamhttps://swayam.gov.in/courses/4512-mechanism-and-robot-kinematicsmechanism-and-robot-kinematics](https://swayam.gov.in/courses/4512-mechanism-and-robot-kinematicsmechanism-and-robot-kinematics)

SEMESTER-V

BFYL118: Statistics & Probability

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	P	Total Hours		TA	CA	SE	Cont. Evaluation	Ext	
1	-	-	1	1	10	15	25	--	---	50

Course Objectives:

1. To introduce basic concept of statistics and probability.

Course Outcomes:

1. To apply concept of statistics in mechanical engineering.
2. To apply the concept probability in Mechanical engineering.

CO Mapping with PO and PSO:

Course Outc	Programme Outcomes	Programme Specific Outcomes

omes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	--	---	--	---	--	---	-
CO2	3	2	---	---	---	--	--	--	-

Contents:

UNIT-I

[6 hrs]

Statistics (CO1)

Mean, Median, Mode, Standard deviation, Mean deviation

UNIT-II

[10 Hrs]

Probability: (CO2)

Discrete & continues random variable, Probability density function, Probability distribution function Joint density function, Mathematical expectation Variance, standard deviation, Co- Variance

Text Books:

1. Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.

Reference Book:

1. Probability and Statistics by Spiegel M. R., Murray R. Spiegel, McGraw-Hill

Online Courses:-

1. Probability and Statistics Prof. Somesh Kumar IIT Kharagpur <https://www.classcentral.com/course/nptel-probability-and-statistics-5228>
2. Probability: Basic Concepts & Discrete Random Variables Mark D. Ward Purdue University via edX <https://www.class-central.com/course/edx-probability-basic-concepts-discrete-random-variables-6989>

SEMESTER-V

BMEL321: Dynamics of Machines

Teaching Scheme				Cre dits	Evaluation Scheme				
					Theory			Practi cal	Tot al Marks
T h	T u	P r	Tot al Ho urs		T A E	C A E	E S E	Cont. Evalu ation	
2	-	2	4	3	10	15	50	25	100

Course Objectives:

1. To make the students conversant with force analysis of mechanism.
2. To Design & develop the concept of flywheel and its applications.
3. To develop competency in graphical and analytical methods in solving problems in rotating and reciprocating machineries.
4. To develop conversancy with basic concepts of vibrations, it's effects and measurement.

Course Outcomes:

1. To apply the concept of static and dynamics force analysis for engineering applications.
2. To design the flywheel for energy storage.
3. To identify and solve problems of rotating and reciprocating machinery and balancing of machinery.
4. To select advanced computing techniques and tools in the area of longitudinal, transverse and torsional vibrations.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	H	M	L	L	-	-
CO2	H	H	L	M	M	L	M	-	-
CO3	M	H	M	H	M	L	M	-	-
CO4	H	M	M	M	H	-	M	-	-

Contents:

Unit I: CO-1

[7 Hrs]

Static Force and Dynamic Force Analysis
Static force Analysis in linkages, Superposition Method, FBD, Equilibrium of four force members, Principal of Virtual Work, D'Alembert's Principal, Engine Force Analysis,

Unit II: CO-2

[8 Hrs]

Turning Moment Diagram, Flywheel, Turning moment Vs crank angle diagram for single – cylinder and multiple – cylinder engines, punching machines etc. Flywheel selection.

Unit III : CO-3

[8 Hrs]

Balancing of Rotary Masses
Static and Dynamic balancing of Rotary masses, Balancing of several masses rotating in different planes.

Balancing of Reciprocating masses: Partial balancing of locomotive, balancing of primary and secondary forces of Multi cylinder In-Line Engine.

Unit IV: CO-4

[8 Hrs]

Longitudinal and Transverse Vibration
Free Vibration, Critical or whirling speed of shaft, free and forced damped vibration, vibration isolation and transmissibility, Vibration Measurement techniques.
Torsional Vibration, Free Torsional Vibration, mode shape, Single, Two and Three rotor system,

Text Books

- 1.:Theory of mechanisms and machines by Shigley J.E., McGraw Hill, Second edition, 2013
- 2.:Mechanism and Machine Theory by J.S. Rao & Dukki Patti, new age publication, Second edition, 2011

3.:Theory of Machine by S. S. Rattan, New Jersey Tata Mcgraw-Hill Pub. Co. Ltd., Third edition, 2010

Reference Books

- 1: Theory of Mechanism and Machine by Ghosh and Malik, affiliated East West Press Pvt. Ltd., Second Edition, 2014.
- 2: Theory of Machine by Thoman Bevan, Pearson Education India, CBS publication Second edition, 2009
- 3: Theory of Machines by V.P.Singh, Danpat Rai publication Third edition, 2012

SEMSTER-V

BMEL322: Energy Conversion

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	Pu	Total Hours		TA	CA	EE	Cont. Evaluation	Ext	
2	-	-	2	2	10	15	50	--		75

Course Objectives:

1. To get awareness and importance of steam generation and fluidized bed boiler.
2. To familiarize with the latest developments in chimney draught system and performance of steam nozzle
3. To study working principle and performance of steam turbine
4. To study steam condensers and cooling towers

Course Outcomes:

Upon the successful completion of course, student will be able to

1. Understand the working of different types of boilers.
2. Illustrate principle of chimney draught and steam nozzles.
3. Make use of velocity triangles to calculate performance of steam turbine
4. Design steam condensers and cooling Towers.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	M	H	M	H	L	H	H	--
CO2	H	H	H	M	M	L	H	H	--

CO3	M	M	M	H	M	H	H	H	--
CO4	M	M	H	H	M	L	H	H	--

Contents:

UNIT- I (CO1) [8 hrs]

Principles of Steam Generation, Classification of Steam Generators, Fire Tube and Water Tube Steam Generators, High Pressure Steam Generators. Fluidized Bed Boilers: Bubbling Fluidized Bed Boilers, Circulating Fluidized Bed Boiler Mountings and Accessories. Performance of Steam Generators. Evaporation Capacity, Equivalent Evaporation, Boiler Efficiency.

UNIT- II (CO2) [8 hrs]

Draught and Its Classification, Chimney Height, Chimney Diameter, Efficiency.

Steam Nozzles: Adiabatic Expansion In Nozzles, Maximum Discharge, Critical Pressure Ratio And Effects Of Friction, Calculation Of Throat And Exit Areas, Supersaturated Flow, Wilson Line.

UNIT- III (CO3) [8 hrs]

Steam Turbines :Principles Of Working Of Steam Turbines, Classification Of Steam Turbines, Comparison of Impulse And Reaction Turbines, Compounding Of Steam Turbines. Energy Losses In Steam Turbines, Flow Of Steam Through Turbine Blades, Velocity Diagrams, Graphical And Analytical Methods, Work Done, Thrust And Power, Dimensions And Proportioning Of the Blades, Steam Turbine Efficiencies, and Condition For Maximum Efficiencies.

UNIT- IV (CO4) [8 hrs]

Steam Condensers: Types Of Condensers, Classification Of Condensers, And Quantity Of Cooling Water Required, Design Calculations For Surface Condensers, Daltons Law Of Pressures, Sources Of Air Leakages And Air Removal. Cooling Towers: Wet Cooling, Dry Cooling Towers Cooling Pond

Advance topic on the subject

Text Books:

1. Power Plant Engineering, V.M. Domkundwar, 3rd edition, Dhanpat Rai and Sons Publication, 2005.
2. Power plant engineering, P.K. Nag, fourth edition, McGraw Publication(India) Pvt. Limited, 2014

Reference Books:

1. Thermal Engineering, P.L. Ballaney, 26th edition, Khanna Publication, 2007.
2. Thermal Engineering B.K. Sarkar, Eighth edition, Tata McGraw Publishing company limited, 2005.
3. Applied Thermodynamics. Dr.R. Yadav, 6th revised edition, Central Publishing House Allahabad, 2011.

Online Courses

1. Steam and Gas Power Systems Prof.Ravi Kumar
IITRoorkeeNPTEL<https://nptel.ac.in/courses/112107216/>
2. Steam And Gas Power Systems Ravi Kumar IIT Roorkeeswayam<https://swayam.gov.in/courses/3554-steam-and-gas-power-systems>
3. Energy conservation and waste heat recovery Bhattacharya A IIT Kharagpur swayam
<https://swayam.gov.in/courses/3814-energy-conservation-and-waste-heat-recovery>

SEMSTER-VI

BFYL119: (Optimization Techniques)

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	Pu	Total Hours		TA	CA	ESE	Cont. Evaluation	Ext	
1	-	-	1	1	10	15	25	--	---	50

Course Objectives:

1. To understand the techniques of optimization method.

Course Outcomes:

1. To apply concept of Graphical methods.
2. Apply basic concepts of Optimization Techniques.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	--	---	--	---	--	---	-
CO2	3	2	---	---	---	--	--	--	-

Contents:

UNIT-I [6 hrs]

Linear Programming Problems (CO1)

Linear programming, mathematical model formulation, solutions by graphical.

UNIT-II [10 Hrs]

Simplex and Big M-Methods (CO2)

Simplex method, Dual Simplex method, Big M Method

Text Books:

4. Higher engineering Mathematics by B S Grewal, 43rd edition, Khanna Publication.

Reference Books:

1. Linear Programming: methods and application by Saul I Gass. 2nd Edition. 2007.
2. Linear Programming: theory and application by Catherine Lewis. 2nd edition 2005.

SEMESTER-VI**BMEL326: Design of Machine Elements**

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	EE	Cont. Evaluation	
3	-	-	3	3	10	15	50	--	75

Course Objectives:

1. To develop proficiency of fundamental concepts of design.
2. To develop competency in designing various joints for various engineering applications.
3. To develop an ability in designing a mechanical elements involved in design projects.
4. To develop analytical & computational skills in designing basic mechanical components used for general purposes.
5. To procreate students conversant with tools for designing a pressure vessel.
6. To give exposure of designing of transmission shafts.

Course Outcomes:

Students shall be able to:

1. Apply basic concepts of design, selection of materials in the design of a Machine Components.
2. Design the joints for various components.
3. Make use of the design principles of power screw, helical & leaf spring in the design of suspension system.
4. Apply the design procedure of clutches and brakes for various applications.
5. Apply the design procedure of pressure vessel in various industrial applications.
6. Design of shafts for various power transmission systems.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO8	PSO1	PSO2	PSO3
CO1	H	H	M	M	H	L	L	M	L

CO2	M	H	M	M	H	L	M	L	L
CO3	M	H	M	M	H	L	M	L	L
CO4	M	H	M	M	H	L	M	L	L
CO5	M	H	M	M	H	M	M	L	L
CO6	M	H	M	M	H	L	M	L	L

Contents:**UNIT I (CO1):****(5 Hrs.)**

Definition of design, types of design, design process, need, defining the problem, feasibility, preliminary, design alternatives, final design selection, preliminary and final plans & drawings. Mechanical Properties, applications and designations as per ISI and their equivalence with other standards of engineering materials, selection of materials,

UNIT II (CO2):**(8Hrs.)**

Design of Cotter and Knuckle Joint, shrink and press fit joints.

Riveted Joint: Riveted joint for boilers, structural works (Uniform Strength Joint), and eccentric loaded riveted Joint.

Welded Joint: Design of single transverse, double transverse, parallel fillet, combination fillet butt joint, eccentrically loaded welded joints.

UNIT III (CO3) :**(8Hrs.)**

Design of Power Screw, Derivation of expression for deflection and shear stress in helical spring, Design of helical spring, Design of leaf spring.

UNIT IV (CO4):**(8Hrs.)**

Kinematics of Friction Drives such as brakes clutches. Design of friction clutch: single plate, multiple plate, cone, and centrifugal clutch. Design of brake: shoe brake, band brake, and internal expanding brake.

UNIT V (CO5):**(8 Hrs.)**

Classification of thin and thick cylindrical pressure vessel, stresses in thin and thick cylindrical pressure vessels. ASME code of pressure vessel and piping, When It Is subjected to internal pressure, Expression for circumferential and longitudinal stresses, design of pressure vessel, heads and cover Plate.

UNIT VI (CO6):**(8Hrs.)**

Design of transmission shafts on the basis of strength, rigidity and critical speed, ASME code for shaft design, design of stepped shaft, axle, splined shaft, keys.

Text Books:

1. "Design of Machine Elements", V.B. Bhandari, Tata McGraw-Hill Education, Third edition, First Reprint 2010.

2. "A Textbook of Machine Design", R.S. Khurmi and J.K.Gupta, Eurasia Publishing House Pvt. Ltd. Fourteenth Edition, 2005.

3. Design Data for Machine elements, B.D. Shiwalkar, Benett & Co Publishing Division, revised edition, 2015.

Reference Books:

1. "Mechanical Design of Machine", Martin J. Siegel, Vladimir L. Maleev, James Busse Hartman, Pennsilveria, International Textbook Co, Fourth Edition, 1972.

2. "Machine Design", P.H. Black, McGraw-Hill, Third Edition, 1983.

3. "Mechanical Engg. Design", J.E. Shigley, Charles R. Mischke, Richard G. Budynas, McGraw-Hill, Tenth Edition, 2014.

Online Courses

1. Understanding Design Prof. Nina Sabnani IIT, B (mooc)

<https://www.iitbombayx.in/courses/understanding-design>

2. Basic 3D animation using Blender Sameer S Sahasrabudhe IIT, B (mooc)

<https://www.iitbombayx.in/courses/basic-3d-animation-using-blender-1>

3. Engineering Design Process with Autodesk Fusion 360 AUTODESK COURSERA

<https://www.coursera.org/learn/engineering-design-process-fusion-360>

4. Machine Design part 1 Dr. Kathryn Wingate, Academic Professional Georgia Institute of Technology (COURSERA)

<https://www.coursera.org/learn/machine-design1>

SEMSTER-VI

BMEL327: Thermal Engineering

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pu	Total Hours		TA	CA	EE	Con t. Eva luat ion	
2	-	2	4	3	10	15	25	--	75

Course Objectives:

1. To study applications reciprocating compressor.
2. To familiarize with the characteristics of rotary compressor.
3. To study internal combustion engines, various testing methods of internal combustion engines

To study applications of gas turbine and jet propulsions.

Course Outcomes:

Student should be able to

1. Choose the different types of air compressors.
2. Evaluate the performance of different types of air compressors
3. Evaluate performance of internal combustion engine.
4. Analyze performance of gas turbine applying basic gas power cycle.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PO 7	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	M	M	M	M	--	H	--
CO2	H	H	M	M	H	M	--	H	--
CO3	H	M	M	M	M	M	--	H	--
CO4	H	M	M	M	M	L	--	H	--

Contents:

Unit I (CO 1) Positive Displacement Compressors: (8Hrs)

Reciprocating compressors : Parts, Operations, Work done during isothermal, polytropic and adiabatic compression process, PV diagram, isothermal efficiency, Effect of clearance, volumetric efficiency, Mechanical efficiency, Multistage compressor, condition for minimum work input, capacity control, Actual indicator diagram.

Unit II (CO 2) Rotary Compressors: (6Hrs)

Rotary and vanes blower and screw compressor: Principle, operation, parts, indicator diagram, work done, Roots efficiency, vanes efficiency.

Centrifugal Compressor:

Principle, operation, parts, velocity diagram, static & total head quantities, work done by impeller, isentropic efficiency of compressor, slip factor, pressure coefficient, power input factor.

Axial flow compressor:

Principle, operation, parts, velocity diagram, work done, Degree of reaction stage efficiency compressor characteristics, surging & chocking. Poly tropic efficiency.

Unit III (CO 3) I.C. Engines: (8Hrs)

Introduction to I.C. Engine: Air standard & fuel air cycles, parts of I.C. Engines, working of I.C. Engines, Two stroke and four stroke I.C. Engines SI & CI Engines, Introduction to combustion in SI & CI Engine, carburetion and fuel injection.

I.C. Engine Testing: Measurement of power-Indicated, friction and brake power, measurement of speed, fuel and air consumption, calculation of indicated and brake thermal efficiency, volumetric efficiency, mechanical efficiency, percentage of excess air, Heat balance sheet, performance, characteristics and factors influencing the performance of I.C. Engines.

Unit IV (CO 4) Gas Turbines and Jet propulsion : (8 Hrs)

Ideal cycles isentropic and small stage efficiency, application of gas turbine pressure losses, effect of inter-cooling, reheat and regeneration, fuel – air ratio, combustion efficiency performance calculation, open cycle and closed cycle gas turbine plants Principles and working of turbojet, turboprop, Ramjet and pulse jet simple turbojet cycle, Thrust power, propulsive power. Thermal efficiency propulsive efficiency, overall efficiency.

Text Books:

1. Thermal Engineering , B.K. Sarkar, Tata McGraw publication, 1998
2. Internal Combustion Engine, fourth edition, V. Ganeshan, Tata McGraw publication, 2012.
3. Gas Turbine, V. Ganeshan, third edition, Tata McGraw publication, 2010

Reference Books:

1. Applied Thermodynamics, Dr. R. Yadav, sixth revised edition, Central Publishing House Allahabad, 2011.
2. Fundamentals of Internal Combustion Engines, Second Edition H.N.Gupta, PHI (Prentice Hall India Learning Private Limited) Publication, 2012
3. Gas Turbine Theory , H. Cohen and G.H. Rogers, H. I.H. Saravanamattoo, Fifth edition, Pearson Education limited, 2001.

Online Courses

1. Jet Aircraft Propulsion Prof. A.M.Pradeep, Bhaskar Roy IIT Bombay NPTEL <https://nptel.ac.in/courses/101101002/>
2. Refrigeration and Air Conditioning Prof. M.Ramgopal, R.C.Arora IIT Kharagpur NPTEL <https://nptel.ac.in/courses/112105128/>
3. Engineering Thermodynamics Jayant K. Singh IIT- Kanpur [swayamhttps://swayam.gov.in/courses/3543-engineering-thermodynamics](https://swayam.gov.in/courses/3543-engineering-thermodynamics)
4. Engineering Thermodynamics D.P. Mishra IIT- Kanpur

swayam[https://swayam.gov.in/courses/364](https://swayam.gov.in/courses/3640-engineering-thermodynamics)

0-engineering-thermodynamics

5. Thermodynamics for Engineering Students Cherish Qualls Udemy <https://www.udemy.com/thermodynamics-for-engineering-students/>

SEMSTER-VI

BMEL328: Heat Transfer

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
T h	T u	P r	To tal Ho urs		T A E	C A E	E S E	Con tEv alua tion	
2	-	2	4	3	10	15	25	--	25
					75				

Course Objectives:

1. To provide a general knowledge on the basic mechanisms of heat transfer
2. Make the right assumptions and approximations for tackling practical situations
3. To develop intellectual skills of providing analytical solutions to variety of real life situation involving heat transfer.
4. Exploring the advanced career opportunities in the area of heat transfer like Design of heat exchangers, heat transfer augmentation methods, Thermal analysis etc.

Course Outcomes:

Upon the successful completion of course, student will be able to

1. Recall basic laws of heat transfer to solve heat conduction problem.
2. Relate various empirical correlation to solve convective heat transfer problem.
3. Apply laws of radiation on problems of heat transfer.
4. Evaluate the performance of heat exchanger using LMTD and NTU method.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	M	M	M	H	H	--
CO2	M	H	M	M	H	M	H	H	--
CO3	M	H	M	M	M	M	H	H	--
CO4	M	H	M	H	H	M	H	H	--

Contents:

UNIT-I

[8 hrs]

Introduction: Modes Of Heat Transfer. Laws Of Heat Transfer And General Heat Conduction Equation in Coordinate systems. One Dimensional Steady State Conduction Equation For The Plane Wall, Cylinder And Sphere. Thermal Resistance Of Composite Structures, Contact Resistance, Overall Heat Transfer Coefficient, Critical Thickness Of Insulation. Extended Surfaces, Types Of Fins. Fins Of Uniform Cross Section Area, Temperature Distribution And Heat Transfer Rate, Fin Efficiency And Effectiveness.

UNIT-II [8 Hrs]

Forced Convection, Physical Signification Of Non Dimensional Parameters. Flow Over A Flat Surface. Concept Of Velocity & Thermal Boundary Layer Thickness, Local And Average Heat Transfer Coefficients

Free Or Natural Convection, Non dimensional Parameters. Horizontal And Vertical Plate. Heat Transfer With Phase Change, Boiling and Condensation,

UNIT-III [7 hrs]

Radiation, Nature Of Thermal Radiation, Black Body Radiation, Radiation Intensity, Laws Of Radiation. Emissivity, Absorptivity, Transmissivity, Reflectivity, Radiosity, Emissive Power, Irradiation. Radiation Network, Radiation Exchange between Surfaces, Idea of Shape Factor & Reciprocity Theorem.

UNIT-IV [7 hrs]

Heat Exchanger: Classification, Overall Heat Transfer Coefficient, Fouling Factor, LMTD Method of Heat Exchanger Analysis. Effectiveness NTU Method, Heat Exchanger Analysis By NTU Method, Design Aspects Of Heat Exchangers. Introduction to Compact Heat Exchanger.

Text Books:

1. Heat and mass transfer, 3rd edition, P. K. Nag Tata McGraw Hill Book Company, 2011
2. Heat Transfer, 10th edition, J.P. Holman McGraw Hill Book Company, New York, 2014

Reference Books:

1. Fundamentals of Heat and Mass Transfer, 7th Edition, Incropera and Dewitt, John Wiley and Sons, 2011
2. Heat and Mass Transfer, 4th edition, Yunus A. Cengel Tata McGraw Hill Publication, 2011

Online Courses

1. Heat and Mass Transfer Prof. S. P. Sukhatme IIT Bombay NPTEL
<https://nptel.ac.in/courses/112101097/>
2. Thermal conduction, convection, and radiation khans academy
<https://www.khanacademy.org/science/physics/thermodynamics/specific-heat-and-heat-transfer/v/thermal-conduction-convection-and-radiation>

[transfer/v/thermal-conduction-convection-and-radiation](https://www.khanacademy.org/science/physics/thermodynamics/specific-heat-and-heat-transfer/v/thermal-conduction-convection-and-radiation)

3. Convective Heat Transfer Arup Kumar Das
IIT Roorkee swayam
<https://swayam.gov.in/courses/3599-convective-heat-transfer>
4. Two phase flow and heat transfer Arup Kumar Das
swayam
<https://swayam.gov.in/courses/3685-two-phase-flow-and-heat-transfer>

Mechanical Engineering Department (New scheme)

V SEM Elective I

Subject Code	Name of Elective
BMEL 323	Unconventional Energy Sources
BMEL 324	Hydraulics and Pneumatics
BMEL 325	Industrial Design
BMEL 326	Industrial Engineering and Management
BMEL 327	Synthesis of Mechanisms
BMEL 328	Design of Material Handling System

V SEM Elective II

Subject Code	Name of Elective
BMEL 329	Compressor and Pumps
BMEL 330	Energy Management / Energy Audit
BMEL 331	Additive Manufacturing
BMEL 332	Advance Manufacturing Process
BMEL 333	Design of Mechanical Drives
BMEL 334	Smart Materials and Structures

V SEM Elective III

Subject Code	Name of Elective
BMEL 335	Automobile Engineering
BMEL 336	I. C. Engine
BMEL 337	Industrial Robotics
BMEL 338	Maintenance Engg. and Condition Monitoring
BMEL 339	Stress Analysis
BMEL 340	Mechanics of composite Materials

VI SEM Elective IV

Subject Code	Name of Elective
BMEL 346	Gas Turbine and Jet Propulsion
BMEL 351	Power Plant Engg.
BMEL 352	Advance Tool Design
BMEL 353	Operation Research and Management
BMEL 354	Mechanical Vibration
BMEL 355	Tribology

VIII SEM Elective V

Subject Code	Name of Elective
BMEL 414 /	Refrigeration and Air-

BMEP 414	conditioning
BMEP 415 / BMEP 415	Automation in Production
BMEP 416 / BMEP 416	Finite Element Method in Engineering
BMEP 417 / BMEP 417	Computer Aided Design
BMEP 418 / BMEP 418	Computational Fluid Dynamics
BMEP 419 / BMEP 419	Metrology& Quality Control,

SEMSTER-V

(Elective I) BMEL 323 Unconventional Energy System (Offline)

Teaching Scheme				Credits	Evaluation Scheme				
Th	Tu	Pr	Total Hours		Theory			Practical	Total Marks
					TA	CA	ES	Cont. Evaluation	
2	-		2	2	10	15	50	--	75

Course Objectives:

1. To understand the importance of Unconventional Energy System to meet energy crisis.
2. To understand systems and applications of different Unconventional Energy System such as solar energy, wind energy, etc.
3. To understand the knowledge of Direct Energy Conversion techniques to meet energy crisis.
4. To understand economic aspects of Unconventional Energy System

Course Outcomes:

1. Show the knowledge of solar energy to meet energy crisis.
2. Explain the knowledge of tidal energy to meet energy crisis.
3. Implement & apply the knowledge of Direct Energy Conversion techniques to meet energy crisis.
4. Determine the knowledge of economic aspects of Unconventional Energy System

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 6	PO 7	PO 12	PSO 1	PSO 2	PSO 3

CO1	H	H	M	H	M	M	--	H	--
CO2	H	H	M	H	M	M	--	H	---
CO3	L	M	M	M	H	M	--	H	--
CO4	L	M	M	M	H	M	--	H	--

Contents:

Unit I(CO 1)

(8 Hr)

Solar Energy:- Energy Sources, convective energy sources, prospects of Renewable & non Renewable energy sources, Solar radiation & its measurement, solar energy collectors, performance of flat plate, cylindrical parabolic concentric collectors, solar energy storage, applications

Unit II (CO 2)

(8 Hrs)

Energy from Biomass: - Introduction, Biomass conversion Technology, biogas generation, biogas plant, materials used, site selection, fuel property of biogas, methods for obtaining biomass, gasification.

Unit III(CO 3)

(7Hrs)

Tidal, wave and ocean thermal energy conversion plants, geothermal plants. Economic analysis of renewable energy system, problem on Economic analysis.

Unit IV(CO 4)

(7Hrs)

Chemicals energy sources :- Introduction, Fuel Cell, design & principle of operation, classification, types, applications, MHD power generation, methods, MHD design problems, status, Thermo electrical power, Thermionic generation.

Text Books:

1. G.N.Tiwari and M.K.Ghosal, 'Renewable Energy Recourses, Basic principle and applications', Narosa publication, 3rd edition 2010.
2. B.H...Khan, 'Non-conventional energy resources', Tata McGraw Hill Publication, 2nd edition 2012.

Reference Books:

1. G.D.Rai, 'Solar Energy Utilization', Khanna publisher New Delhi, 5th edition 2001.
2. G.D.Rai, 'Non-conventional Energy Sources', Khanna publisher New Delhi, 4th edition 2009.
3. S.P.Shukhatme, J. K. Nayak, 'Solar Energy' Tata McGraw Hill Publication, 3rd edition 2008

SEMSTER-V

Elective-I BMEL 324 HYDRAULICS AND PNEUMATICS

Teaching Scheme				Credits	Evaluation Scheme				
Th	Tu	Pr	Total Ho		Theory			Practical	Total Marks
					TA	CA	ES	Cont. Evaluation	

			ur s					n		
2	-	-	2	2	1 0	1 5	5 0	--	--	75

Course Objectives:

1. To understand the basic concept of Hydraulic and Pneumatic system, along with its functional element.
2. To understand the circuit design, and working of Hydraulic and Pneumatic system

Course Outcomes:

1. Student should be able to identify basic components of hydraulic and pneumatic system.
2. Student should be able to design and analyse various hydraulic systems
3. Student should be able to identify various failures and troubleshoot them.
4. Student should be able to explain various servo system.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO1	H	M	H	L	L	L	M	M	-
CO2	L	M	H	M	L	L	L	H	-
CO 3	M	L	H	H	L	L	L	L	-
CO4	H	L	H	M	L	L	H	M	-

Contents:

Unit I(CO 1)

(8 Hr)

Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations, properties of fluids, fluids for hydraulic systems, governing laws, distribution of fluid power, ISO symbols, energy losses in hydraulic systems, applications, basic types and constructions of hydraulic pumps and motors, pump and motor analysis, performance curves and parameters.

Unit II (CO 2)

(8 Hrs)

Hydraulic actuators, types and constructional details, lever systems, control elements direction, pressure and flow control valves, valve configurations, general valve analysis, valve lap, flow forces and lateral forces on spool valves,

series and parallel pressure compensation flow control valves, flapper valve analysis and design.

Unit III(CO 3)

(7Hrs)

Proportional control valves and servo valves, nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities), design and analysis of typical hydraulic circuits, regenerative circuits, high low circuits, synchronization circuits, and accumulator sizing, intensifier circuits meter-in, meter-out and bleed-off circuits, fail safe and counter balancing circuits, accessories used in fluid power system, filtration systems and maintenance of system.

Components of pneumatic systems, direction, flow and pressure control valves in pneumatic systems, development of single and multiple actuator circuits, valves for logic functions, time delay valve, exhaust and supply air throttling, examples of typical circuits using displacement, time and travel-step diagrams, will-dependent control, travel dependent control and time dependent control, combined control, program control, electro-pneumatic control and air-hydraulic control, ladder diagrams, applications in assembly, feeding, metalworking, materials handling and plastics working.

Unit IV(CO 4)

(7Hrs)

Servo systems, hydro mechanical servo systems, electro hydraulic servo systems and proportional valves, fluidics – introduction to fluidic devices, simple circuits, introduction to electro hydraulic pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control, fluid power circuits; failure and troubleshooting.

Text Books:

1. Fluid Power Control Blackburn, J. F., G. Reethof and J. L. Shearer Technology Press of M. I. T. New York and Wiley
2. Fluid Power with applications Anthony Esposito Pearson Education

Reference Books:

1. Oil Hydraulic Power and its Industrial Applications Ernst, W McGraw Hill, New York
2. Design of Hydraulic Control Systems E. E., and H. Stern McGrawHill, New York
3. Electro hydraulic Servomechanism Morse, A. C. McGraw Hill, New York.
4. Fluid Power Control Systems Pippenger J.J. and R.M. Koff McGraw Hill, New York

SEMSTER-V

Elective I BMEL 325 : Industrial Design

Teaching Scheme	Credit	Evaluation Scheme		
		Theory	Practical	Total

T h	T u	P r	To tal Ho ur		T A E	C A E	E S E	Co nt. Ev al ua tio n	E xt	Ma rk s
2	-	-	2	2	1 0	1 5	5 0	--	--	75

Course Objectives:

1. To understand the engineering knowledge, innovation associated with designing and development of industrial products effectively.
2. To grow in the development of skills, knowledge and dispositions that enable graduates to immediately function as entry-level professional industrial designers.
3. To design, develop, implement and improve integrated systems or products that include people, materials, information, equipment and energy using appropriate analytical, computational and experimental practices.
4. To provide education and to develop leadership qualities required for industries by nurturing multiple.

Course Outcomes:

Student should be able to

1. Design a component, system or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
2. Interpret, represent and respond to the socio-economic and cultural contexts of industrial design and the ethical responsibilities of the professional designer.
3. Contextualize, generate and apply aesthetic aspects of industrial design.
4. Recognize and contribute to professional practice relevant to industrial design and develop an ability to engage in lifelong learning.

CO Mapping with PO and PSO:

Cour se Outc omes	Programme Outcomes				Programme Specific Outcomes		
	PO1	PO2	PO3	PO5	PS O 1	P S O 2	PS O3
CO1	H	M	H	M	H	-	-

CO2	H	L	M	L	M	-	-
CO3	H	M	L	M	H	-	-
CO4	H	M	L	L	H	-	-

Contents:

Unit-I: (CO 1)

(7hrs)

Introduction:

Investigations and study of visual function and ergonomic requirements of control and display elements.

Legibility of display elements, character of different typefaces and their readability. Individually planned design projects involving research, analysis and design of control and display panels.

Unit II: (CO 2)

(8Hrs)

Human being in man-made world, Gross human anatomy, Anthropometry, static and dynamic, Muscles and work physiology, Static and dynamic work including maximum capacity Bio-mechanics.

Unit III: (CO 3)

(7Hrs)

Environmental condition including thermal, illumination, noise and vibration. Biological transducers and nervous system including their limitation. Controls and display Psycho physiological aspects of design, needs of ergonomics and aesthetic design, Physiological aspects of work, Work measurement through physiological tests, Work physiology, Paced and un-paced work performance.

Unit IV: (CO 4)

(8Hrs)

User-centred design, human cognitive processes, human memory, human errors, conceptual models, understanding users through models, usability goals, heuristic evaluation, human-computer interaction design process.

Text Books:

1. J. Raskin, The Humane Interface: New Directions for Designing Interactive Systems, Pearson Education, 2000.
2. J. Nielsen, Usability Engineering, Morgan Kaufmann, 1993.

Reference Books:

1. D. B. Edward, Lateral Thinking, A Textbook of Creativity, Penguin Books, 1970.
2. D. J. Mayhew, The Usability Engineering Lifecycle: A Practitioner's Handbook for User Interface Design, Morgan Kaufmann, 1999.
3. J. S. Dumas, J. C. Redish, Practical Guide to Usability Testing, Exeter: Intellect, 1999.
2. N. F. M. Roozenburg, J. Eekels, Product Design, Fundamentals and Methods, Wiley Publications, 2008.

SEMSTER-V

Elective-I: BMEL 326 Industrial Engineering and management

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	ES	Cont. Evaluation	
2	-	-	2	2	10	15	25	--	50

Course Objectives:

1. Contribute to the success of companies through effective problem solving
2. Design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments
3. Effectively manage business operations and project management teams
4. Continue to develop holistically, including the personal and professional skills necessary to adapt to our changing societal, technological, and global environments

Course Outcomes:

1. To apply knowledge of mathematics, science, and engineering;
2. An ability to design and conduct experiments, as well as to analyze and interpret data;
3. An ability design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
4. An ability to function on a multidisciplinary team

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes				Programme Specific Outcomes		
	PO 1	PO 2	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	H	L	M	H	-	-
CO2	H	M	M	L	H	-	-
CO3	H	H	M	M	H	M	-
CO4	H	L	H	H	H	-	-

Contents:

UNIT I (CO1)

(7 hrs)

Productivity: Productivity concept and definition, Techniques of productivity improvement- Work content and ineffective time, improving productivity by reducing work

content and ineffective time, Benefits of higher productivity.

UNIT II (CO2)

(8hrs)

Productivity Measurement: Need for productivity measurement, total productivity index, partial productivity indices. Productivity models, Viz (1) Craig & Harris (2) Total productivity Model (3) American Productivity Centre model and Numerical Problems.

UNIT III (CO3)

(7 hrs)

Format and Functions of the objective matrix, productivity criteria, performance scores, weights, values and Indicators. OMAX applications. Computer applications in work study.

UNIT IV (CO4)

(8hrs)

Work Sampling: Theory of sampling and the law of averages, the normal and Binomial distribution as applied to work sampling. Accuracy of work sampling measurement, procedure for making a work sampling measurement, procedure for making a work sampling study, use of control chart in work sampling, Advantages and disadvantages of work sampling.

Text Books:

1. Sumanth D J, "Productivity Engineering & Management", McGraw Hill (1995).
2. Ralph M-Barnes, "Motion & Time Study - Design & Measurement of work "John Wiley & sons.
3. International Labour organization, "Introduction to work-study", Universal Publishing Company. ISBN 81-850270

Reference Book :

1. Maynard H. B., "Industrial Engineering Handbook", 3rd edition, McGraw Hill Book Company. ISBN 0-07-041084-4
2. John Sterman , Business Dynamics: Systems Thinking and Modeling for a Complex World, Irwin/McGraw\ Hill(2000).
3. Sushil, System Dynamics : A Practical Approach for Managerial Problems,Wiley Eastern (1993)
4. J.W. Forrester, Industrial Dynamics, Cambridge MA: Producticity Press (1961)
5. Michael R. Goodman, Study Notes in System Dynamics, Pegasus Communications (1989)

SEMESTER-V

Elective-I: BMEL 327 Synthesis of Mechanisms

Teaching Scheme	Credits	Evaluation Scheme		
		Theory	Practical	Total

T h	T u	P r	Tot al Ho urs		T A E	C A E	E S E	Cont. Evalu ation	Ma rks
2	-	-	2	2	1 0	15	5 0	--	75

Course Objectives:

1. To develop the fundamental aspects of synthesis.
2. To develop the skills of graphical approach of synthesis.
3. To develop the skills of analytical approach of synthesis.
4. To develop an ability to make use of application of coupler curves.

Course Outcomes:

Students shall be able to:

1. Define the synthesis of mechanism.
2. Choose the proper mechanism for the engineering applications.
3. Apply the Freudenstein's equation for synthesis of mechanism.
4. Design the six bar mechanism with the application of coupler curves.

CO Mapping with PO and PSO:

Cour se Outc omes	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 8	P S O 1	P S O 2	PS O3
CO1	H	L	L	L	L	L	M	L	-
CO2	H	M	L	L	H	M	M	L	M
CO3	M	H	H	M	M	L	M	L	L
CO4	H	H	H	M	M	L	M	L	M

Contents:

Unit-I : (CO1) (8hrs)

Introduction, tasks of Kinematics Synthesis, Type synthesis, Tools of dimensional synthesis,

Unit-II: (CO2) (7hrs)

Graphical synthesis: Motion generation-two and three prescribed motions, Path generation - three prescribed positions, prescribed timings, four positions without prescribed timings, Function Generator: Three prescribed points.

Unit-III (CO3) (8hrs)

Introduction to Analytical synthesis, Standard Dyad form, three prescribed positions for motion, path and function generation, circle, point and center-point circles, Freudenstein's equations for three point function generation, order synthesis.

Unit-IV (CO4) (7hrs)

Coupler curves for four-link, slider-crank and inverted slider-crank mechanisms, Application of

coupler curves in design of six-link mechanism, Coupler cognate mechanisms.

Text Books:

1. Arthur G. Erdman, George N. Sandor, Mechanism Design -Analysis and Synthesis, Vol. I, Prentice Hall, New Jersey, 1984.
2. A.H Soni, Mechanism Synthesis and Analysis, McGraw Hill, 1984.

Reference Books:

1. Robert L. Norton, Design of Machinery- An Introduction to the Synthesis and Analysis of Mechanisms, WCB McGraw Hill, Boston, 1999.

SEMESTER-V

Elective-I : BMEL 328 Design of Material Handling System

Teaching Scheme				Cre dits	Evaluation Scheme				
					Theory			Practi cal	Tot al Ma rks
T h	T u	P r	Tot al Ho urs		T A E	C A E	E S E	Cont. Evalu ation	
2	-	-	2	2	1 0	15	5 0	-	75

Course Objectives:

1. To enable understanding of , principal groups of material handling equipments, choice of material handling equipment,
2. To understand constructional details and operations of Load handling attachments,
3. Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thruster operated, controller brakes.
4. To provide exposure to Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, cranes with luffing boom cantilever cranes.

Course Out Comes:

Students shall be able to:

1. Select material handling equipment as per requirement.
2. Design various overhead hoisting materials handling system for different applications.
3. Design and select load handling attachment for lifting application
4. Select drives for various material handling applications.

CO Mapping with PO and PSO:

Cour se Outc omes	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 7	P O 8	P S O 1	P S O 2	PS O3

CO1	L	L	L	M	H	H	H	M	L
CO2	H	H	M	M	M	M	M	H	M
CO3	H	H	M	M	M	M	M	H	M
CO4	H	M	L	M	M	H	M	M	L

Contents:

UNIT – I (CO1) (8 Hrs)

Types of intra plant transporting facility, principal groups of material handling equipments, choice of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments.

UNIT-II(CO2) (7 Hrs)

Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, electric lifting magnets, grabbing attachments for loose materials, crane attachments for handling liquid materials.

UNIT – III (CO3) (10 Hrs)

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thruster operated, controller brakes, shoe brakes, thermal calculations of shoe brakes and life of linings, safety handles, load operated constant force and variable force brakes general theory of band brakes, its types and construction.

UNIT-IV(CO4) (7 Hrs)

Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, cranes with luffing boom cantilever cranes, cage elevators safety devices of elevators belt and chain conveyors and their power calculations, vibrating and oscillating conveyors pneumatic and hydraulic conveyors, screw conveyors hoppers, gates and feeders. Introduction to AGV's as new material handling device, use of robot for material handling.

Text Books:

1. Materials Handling Equipment , N. Rudenko, 2nd Edition, Envee Publishers, New Delhi, 1969

Reference Books:

1. Materials Handling Equipment, M.P. Alexandrov, 1st Edition, Mie publications, Maskow, 1981

SEMSTER-V

Elective-II BMEL 329 Compressor and Pumps

Teaching Scheme	Cr edi	Evaluation Scheme		
		Theory	Practical	To

T h	T u	P r	To tal Ho urs	ts	T A E	C A E	E S E	Cont . Eval uatio n	E x t	tal M ar ks
1	1	-	2	2	1 0	1 5	2 5	--	--	50

Course Objectives:

1. Identify and explain the function of various components in pumps and compressors
2. To analyze the performance of pumps and compressor

Course Outcomes:

1. To learn the classification reciprocating compressor and its performance parameter
2. To select the rotary compressor for practical application
3. To understand the basic components of various types of pumps
4. To do the analysis of the reciprocating pumps

CO Mapping with PO and PSO:

Cour se ↓ Outc omes	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 1 2	P S O 1	P S O 2	PS O3
CO1	H	M	--	---	--	--	--	---	-
CO2	H	M	---	---	---	--	--	--	-
CO3	H	M	--	---	---	--	--	--	--
CO4	H	M	--	---	---	--	--	--	--

Contents:

UNIT-I [6 hrs]

Reciprocating compressors:

Indicator diagram, minimum work condition, Intercooling, mean effective pressure, Indicated power, Mechanical efficiency, Isothermal efficiency, Multistaging of Compressor, control of delivery of air compressors, compressed air motors.

UNIT-II [5 Hrs]

Rotary Compressors:

Introduction, Classification, roots blower, vane type, screw compressor, scroll compressor, centrifugal and axial flow compressors, Centrifugal Compresso Axial flow compressors,

UNIT-III [4 Hrs]

Pumps:

Rotodynamic pumps, centrifugal turbine pumps and axial flow pumps, constructional features and working theory

UNIT-IV**[3 Hrs]****Reciprocating Pumps (CO4)**

Single acting, double acting pumps, air vessels, efficiency,

Text Books:

1. Hydraulic Turbines, R.L.Daugherty, McGraw Hill Book Co., New York, 3rd Revised Ed., 1920
2. Thermal Engineering , B.K. Sarkar, Tata McGraw publication,1998

Reference Books:

1. Theory and Design of Hydraulic Machines including Basic Fluid Mechanics, V. P. Vasandani, Khanna publishers, New Delhi, 11th Ed., 2011.
2. Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar, S.K.Kataria& Sons, New Delhi, 8th Ed., 2013.
3. Power plant engineering, P.K. Nag, fourth edition, McGraw Publication(India) Pvt. Limited, 2014

Online Courses:-

1. Fluid Dynamics and Turbo machines, Dhiman Chatterjee, IIT Madras swayam <https://swayam.gov.in/courses/3683-fluid-dynamics-and-turbomachines>
2. Energy conservation and waste heat recovery Bhattacharya A IIT Kharagpurswayam<https://swayam.gov.in/courses/3814-energy-conservation-and-waste-heat-recovery>

Elective-II BMEL 330 Energy Management / Energy Audit (Offline)

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	ES	Cont. Evaluation	
2	-	-	2	2	10	15	25	--	50

Course Objectives:

Students shall be able to

1. To understand the need of energy audit and management
2. To improve energy optimization techniques
3. To collect the required information for audit
4. To write an energy report

Course Outcomes:

Student should be able to

1. Apply the principles of energy management

2. Maximize the performance of system
3. Accumulate the required data of system
4. Prepare an energy audit report with a suggestion of improvement.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 4	PO 8	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	H	M	M	L	L	M	H	H	--
CO2	M	H	M	M	M	L	H	H	--
CO3	M	H	M	M	L	M	H	H	--
CO4	L	L	M	M	H	M	H	H	--

Contents**Unit -01 (CO 1)****(7hrs)**

General Philosophy and need of Energy Audit and Management. Definition and Objective of Energy Management, General Principles of Energy Management, Energy Management Skills, Energy Management Strategy.

Unit-II : (CO 2)**(7hrs)**

Energy Audit: Need, Types, Methodology and Approach. Energy Management Approach, Understanding Energy Costs, Bench marking, Energy performance, Matching energy usage to requirements, Maximizing system efficiency, Optimizing the input energy requirements, Fuel and Energy substitution.

Unit-III : (CO 3)**(8hrs)**

Data gathering : Level of responsibilities, energy sources, control of energy and uses of energy get Facts, figures and impression about energy /fuel and system operations, Past and Present operating data, Special tests, Questionnaire for data gathering.

Analytical Techniques: Incremental cost concept, mass and energy balancing techniques, inventory of Energy inputs and rejections, Heat transfer calculations, Evaluation of Electric load characteristics, process and energy system simulation.

Unit IV (CO4)**(8hrs)**

Evaluation of saving opportunities:

Determining the savings in Rs, Noneconomic factors, Conservation opportunities, estimating cost of implementation.

Energy Audit Reporting:

The plant energy study report- Importance, contents, effective organization, report writing and presentation.

Text Books:

1. Barunkumar De, Vrinda Publication" Energy Audit & Management" 2nd Edition 2010.

Reference Books:

1. "Handbook on Energy Audit" by Sonal Desai, McGraw Hills publication.

SEMSTER-V

Elective-II: BMEL 331 Additive Manufacturing

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	EE	Cont. Evaluation	
2	-	-	2	2	10	15	25	--	50

Course Objectives:

1. To introduce the concept of Additive manufacturing to students.
2. To develop skills for designing and data preparation for AM
3. To introduce the basics of AM machine and factors affecting the manufacturing
4. To develop skills in student to solve engineering problems by applying concepts of AM in all possible field of engineering and human life

Course Outcomes:

1. Knowledge assimilation of the principles of AM and its applications in various field of engineering.
2. To generate model and prepare file as per AM format for manufacturing.
3. To solve complex manufacturing problems for significant technological and societal development through AM.
4. To conceptualize and analyze new problems leading to research and development in AM.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO12	PSO1	PSO2	PSO3
CO1	H	L	L	L	L	H	M	-	L
CO2	H	L	H	M	M	M	M	-	L
CO3	H	M	M	H	H	L	H	-	H
CO4	H	H	M	L	M	H	M	-	M

Contents:

Unit-I: (CO1)

(7hrs)

Overview of Additive Manufacturing: Introduction to AM, AM evolution, Distinction between additive and subtractive manufacturing, Need of AM, Basic Principles of AM, Steps in AM, Process chain of AM in integrated CAD-CAM environment, Advantages of AM,

Unit-II (CO2)

(8hrs)

Classifications of different AM techniques, Materials for AM, CAD conversion to STL, STL error correction, STL file manipulation, Process parameters, Machine setup, Errors in AM, post processing. Slicing, Internal Hatching, Infills, Support Structure, Part Orientation.

Unit-III (CO3)

(7hrs)

Rapid Tooling (RT): Introduction to RT, Indirect RT processes – silicon rubber molding, epoxy tooling, spray metal tooling and investment casting. Direct RT processes – laminated tooling, powder metallurgy based technologies, welding based technologies, direct pattern making, emerging trends in RT. Reverse Engineering: Geometric data acquisition, 3D reconstruction. Applications and case studies: Engineering applications, Medical applications.

Unit-IV (CO4)

(8hrs)

Programming in RP, Modelling, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly,

Text Books:

1. Chua, C.K., Leong, K.F., Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley and Sons Inc., 2009.
2. Noorani, R., Rapid Prototyping: Principles and Applications, John Wiley & Sons, Inc., New Jersey, 2006.

Reference Books:

1. Pham, D.T., Demov, S.S., Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer-Verlag London Limited, 2001.
2. Hopkinson, N., Hague, R.J.M. and Dickens, P.M., Rapid Manufacturing and Industrial Revolution for the Digital Age, John Wiley and Sons Ltd, Chichester, 2005.

SEMSTER-V

Elective II: BMEL 332 Advance Manufacturing Processes

Teaching Scheme	Credits	Evaluation Scheme		
		Theory	Practical	Total

T h	T u	P r	Tot al Ho urs		T A E	C A E	E S E	Cont. Evalu ation	Ma rks
2	-	-	2	2	1 0	15	2 5	--	50

Course Objectives:

1. To introduce concepts of advances in machining in the field of manufacturing.
2. To develop skills in student to solve engineering problems based on machining.
3. To understand the concepts of plasma arc welding process.
4. To understand the basics of Laser beam machining process.

Course Outcomes:

1. Select non-conventional machining over conventional machining process
2. Solve problems with abrasive jet machining and electrochemical machining.
3. Select the cutting tools based on the various cutting parameters.
4. Select the various plasma arc machining parameters.

CO Mapping with PO and PSO:

Cour se Outc omes	Programme Outcomes				Programme Specific Outcomes		
	PO1	PO2	PO5	PO6	PS O 1	P S O 2	PS O 3
CO1	H	L	M	M	H	-	-
CO2	H	M	M	L	M	-	-
CO3	H	M	L	L	H	-	-
CO4	H	M	M	M	M	-	-

Contents:

Unit-I:(CO1) (7hrs)

Introduction: Need for Non-traditional Machining, Classification, and process selection. Ultrasonic machining: Principle, Transducer, Magnetostrictive material, Analysis for Material Removal Rate by Shaw, Effect of process parameters, Application.

Unit-II (CO2) (8hrs)

Abrasive Jet Machining: Principle, Application, Advantages and disadvantages, Variables in AJM, Water Jet Machining- Jet Cutting equipment, Principle, advantages, Practical Application.

Electrochemical Machining: Principle, Faraday's law, Material Removal Rate, Dynamics of ECM process, Tool design, Advantages, Application, Limitation, Electro –chemical grinding, Deburring and Honing.

Unit-III (CO3) (7hrs)

Electro Discharge Machining: mechanism of material removal, Basic EDM circuitry and principles of operation, Analysis of relaxation circuits, Concepts of critical resistance, Machining accuracy and surface finish, Tool Material, Dielectric fluid, Application limitation.

Unit-IV (CO4) (8hrs)

Plasma Arc Machining: generation of Plasma, Equipment, Torch, Classification, Direct and in direct torches and applications, parameters effecting cutting, Advantages.

Laser Beam Machining: Lasing process and principle, population inversion, Principle of Ruby laser, Nd: YAG Laser and CO2 Laser, Power control of laser output, Application.

Text Books:

1. Modern machines process- P.C. Pandey and H.S. Shan. Tata McGraw Hill Publishers, 2004.
2. Non-Conventional Machining- P.K. Mishra, Narosa Publishing House (19 July 2007).

Reference Books:

1. Manufacturing Processes- Amstead, Ostwald & Begeman, John Wiley & Sons. Processes and Materials of Manufacturing- Lindberg, PHI.

SEMESTER-V

Elective-II: BMEL 333 Design of Mechanical Drives

Teaching Scheme				Cr ed its	Evaluation Scheme			
					Theory			Tot al Ma rks
T h	T u	P r	Total Hour s		T A E	C A E	E S E	Prac tical Cont · Evalu ation
2	-	-	2	2	10	15	25	--

Course Objectives:

1. To develop competency in designing couplings, flywheel.
2. To develop competency in designing transmission system.
3. To develop skills in designing profiles of the various gears.
4. To make students conversant with tools for designing gear drive

Course Outcomes:

Students shall be able to:

1. Apply the basics of design of mechanical components like coupling and flywheel and their applications.
2. Select the different mechanical drives like, belt, rope, chain drive for the various uses.

- Design the spur or helical gears in the manufacturing industries.
- Design and select the worm and worm or bevel gear for various application.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO6	PO8	PSO1	PSO2	PSO3
CO1	M	H	H	M	H	L	H	L	L
CO2	H	M	M	H	L	M	M	M	L
CO3	H	H	M	H	L	L	H	H	M
CO4	H	H	M	M	L	L	H	H	M

Contents:

UNIT I: CO-1 (7 Hrs.)

Coupling : types of shaft coupling, design of flange coupling, flexible bush coupling.

Flywheel : coefficient of fluctuation of energy and coefficient of fluctuation of speed, energy store in flywheel, stresses in flywheel, design of flywheel.

UNIT III: CO-2 (8Hrs.)

Flat belt drive : types of belts and belt material, analysis of belt tension, condition for transmitting maximum power, design of flat belt, flat belt pulley.

V belt drive : types of V-belt, analysis of V-belt tension, design of V belt pulley,

Roller chain drive : velocity ratio and length of chain, design of chain, dimensions of tooth profile, sprocket.

UNIT IV: CO-3 (8Hrs.)

Review of kinematics of gears and terminology, interference, tooth profiles, formative number of teeth etc. Buckingham equation, design of spur gear drive, helical gear drive, hypoid gear, spiral gear

UNIT V: CO-4 (8Hrs.)

Worm gear drive: types and proportion of worm and worm gear, force analysis, beam strength of worm gear teeth, dynamic tooth load, wear load, thermal rating of worm gear, design of worm and worm gear.

Bevel gear drive; types of bevel gear, proportions of bevel gear, force analysis of bevel gear drive design of bevel gear drive.

Text Books:

1. Mechanical Design of Machine, Martin J.Siegel, Vladimir L.Maleev, James Busse Hartman International Textbook Co, Second edition, 1965.

2. Machine Design, P.H. Black mcgraw hill publication, Third edition 1981

3. Mechanical Engg. Design J.E.Shigley, Charles R.Mischke, Richard G.Budynas, McGraw-Hill, fifth edition, 1986

Reference Books:

1. Design Data Book, B.D.Shiwalkar, central techno publication,

2. Standard hand book of Machine Design“, Joseph Shigley, Charles Mischke,

Thomas Brown,” Mc-Graw-Hill Professional, 3rd edition, 2004. 2. Mechanical Engineering Hand Book, Kent William, New York, Wiley, 1918.

3. Design Data Book, PSG College of Technology, PSG College of Technology, Third edition, 1966.

4. Machine Design Analysis & Synthesis, Sandor and Erdman, P.H.I. PUBLICATION, second edition, 1984

SEMESTER-V

Elective-II: BMEL 334 Smart Materials and Structure

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	ES	Cont. Evaluation	
2	-	-	2	2	10	15	25	-	50

Course Objectives:

- To explain the basic concepts of Smart materials.
- To develop competency in selection high-band width low strain smart sensors
- To make students conversant with Smart Actuators.
- To make the students conversant with Advances of smart materials and structures.

Course Out Comes:

- To explain basic principles of piezoelectricity.
- Modelling of smart materials
- To explain the concept of smart actuators
- To explain the applications of Smart materials and advancements.

CO Mapping with PO and PSO:

Course Outcomes	Programme Specific Outcomes							
	PO1	PO6	PO7	PO8	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	M	L	L	M	L
CO2	H	M	M	M	L	H	M	L
CO3	H	M	M	L	M	M	L	L
CO4	M	H	H	H	M	M	M	M

Contents:

UNIT 1 (8 Hrs)
Introduction to Smart Materials, Principles of Piezoelectricity, Perovskite Piezoceramic Materials, Single Crystals vs Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids

UNIT 2 (8 Hrs)
High-band width low strain smart sensors
Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteucci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors

UNIT 3 (8 Hrs)
Smart actuators
Modelling Piezoelectric Actuators, Amplified Piezo Actuation – Internal and External Amplifications, Magnetostrictive Actuation, Joule Effect, Wiedemann Effect, Magneto volume Effect, Magnetostrictive Mini Actuators, IPMC and Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control

UNIT 4 (7 Hrs)
Advances in Smart Materials and Structure
Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self-Healing Polymers, Intelligent System Design, Emergent System Design

Text Books:

1. M V Gandhi & B.S. Thomson
CHAPMAN & HALL Publications, 1992

Reference Books:

1. SMART STRUCTURES AFZAL SULEMAN
Springer -Verlag PUBLICATIONS, 2001

SEMSTER-V

Elective – III: BMEL 335 Automobile Engineering

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	
Th	Tu	Pr	Total Ho		TA EE	CA EE	ES EE	Cont. Ev	Ext

			ur s					al ua tio n		
2	0	0	2	2	1 0	1 5	2 5	--	--	50

Course Objectives:

1. To understand various systems & mechanisms in automobiles
2. To learn the emerging Technology in the field of automobile Engineering
3. To study maintenance of automobiles

Course Outcomes:

Upon the successful completion of course student shall be able to

1. Transmit power developed by engine to vehicle reducing transmission losses.
2. Control Vehicle
3. Choose various human confront
4. Select recent technologies

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	M	M	H	H	M	H	M	-
CO2	H	L	M	H	H	M	L	M	-
CO3	H	L	L	H	H	L	M	M	-
CO4	H	L	L	L	H	L	L	H	-

Contents:

Unit-I :Chassis and Transmission (8hrs)
Chassis, Clutch, Gear box, Differential, Automatic and manual transmission
Unit – II: Steering and Brakes (8 hrs)
Steering geometry, mechanical and electrical brakes, tyres
Unit – III: Suspension & Electrical System (8 hrs)
Independent & Conventional, active and passive suspension system, batteries, alternator, ignition
Unit – IV: Recent trends in automobile engineering (8 hrs)
Adaptive cruise control, Automatic emergency brakes, collision avoidance, electric vehicles,

SEMSTER-V

(Elective III: BMEL 336 Automotive Engines/I.C.Engines)

Teaching Scheme				Credits	Evaluation Scheme					
Th	Tu	Pr	Total Hours		Theory			Practical		Total Marks
					TA	CA	ES	Cont. Eval	Ext	
				E	E	E				

			ur s	s				n		s
2	0	0	2	2	10	15	25	--	--	50

Course Objectives:

1. To understand various systems of I C engine.
2. To learn the emerging Technology in the field of automobile engines Engineering
3. To learn performance of I C engines
4. To study various emission norms.

Course Outcomes:

Upon the successful completion of course student shall be able to

1. Choose various engine components
2. Classify various combustion process
3. Select various fuel injection techniques
4. Identify appropriate alternate fuel to reduce emission.
5. CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes				Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 6	PSO 1	PSO 2	PSO 3
CO1	H	M	M	L	M	H	-
CO2	H	H	L	M	M	H	-
CO3	H	H	H	L	L	H	-
CO4	H	H	H	H	M	H	-

Contents:

Unit-I: Engine nomenclature and components. (8hrs)

Engine nomenclature, losses in engines, actual and air standard engines.

Unit – II: Combustion in SI & CI Engines (8 hrs)

Combustion Phenomenon in SI & CI Engines, Knock, Detonation, combustion chambers,

Unit – III: Fuel injection & ignition, engine performance (8 hrs)

Diesel injection system, MPFI, electronic ignition and injection system, carburetors.

Determination of BP, IP, performance characteristics, Energy balance.

Unit – IV: Alternate Fuels and Emission (8 hrs)

Engine emission, alternate fuels, exhaust after treatment devices, emission norms.

SEMSTER-V

Elective III: BMEL 337 Industrial Robotics

Teaching Scheme				Credits	Evaluation Scheme			Total Marks
					Theory		Practical	
					T A E	C A E	E S E	
T h	T u	P r	Total Hours				Cont. Evaluation	
2	0	2	4	3	1	15	5	25
								10

					0		0		0

Course Objectives:

1. To understand constructional details and operations of CNC lathe and milling as well as part programming.
2. To learn about working of Wire EDM machine.
3. To enable learning about constructional and operational details of robotics.
4. To explain the robot programming and various sensors used in robot.

Course Outcomes:

After successfully completing the course students will be able to:

1. Select various types of cutting tools, work holding devices etc.
2. Develop programs using manual part programming technique and APT for CNC lathe and milling machine.
3. Develop the programs for robot.
4. Select appropriate robot for the given application.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes				Programme Specific Outcomes		
	PO1	PO2	PO3	PO5	PSO1	PSO2	PSO3
CO1	H	M	H	H	H	-	-
CO2	H	L	M	H	M	-	-
CO3	H	M	L	M	H	-	-
CO4	H	L	M	M	M	-	-

Contents:

Unit-I (CO1)

[7 Hrs]

Concepts of NC, CNC, DNC. Classification of CNC machines, Machine configurations, Types of control, CNC controllers characteristics, Interpolators. Cutting tool materials, carbide inserts classification, qualified; semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines.

Unit-II

[8Hrs]

Programming CNC machines, Part print analysis and Process planning, Advanced Programming features, Canned cycles, Subroutines, Macros, special cycles etc. APT part programming using CAD/CAM, Parametric Programming. Manual part programming for CNC turning, milling and machining center.

Unit-III

[7Hrs]

Wire EDM machines. Computer assisted part programming techniques, Conversational and

Graphics based software, Solids based part programming. Freeform surface machining. Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM. Robotics, Basic concepts, Robot configurations, Basic robot motions, Types of drives, Applications

Unit IV [8Hrs]

Robot programming, Methods, Languages, Computer control and Robot Software – Programming Languages. Sensory devices, Non optical and optical position sensors, Velocity and Acceleration, Range, Proximity, touch, Slip, Force, Torque. Machine vision, Image components, Representation, Hardware, Picture coding, Object recognition and categorisation, Integration of Robots with CNC machines for CIM.

TEXTBOOKS:

1. P. Radhakrishnan, S. Subramanyam, V. Raju, "CAD/CAM/CIM", New Age Publisher, 2004
2. Mikell P. Groover, "Automation, Production Systems, and Computer-integrated Manufacturing", Prentice Hall, 2013

REFERENCE BOOKS:

1. Krar, S., and Gill, A., "CNC Technology and Programming", McGraw Hill Publication Co, 2012.
2. Gibbs, D., "An Introduction to CNC Machining", Casell, 2015.
3. Seames, W.S., "Computer Numerical Control Concepts and Programming", Delmar Publishers, 1986.
4. Lynch, M., "Computer Numerical Control for Machining", McGraw Hill, 2002.
5. Koren Y, "Computer Control of Manufacturing Systems", McGraw, 2005.

SEMSTER-V

Elective III: BMEL 338 Maintenance Engineering and Condition Monitoring

Teaching Scheme				Credits	Evaluation Scheme					
Th	Tu	Pr	Total Hours		Theory			Practical		Total Marks
					TA	CA	EE	Cont. Evaluation	Ext	
2	-	-	2	2	10	15	25	--	--	50

Course Objectives:

1. Assess the condition of various machine installations based on Insulation status.
2. Implement condition monitoring plan for complete machine System
3. Identify amount of damage in the Equipment

4. Check the mechanical integrity of the equipment

Course Outcomes:

1. Develop the maintenance strategies for various types of maintenance.
2. Apply the basic signal processing techniques.
3. Solve the industrial maintenance problems using condition based monitoring.
4. Adopt mechanical fault diagnosis techniques in monitoring and maintenance of machines.

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes				Programme Specific Outcomes		
	PO1	PO2	PO3	PO5	PS O 1	PS O 2	PS O 3
CO1	H	L	H	L	H	M	-
CO2	H	M	M	L	M	H	-
CO3	H	M	L	M	M	M	-
CO4	H	L	M	M	M	H	-

Contents:

Unit-I: (CO 1)

(7hrs)

Principal of maintenance:

Definition, system approach, objectives, responsibilities of maintenance department, maintenance strategies, principles of maintenance, concepts of maintainability, availability and reliability, implementation of CBM, comparison of CBM with other maintenance techniques and case studies.

Unit-II: (CO2)

(8hrs)

Digital Signal Processing:

Probability distribution and density, Fourier analysis, Hilbert Transform, Cepstrum analysis, Digital filtering, Deterministic / random signal separation, Time-frequency analysis

Wavelet Transform:

Introduction to Wavelets, Continuous Wavelet Transform (CWT), Discrete Wavelet Transform (DWT), Wavelet Packet Transform (WPT), Types of wavelets.

Unit-III: (CO3)

(7hrs)

Condition Based Monitoring:

Basic concept, techniques-visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, crack monitoring, thickness monitoring, noise and sound monitoring.

Unit-IV: (CO4)

(8hrs)

Machine Condition Monitoring and Fault Diagnostics Techniques:

Wear monitoring and lubricant analysis-sources of contamination, techniques, Spectrometric Oil Analysis Procedure (SOAP) and ferrography.

Recoding Analysis and instrumentation:

Vibration meters, data collectors, frequency domain analyser, time domain instruments,
Gear Diagnostics

Text Books:

1. Amiya Ranjan Mohanty, 'Machinery Condition Monitoring: Principles and Practices', CRC Press, Taylor and Francis Group.
2. R. C. Mishra, K. Pathak, 'Maintenance Engineering and Management', Prentice Hall of India Pvt. Ltd., 2002.
3. R. A. Collacot, 'Mechanical Fault Diagnosis and condition monitoring', Chapman and Hall Ltd.

Reference Books:

1. Hamid A Toliyat, Subhasis Nandi, Seungdeog Choi, Homayoun Meshgin-Kelk, 'Electric Machines: Modeling, Condition Monitoring and Fault Diagnostics, CRC Press Theory, Implementation and Analysis', Springer, 2013
2. John S. Mitchell, 'Introduction to Machinery Analysis and Monitoring', PennWell Books.
3. Robert Bond Randall, 'Vibration-Based Condition Monitoring—Industrial, Aerospace and Automotive applications', John Wiley & Sons Ltd., 2011.

SEMESTER-V

E-III: BMEL 339 Stress Analysis

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	SE	Cont. Evaluation	
2	-	-	2	2	10	15	25	-	50

Course Objectives:

1. To understand basic concepts of stress analysis.
2. To develop competency in analytical methods in solving problems of stress distribution
3. To make the students conversant with 3-D photo elasticity and to give exposure on fringes.
4. To learn and apply various methods in stress and strain analysis and exposure to new advancements in stress analysis.

Course Out Comes:

1. Shall be able to evaluate and compare Able to justify on the suitability of selected material it is capable to sustain load or pressure to given problem.

2. Able to check elasticity of any material by the help of polar scope.
3. Able to check stress propagation of dynamic load problem, heat transfer problem and fluid related problem if it is isoclinic and is chromatic basic.
4. Able to check some casting material in view of stress freezing phenomenon and fringe multiplication

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 1 2	PSO 1	PSO 2	PSO 3
CO1	H	M	L	L	M	H	M	L	-
CO2	H	M	M	L	M	M	M	-	-
CO3	H	M	M	M	M	L	M	M	L
CO4	M	H	M	M	L	H	M	M	M

Contents:

UNIT I (CO1)

(8 Hrs.)

Two Dimensional Problems in Cartesian coordinate system – Fundamentals of stress and strain, stress – strain relationship, Elastic constant, plane stress, plane strain, differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation, Airys stress function. Stress analysis of cantilever subjected to concentrated load at it's end and simply supported beam subjected to uniformly distributed load

UNIT II (CO2)

(7 Hrs.)

Two dimensional problem in polar coordinate systems – General equations of equilibrium in polar coordinate compatibility equation, stress distribution about symmetric, axis, stress analysis of cylinder subjected to ~ internal and external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk.

Two Dimensional Photoelasticity – Introduction to basic optics related to photoelasticity, Various photoelastic materials and their properties, Casting of photoelastic models, Tardy's compensation technique, Separation techniques like, shear difference, oblique incidence and electrical analogy.

UNIT III (CO3)

(7 Hrs.)

Introduction to 3-D photoelasticity – Phenomenon of Stress freezing, Method of stress freezing, slicing techniques, determination of material fringe constant at critical temperature.

Scaling Model – Prototype relations.

UNIT IV: (CO4) (7 Hrs.)

Grid technique of strain analysis, Brittle coating method for stress and strain analysis, Morie fringe method for stress and strain analysis.

Text Books:

1. Theory of Elasticity, S. P. Timoshenko ,3rd Edition, Tata McGraw Hills, 1970

Reference Books:

1. Experimental stress analysis, Dally and Riley, 3rd Edition, Tata McGraw Hills, 1991

SEMESTER-V**Elective III: BMEL 340: Mechanics of Composite Materials**

Complete Material									
Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	P	Total Hours		TA E	CA E	ES E	Cont. Evaluation	
2	-	-	2	2	10	15	25	-	50

Course Objectives:

1. To study students to Composite materials and their applications
2. To imbibe students about Micromechanical Analysis of Composite
3. Familiarization with the basic expressions and methods used in the mechanics of composite structures.
4. To study Analysis of Unidirectional and Laminated Composite

Course Out Comes:

Upon successful completion of the course, the students will be able to:

1. Understand the specifics of mechanical behavior of layered composites
2. Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
3. Determine stresses and strains in composites.
4. Apply failure criteria and critically evaluate the results

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	M	L	M	L	L	L	L

CO2	H	H	L	L	M	L	L	M	L
CO3	M	M	H	H	M	L	M	M	M
CO4	M	M	H	H	M	M	M	M	M

Contents:**Unit I (CO1)****[6 Hrs.]**

Introduction to Composite Materials: Definitions: Composite material, Fiber, Matrix. Types of fibers and Raw Fiber Properties, Types of Matrix, Prepregs, Fillers and other Additives; Advantages of Composite Materials and Structures. Applications and Use of Composite materials in present world; Mechanical Behavior of Composite Materials. Lamina, Laminate: The basic building block of a composite material

Unit II (CO2)**[8 Hrs.]**

Micromechanical Analysis of Composite Strength and Stiffness: Properties of typical composite materials. Volume and Weight Fractions. Longitudinal Strength and Stiffness. Transverse Modulus. In-plane shear Modulus. Poisson's ratio

Unit III (CO3)**[8 Hrs.]**

Elastic Properties of the Unidirectional Lamina: Stress-strain relationships. Engineering Constants. Stress strain relations of a Thin Lamina. Examples

Unit IV (CO4)**[8 Hrs.]**

Analysis of Laminated Composites: Laminates, Basic Assumptions, Strain-Displacement Relationship, Stress-Strain Relationships, Equilibrium Equations, Laminate Stiffness, Determination of Lamina Stresses and Strains, Types of Laminate Configuration, Balanced Laminate, Anti-symmetric Laminate, Examples

Text Books:

1. Mechanics of Composite Materials and Structures, MadhujitMukhopadhyay,Universities Press
2. Mechanics of Composite Materials, R M Jones, CRC Press

Reference Books:

1. Engineering Mechanics of Composite Materials, Issac M. Daniel, Orilshai, Abebooks
2. Micro-mechanics of Composite Materials, George J Dvorac, Springer

SEMSTER-VI**Elective IV: BMEL 346 Gas Turbine and Jet Propulsion**

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	Pu	Total Hours		TA	CA	ESA	Int	Ext	

			ur s							
2	-	-	2	2	1 0	1 5	2 5	--	--	50

Course Objectives:

1. To get awareness and familiarize with the latest developments in turbojet propulsion systems.
2. To know principles of jet propulsion and rocketry.
3. To study solid and liquid rocket propulsion system.
4. To know ramjet and integral rocket ramjet propulsion system.

Course Outcomes:

1. Build various concepts of turbojet propulsion systems.
2. Distinguish the jet propulsion and rocketry.
3. Categorize solid and liquid rocket propulsion system.
4. Interpret ramjet and integral rocket ramjet propulsion system

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	M	M	L	M	L	L	M	-
CO2	H	L	M	L	L	L	-	L	-
CO3	H	L	L	L	L	M	-	L	-
CO4	H	L	M	M	M	L	-	L	-

Contents:

Unit-I: (CO 1)

(8hrs)

Turbo Jet Propulsion System

Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery- compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis. Flight Performance: Forces acting on vehicle – Basic relations of motion – multi stage vehicles.

Unit-II (CO2)

(8hrs)

Principles of Jet Propulsion and Rocketry

Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet , turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.

Unit-III (CO3)

(8hrs)

Solid and Liquid Rocket Propulsion System

Solid propellants – classification, homogeneous and heterogeneous propellants, double base

propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.

Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components.

Unit VI: (CO 4)

(8 Hrs)

Ramjet and Integral Rocket Ramjet Propulsion System

Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and sub-critical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.

Reference Books:

1. Sarvanamuttoo, H.I.H., Rogers, G. F. C. and Cohen, H., Gas Turbine Theory, 6th Edition, Pearson PrenticeHall, 2008.
2. Ganesan, V., Gas Turbines, 3rd Edition, Tata McGraw Hill, 2010.
3. Yahya, S. M., Turbines, Compressors and Fans, 4th Edition, Tata McGraw Hill, 2010.
4. Mechanics and Dynamics of Propulsion/ Hill and Peterson/John Wiley & son.
5. Rocket propulsion elements/Sutton/John Wiley & Sons edition 8.
6. Gas Turbines/Ganesan /TMH
7. Gas Turbines & Propulsive Systems/Khajuria&Dubey/DhanpatRai& Son.
8. Rocket propulsion/Bever/ 6. Jet propulsion /Nicholas Cumpsty/

SEMSTER-VI

Elective IV: BMEL 351 Power Plant Engineering (Offline)

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	Pr	Total Hours		TA	CA	EE	Cont. Evaluation	
2	-	-	2	2	1 0	1 5	2 5	--	50

Course Objectives:

Students shall be able to

1. To understand the power capacity of nuclear power plant
2. To study performance of hydro power plants
3. To understand the steam power plant
4. Study the various components of power plant and unconventional power sources

Course Outcomes:

Student should be able

1. Demonstrate the nuclear power plant and its subcomponents
2. Utilize knowledge of hydroelectric power plant in application
3. Analyzing the components of steam power plant
4. Categorized the various sub components of power plant and unconventional power sources

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	L	L	L	M	H	L	M	-
CO2	H	H	H	L	M	H	L	M	-
CO3	M	H	H	M	L	L	M	M	-
CO4	H	L	M	L	L	M	L	M	-

Contents**Unit I (CO 1)****[7 hrs]**

Nuclear Power Generation

Introduction to Nuclear Engineering: Binding Energy, Energy release, Nuclear reactions & its initiation, Fission, Component of nuclear reactors & its material, Numericals based on energy release.

Nuclear Reactors: Types of reactors, PWR, BWR, CANDU, Gas cooled liquid metal cooled, Breeder reactor problems of operation, location of nuclear station, present & proposed nuclear plant in India.

Unit II (CO 2)**[6 hrs]****Hydroelectric Power Plant**

Hydrology : Rainfall, Runoff, Hydrograph, flow duration curve, mass curve.

Hydroelectric power plant : Site selection, classification of hydroelectric power plant, general arrangement, details of different components prime movers, governing, model & model testing advantages, comparison with other power plant.

Unit III (CO 3)**[7 hrs]**

Steam Power Plant

Introduction: Coal – its properties, handling & storage, fuel firing methods ash & dust handling boiler accessories, high pressure boiler, draught

system, steam turbine, condenser, cooling towers. Water treatment, steam pipes, power plant layouts, pollution from steam power plant.

Unit IV (CO 4)**[8 hrs]**

Introduction, classification, various components, different arrangement, governing, methods to improve efficiency, comparison with other power plant.

Diesel Electric Power Plant: Introduction, Outline, type of engines, different components, performance, plant layout comparison with other power plant.

Introduction to unconventional power sources – Solar, wind, Tidal, geothermal, MHD.

SEMSTER-VI**Elective IV: BMEL 352: Advanced Tool Design**

Teaching Scheme				Cr edi ts	Evaluation Scheme					
Th	Tu	Pr	To tal Ho ur s		Theory			Practical		To tal Mar ks
					TA E	CA E	ES E	Cont · Eval uation	Ext	
3	-	-	3	3	10	15	25	--	--	50

Course Objectives:

1. To reveal the essential properties, selection and recent progress in cutting tool materials
2. To select suitable single point cutting tool and multipoint cutting tool for machining process
3. To develop skill on design of Jigs and Fixtures for holding tool and work piece respective.
4. To create expertise in press tool design and fixtures for CNC machines.

Course Out Comes:

Upon the successful completion of the course students will be able to

1. Identify the properties of tool material, tool nomenclature and to classify the cutting tools
2. Interpret the parameters of the cutting tools for machining process
3. Distinguish the various locating and clamping methods
4. Design the jigs, fixtures, press tools and CNC machine tools

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	M	H	H	M	H	-	H
CO2	H	M	M	H	M	H	-	M
CO3	H	L	H	M	H	H	-	L
CO4	H	L	M	L	M	M	-	L

Contents:**Unit I (CO1) (7 Hrs.)**

INTRODUCTION TO TOOL DESIGN Introduction – Tool Engineering –Tool Classifications–Tool Design Objectives –Tool Design in manufacturing-Challenges and requirements-Standards in tool design-Tool drawings -Surface finish –Fits and Tolerances -Tooling Materials-Ferrous and Non-ferrous Tooling Materials-Carbides, Ceramics and Diamond –Non-metallic tool materials-Designing with relation to heat treatment.

Unit II (CO2) (8 Hrs.)

DESIGN OF CUTTING TOOLS Mechanics of Metal cutting –Oblique and orthogonal cutting-Chip formation and shear angle -Single-point cutting tools –Milling cutters –Hole making cutting tools-Broaching Tools -Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters

Unit III (CO3) (7 Hrs.)

DESIGN OF JIGS AND FIXTURES Introduction – Fixed Gages –Gage Tolerances –selection of material for Gages –Indicating Gages –Automatic gages –Principles of location –Locating methods and devices –Principles of clamping –Drill jigs – Chip formation in drilling –General considerations in the design of drill jigs –Drill bushings –Methods of construction –Thrust and Turning Moments in drilling -Drill jigs and modern manufacturing-Types of Fixtures –Vice Fixtures –Milling Fixtures –Boring Fixtures –Broaching Fixtures –Lathe Fixtures – Grinding Fixtures –Modular Fixtures –Cutting Force Calculations.

Unit IV (CO4) (8 Hrs.)

DESIGN OF PRESS TOOL DIES Types of Dies – Method of Die operation–Clearance and cutting force calculations-Blanking and Piercing die design –Pilots –Strippers and pressure pads-Presswork materials –Strip layout –Short-run tooling for Piercing –Bending dies –Forming dies –Drawing dies-Design and drafting. **TOOL DESIGN FOR CNC MACHINE TOOLS** Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools-Sub plate and tombstone fixtures-Universal fixtures–Cutting tools–Tool holding methods–Automatic tool changers and tool positioners –Tool presetting–General explanation of the Brown and Sharp machine.

Text Books:

1. Cyril Donaldson, George H. LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2010.
2. E.G. Hoffman, "Jig and Fixture Design", Thomson Asia Pvt Ltd, Singapore, 2013
3. Prakash Hiralal Joshi, "Tooling data", Wheeler Publishing, 2006

Reference Books

1. M. Weck, "Handbook of Machine Tools, Vol. 1-4", John Wiley, USA. 20102. Mehta, N.K., "Machine Tool Design", Tata McGraw Hill, 2012.

Web References: 1. www.irdi.on.ca/irdi/front.html
2. www.techsolve.org/flashhome.html

Online Courses:

1. <https://www.coursera.org/specializations/digital-manufacturing-design-technology>
2. <https://www.edx.org/learn/mechanical-engineering>
3. <https://nptel.ac.in/courses/112105126/35>

SEMSTER-VI**Elective IV: BMEL 353 OPERATION RESEARCH & MANAGEMENT**

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	
T	T	P	Total Hours		T A E	C A E	E S E	Cont. Evaluation	Total Marks
2	-	-	2	2	10	15	25	--	50

Course Objectives:

1. To study operational research methodology and its application to engineering
2. To illustrate students the use of quantitative methods and techniques for effective decision making
3. To study Transportation and Assignment problems and its application to engineering
4. To study project management and its importance to engineering students

Course Outcomes:

1. To solve the industrial problems using Operation Research methodology.
2. To formulate the real world problem into a mathematical form and provide an optimum solution for implementation.
3. To solve the real world assignment and Transportation Models and provide an optimum or feasible solution.
4. To utilize the concept and knowledge of project management to achieve the project goals.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 1 1	PO 1 2	PSO 1	PSO 2	PSO 3
CO1	H	M	M	H	L	M	H	-	-

CO2	H	H	L	M	M	L	M	-	-
CO3	H	H	L	L	L	M	H	-	-
CO4	H	H	H	H	H	L	L	-	-

Contents:

Unit-I: (CO 1) (07 Hrs)

Introduction:

OR methodology, Definition of OR, Application of OR to engineering and Managerial problems, Features of OR models, Limitation of OR.

Unit II: (CO 2) (08 Hrs)

Linear Programming:

Definition, mathematical formulation, standard form, solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Graphical and simplex methods, Big M Method, formulation of Dual of LPP.

Unit III: (CO 3) (07 Hrs)

Transportation & Assignment Problems

Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods, Unbalanced transportation problem, Variants in Transportation Problems, Applications of Transportation problems. Transshipment problems. Formulation of the Assignment problem, unbalanced assignment problem, typical assignment & travelling salesman problem.

Unit IV: (CO 4) (08 Hrs)

Project Planning

Project Management: Drawing of Network, CPM & PERT, Probability of completion of project, Cost analysis of project, Allocation & updating of Network.

Text Books:

1. 'Operation Research' by Ashkhedkar&Kulkarni

Reference Books:

1. 'Operation Research' by Hira& Gupta, S. Chand Publishers, Revised Edition.
2. 'Operation Research' by J.K. Sharma, Trinity Publishers, sixth edition.
3. 'Operation Research' by Vohra N D, McGraw Hills Publishers, third edition.
4. 'Operation Research' by Liberman, McGraw Hills Publishers, 10th edition, 2015.
5. 'Operation Research' by A P Verma, S.K. Kataria& Sons publishers, 2012 edition.
6. 'Operation Research' by Manohar&Mahajan, DhanpatRai Publications, 2004.

SEMESTER-VI

E-IV: BMEL 354 Mechanical Vibration

Teaching Scheme	Credits	Evaluation Scheme		
		Theory	Practi	Tot

T h	T u	P r	Tot al Ho urs					cal	al Ma rks
					T A E	C A E	E S E	Cont. Evalu ation	
2	-	-	2	2	1 0	15	2 5	-	50

Course Objectives:

1. To know the general requirements of machine tool design process.
2. To acquire the knowledge of design of machine tools transmission systems
3. To know the design procedure for machine tool structures
4. To understand the various parameters in machine cutting process.

Course Out Comes:

At the end of the course, the student will be able

1. To build the machine tool Layout
2. To choose the proper drive for the specific machine tool
3. To interpret the cutting forces analysis and estimation of Power Requirement
4. To design the machine tool structural elements.

CO Mapping with PO and PSO:

Cour se Outc ome s	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O1 2	P S O 1	P S O 2	PS O3
CO1	H	H	M	M	H	L	H	M	M
CO2	H	L	L	M	M	L	H	M	L
CO3	M	H	H	L	M	L	H	M	L
CO4	M	H	H	M	L	L	H	L	M

Contents:

Unit-1 Principles Of Machine Tool Design

(5 hrs)

General requirements of machine tool design - design process machine tool layout general requirements of machine tool design – design process machine tool layout

Unit-2 Machine Tool Drives and Mechanisms (7 hrs)

Working and auxiliary motion. Drives- Electric drives, Hydraulic transmission, Kinematic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, stepless regulation of speeds and feeds.

Unit-3 Cutting Force Analysis And Power Requirement (7 hrs)

In Turning, Milling, Drilling, Shaping and Broaching operation with simple problems. General

requirements of machine tools - Centre lathe, Milling machine.

Unit-4 Design Of Machine Tool Structures

(7 hrs)

Functions-Requirements-Design criteria Material used – static and dynamic stiffness – Profile and basic design procedure for machine tool structures. Design of beds, columns, housing, bases, tables, cross-rails, arms saddle, carriages.

Text Books:

1. Machine tool design and numerical control by N. K. Mehta, Tata McGraw Hills
2. Design of Machine Tools by S. K. Basu, H. K. Pal, OBIH
3. Principles of machine Tools by Sen. and Bhattacharya, New Central Book Agency
4. Metal cutting Theory and Practice, A. Bhattacharya, New Central Book Agency(P)Ltd
5. Machining and Machine Tools, A. B. Chattopadhyay. Wiley-India Publication

Reference Books:

1. Principles of machine Tools by Koenigs-Berger

SEMESTER-VI

BMELE-IV: BMEL 355 Tribology

Teaching Scheme				Credits	Evaluation Scheme				Total Marks
T	T	P	Total Hours		Theory			Practical	
h	u	r			T A E	C A E	E S E	Cont. Evaluation	
2	-	-	2	2	10	15	50	--	75

Course Objectives:

1. To Introduce And Expose Students To The Field And Fundamentals In Tribology And Its Applications.
2. To explain the different Friction and wear processes in contacts between metallic, ceramic and polymeric surfaces.
3. To develop an ability to Explain the processes of lubrication in all regimes Select a suitable lubricant for a specific application.
4. To develop analytical skills for general purposes and select a suitable material combination for tribological contacts.

Course Outcomes:

Students shall be able to:

1. Ability To Design Friction, Wear And Lubrication
2. Ability To Identify Different Types Of Sliding & Rolling Friction, Wear And Related Theories

3. Ability To Distinguish Among The Different Lubricant Regime.

4. Select Materials For Bearing.

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 1 2	PSO 1	PSO 2	PSO 3
CO1	H	H	H	H	H	H	M	H	H
CO2	H	H	M	H	M	M	H	H	M
CO3	H	M	M	H	M	H	M	H	M
CO4	M	H	H	H	M	H	M	H	M

Contents:

UNIT I (CO1): (8 Hrs.)

Defining Tribology, Tribology in Design - Mechanical design of oil seals and gasket - Tribological design of oil seals and gasket, Tribology in Industry (Maintenance), Defining Lubrication, Basic Modes of Lubrication, Properties of Lubricants, Lubricant Additives, Defining Bearing Terminology - Sliding contact bearings - Rolling contact bearings, Comparison between Sliding and Rolling Contact Bearings.

UNIT II (CO2): (7Hrs.)

Friction - Laws of friction - Friction classification - Causes of friction Theories of Dry Friction, Friction Measurement, Stick-Slip Motion and Friction Instabilities, Wear - Wear classification - Wear between solids - Wear between solid and liquid - Factors affecting wear - Measurement of wear, Theories of Wear, Approaches to Friction Control and Wear Prevention, Boundary Lubrication, Bearing Materials and Bearing Construction.

UNIT III (CO3): (8Hrs.)

Mechanics of Fluid Flow - Theory of hydrodynamic lubrication - Mechanism of pressure development in oil film, Two Dimensional Reynolds's Equation and its Limitations. Idealized Bearings, Infinitely Long Plane Fixed Sliders, Infinitely Long Plane Pivoted Sliders, Infinitely Long Journal Bearings, Infinitely Short Journal Bearings, Designing Journal Bearing - Sommerfeld number - Raimondi and Boyd method - Petroff's Solution - Parameters of bearing design - Unit pressure - Temperature rise - Length to diameter ratio - Radial clearance - Minimum oil-film thickness.

UNIT IV (CO4): (7Hrs.)

Flat plate thrust bearing, Tilting pad thrust bearing, Pressure Equation, Load, center of pressure, Friction, gear teeth bearings, rolling element bearings. Hydrostatic Lubrication, Squeeze Film

Lubrication, journal bearings. Thrust bearings with air lubrication,

Text Books:

1. [Fundamentals Of Engineering Tribology With Applications](#), Harish Hirani, Cambridge university press, 2017
2. A Textbook of Tribology, [A. kumar](#), S K KATARIA & SONS, edition, 2014.
3. Tribology, [Krishan Kant Sharma](#), Laxmi Publications; First edition (2016),
4. Fundamentals of Tribology, [Basu](#), Prentice Hall, 2005
5. "Principles and applications of tribology", by B. Bhushan, Wiley, 2012
6. A. Harnoy. "Bearing Design In Machinery "Marcel Dekker Inc, New York, 2003.

References books

1. Introduction to Tribology of Bearings, B C Majumdar, S. Chand and company ltd. 2010.
2. Engineering Tribology" by G. Stachowiak and A.W. Bachelor.

SEMSTER-VIII

Elective V: BMEL 414 BMEP 414: Refrigeration & Air Conditioning (Offline) (Elective V)

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
								Int	Ext	
Th	Tu	Pr	Total Hours		TA	CA	ESE			
2	-	2	4	3	10	15	50	25	--	100

Course Objectives:

1. To get awareness and familiarize with the latest developments in refrigeration and air-conditioning.
2. To know environment related issues with use of refrigerants and ecofriendly refrigerants.
3. To study both conventional and non - conventional refrigeration systems.
4. To know air conditioning equipment's and study design of air conditioning, and air handling units.

Course Outcomes:

1. Build various concepts of refrigeration systems and environment related issues with use of refrigerants related to engineering field in order to become professionally efficient.
2. Distinguish the multistage refrigeration system also analyze various non-conventional

refrigeration systems to develop new efficient systems.

3. Determine various psychometric terminologies and load calculation
4. Design air transmission, handling and distribution systems.

CO Mapping with PO and PSO:

Course ↓ Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 7	PSO 1	PSO 2	PSO 3
CO1	H	H	M	H	M	H	M	H	L
CO2	H	L	M	M	L	M	M	H	L
CO3	H	H	H	M	L	L	M	H	-
CO4	H	H	H	M	L	L	M	H	-

Contents:

Unit-I: (CO 1)

(8hrs)

Refrigeration

Introduction, Definition, Applications. Study of simple vapour compressions refrigeration system: Analysis of simple vapour compression refrigeration system, effect of sub-cooling, superheating, polytropic compression & pressure drops on the performance of the system.

Study of vapour absorption refrigeration system: Introduction Ammonia –Water, Lithium bromide-water systems, three fluid refrigerator.

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential Montreal&Kyoto protocol. Alternanteréfrigérants.

Unit-II (CO2)

(8hrs)

Multi stage vapour compression Refrigeration system and Other Refrigeration Techniques

Multiple compressor & multiple evaporator systems, cascade refrigeration systems. Study of equipment's such as compressors, evaporators, expansion devices & controls defrosting Methods (types & principle only). Testing & charging of refrigeration systems.

Other Refrigeration Techniques

Air cycle refrigeration, Applications in air refrigeration systems, Vortex tube, and thermoelectric refrigeration.

Cryogenics: Introduction Application of cryogenics Houle – Thomson coefficient, inversion curve methods of liquefaction of air.

Unit-III (CO3)

(8hrs)

Psychrometry

Introduction, Psychometric properties of air, psychometric chart psychometric processes by pass factor, apparatus dew point temperature.

Human Comfort: Mechanism of body heat losses, factors affecting human comfort effective temperature, Comfort chart.

Application of psychometric to various air-conditioning systems RSHF, GSHF, ESHF, Airwashers, air coolers. Heat Load Calculations: Data collection for load calculation, various components of heat load estimate, method of cooling load calculation.

Unit VI: (CO 4) (8 Hrs)

Air Transmission & Distribution

Principle of air distribution, types of grills & diffusers & their selection criteria, air alteration, types of air filter, distribution of air through ducts, pressure losses in ducts, methods of duct design, duct friction chart, air conditioning controls.

Reference Books:

1. Refrigeration & Air conditioning, C.P. Arora, Second Edition, Tata McGraw Hill Publication, 2009
2. Refrigeration & Air conditioning, Dr. Manohar Pressed, First Edition, New Age International Publication, 2007
3. Refrigeration & Air conditioning, P.L. Ballany, Second Edition, Khanna Publisher, 2007
4. A Course in Refrigeration & Air conditioning, Domkundwar & Arora, Second Edition, Dhanpat Rai & Sons Co. 2009
5. Refrigeration & Air conditioning, Stocker & Jones, Second Edition, McGraw Hill Publication, 2008
6. ASHRAE hand books, Air Conditioning Engineers, 2005.

SEMSTER-VIII

Elective V: BMEL 415: BMEP 415: Automation in Production

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	P	Total Hours		TA	CA	EE	Cont. Evaluation	
2	0	2	4	3	10	15	50	25	100

Course Objectives:

1. To introduce concept of fixed automation through design of transfer lines and automated handling systems
2. To introduce numerical control of machine tools, their construction as well programming of robot.
3. To provide exposure to automated material handling and tool handling systems such as industrial robots, AGVs and AS/RS

4. To introduce FMS and awareness of usage of computers in process planning and quality control

Course Out Comes:

Upon successful completion of the course, students will be able to

1. Apply the automation techniques in industry.
2. Develop part programming of CNC and robotics.
3. Design automated storage and retrieval systems
4. Implement GT and FMS concepts in manufacturing and use various quality inspection techniques.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes				Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 5	PSO 1	PSO 2	PSO 3
CO1	H	M	H	H	H	-	-
CO2	H	L	M	H	M	-	-
CO3	H	M	L	M	H	-	-
CO4	H	L	M	M	M	-	-

Contents:

UNIT-I(CO1)

(7 Hrs)

Automation – Definition, Comparison of fixed, programmable and flexible automation, automation strategies, reasons for automation, applications. Automated Flow Line - Methods of work part transport, transfer mechanisms, analysis of transfer lines with and without buffer storage, Assembly line: Line balancing problem, methods of line balancing, parts delivery system.

UNIT II(CO2)

(8Hrs)

Numerical Control – Basic concepts, components of NC, types of NC Systems – point to point, straight cut and continuous path, applications and economics of NC, CNC part programming: Manual part programming and APT programming
Industrial Robotics – Definition, robot anatomy, robot configurations, robot specifications. Robot peripherals: End effectors, sensors, Robot applications

UNIT – III(CO3)

(7 Hrs)

Automated Guided Vehicle Systems : Types, Vehicle guidance & Routing, Traffic control & Safety system management, Analysis of AGVS systems, AGVS applications.

Automated Storage & Retrieval System: Types, Basic components & special features of AS/RS,

Carousel storage systems, quantitative analysis of AS/RS & Carousel.

UNIT – IV(CO4) (8Hrs)

Flexible manufacturing system and Group technology:

FMS – Components, Types of systems, FMS layout configuration computer functions, level of flexibility, data files system reports, FMS benefits

Computer Aided Process Planning and Computer Aided Quality Control:

CAPP - Retrieval & generative CAPP systems, benefits of CAPP

TEXTBOOKS:

1. P. Radhakrishnan, S. Subramanyam, V. Raju, "CAD/CAM/CIM", New Age Publisher, 2004
2. Mikell P. Groover, "Automation, Production Systems, and Computer-integrated Manufacturing", Prentice Hall, 2013

REFERENCE BOOKS:

1. Krar, S., and Gill, A., "CNC Technology and Programming", McGraw Hill Publication Co, 2012.
2. Gibbs, D., "An Introduction to CNC Machining", Casell, 2015.
3. Seames, W.S., "Computer Numerical Control Concepts and Programming", Delmar Publishers, 1986.
4. Lynch, M., "Computer Numerical Control for Machining", McGraw Hill, 2002.
5. Koren Y, "Computer Control of Manufacturing Systems", McGraw, 2005.

SEMESTER-VIII

E-V: BMEL 416: BMEP 416: Finite Element Method In Engineering

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	Total Marks
Th	Tu	P	Total Hours		TA	CA	EE	Cont. Evaluation	
2	-	-	2	2	10	15	25	-	50

Course Objectives:

1. To teach the fundamentals of finite element method with emphasize on the underlying theory and assumption.
2. To develop theoretical foundations and appropriate use of finite element methods.
3. To provide hands on experience using finite element software to model, analyze and design systems.
4. To inculcate programming knowledge of generating algorithms.

Course Out Comes:

1. Shall be able to evaluate and compare FEM with other numerical methods
2. Students shall demonstrate an ability to derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts. Shall be able to develop the skills of solving truss and beam problems for various loading conditions
3. Shall be able to develop an appropriate knowledge of analysis to handle for the mechanical problems, with proper selection of materials and elements.
4. Shall be able to develop competence to design and analyze problems of engineering particularly having relevance to vibration & dynamic analysis. Shall be able to demonstrate ability to make use of commercial software to solve problems.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	M	H	H	H	M	M	M
CO2	H	H	H	H	H		H	H	M
CO3	H	H	M	H	H	H	H	M	M
CO4		H		H	H	H	H	H	H

Contents:

UNIT I (CO1)

(7Hrs)

Fundamentals of stress and strain, stress and strain components, stress strain relationship, Elastic constants, plane stress, plane strain, differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle, Airy's Stress function.

UNIT II : (CO2)

(7Hrs)

Fundamental concept of FEM – Historical background, Scope of FEM in Engg. Applications, Principle of minimum potential energy. Concept of Virtual work Raleigh – Ritz method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra and operations, eigen values and eigen vectors. Methods for solution of simultaneous equations. Like Gauss elimination, Matrix decomposition method. Concept of discretization of body into elements, degrees of freedom, bandwidth, Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function Commercial FE Software's. Finite element modeling and analysis using Bar and Beam element – stiffness matrix assembly, boundary conditions, load vector,

temperature effects. Two dimensional plane - Local and Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force and stress calculations.

UNIT III : (CO3) (8Hrs)

Two dimensional problems using CST and LST – formulation of CST and LST elements, element stiffness matrix, assembly, boundary conditions, load vector. Stress calculation. Axis-symmetric solids subjected to axi-symmetric loading – axi – symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses.

UNIT IV: (CO4) (7Hrs)

Steady state one dimensional and two dimensional heat conduction problems using I-D and triangular element respectively.

Programming aspects of FEM – Algorithms for, reading Finite Element modeling data, formation of element stiffness matrix, formation of elemental load vector. Assembly of individual elemental spiffiness matrix into global ‘stiffness’ matrix, assembly of individual elemental load vector into global load vector, application of boundary conditions, solution of equations, determination of stresses and strains.

Pre – Post processing in FEA.

Text Books:

1. Introduction to Finite Elements in Engineering- Tirupathi R. Chandrupatla, Ashok D. Belegundu, 3rd Edition, Pearson Education, 2002
2. Theory Of Elasticity- GoodierJn, Sp Timoshenko, Timoshenko Sp, 3rd Edition, Tata Mcgraw Hill Publishing Co. Ltd-2012

Reference Books:

1. Concept and applications of Finite element Analysis- David S Malkus, Robert D Cook, Michael E Plesha, 4th Edition, John Wiley & Sons Inc (sea) Pte Ltd-2012
2. The Finite Element Method – A basic introduction for engineers – D.W. Griffiths, D.A. Nethercot, Granada Publishing, 1983

SEMESTER-VIII

E-V: BMEL 417: BMEP 417: Computer Aided Design

Teaching Scheme				Credits	Evaluation Scheme					
Th	Tu	Pr	Total Hours		Theory			Practical		Total Marks
					TA	CA	EE	Cont. Evaluation	Ext	

2	-	2	4	3	10	15	50	25	--	100

Course Objectives:

1. To develop basic knowledge and experience of engineering modeling concepts.
2. To understand various transformations used in CAD.
3. To develop basic knowledge and experience of various curve representations and generations.
4. To teach the fundamentals of Finite element method.
5. To study and use various analysis techniques
6. To develop competency in optimization techniques

Course Out Comes:

Upon the successful completion of the course students shall be able to

1. Choose and Define the CAD principles in engineering problems.
2. Apply Rasterization principles over Computer Graphics.
3. To solve numerical on transformation and modeling of curves.
4. Evaluate engineering problems using Finite element method & Finite element analysis.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 9	PSO 1	PSO 2	PSO 3
CO1	H	H	M	H	H	H	M	-	-
CO2	M	H	M	H	H	H	M	H	M
CO3	H	H	M	H	H	M	M	-	-
CO4	H	H	M	H	H	-	M	H	M

Contents:

UNIT I(CO1)

(6 Hrs)

Introduction to CAD, application and advantages of CAD to Mechanical Engineering filed etc. CAD Softwares modules (Operating System, Graphics, Applications, Programming, Communication). Rasterization Principle, Rasterization of line, frame buffer, N- bit plane buffers, simple colour frame buffer.

UNIT II (CO2)

(7 Hrs)

Line, Circle and Ellipse Generation using Bresenham algorithms and Line Generation using DDA Algorithm. Two dimensional transformation- Rotation Scaling, translation, reflection, mirror and shear. Homogeneous transformation,

concatenation. Inverse transformations.

UNIT III(CO3) (9 Hrs)
Three dimensional geometric and co-ordinate transformation- Scaling, translation, reflection. Geometric Modeling- Wireframe, Surface and Solid Modeling. Representation of Curves and surfaces – parametric Form, Design of Curve shape-Cubic Spline, Bezier Curve, B-Spline, design of surfaces. CSG and B-rep.

UNIT IV (CO4) (8 Hrs)
Finite Element Method: introduction- Basic Concept of Finite Element Method-Plain Stress and Strain, Minimum potential energy principle. Displacement function, shape function for linear and quadratic bar element. Matrices- Stiffness, Force and displacement. Finite Element analysis of 1-D Problem.

UNIT V (CO5) (7 Hrs)
Truss: - Finite Element analysis of 2-D problems-constant Stain Triangle, Mesh generation Techniques, Problems on Beams and Frames.

UNIT VI (CO6) (9 Hrs)
Optimization: Optimal Problem Formation, Engineering optimization problems. Optimization Algorithms: single Variable optimization algorithm using Golden Search method, Bisection method. Multivariable Optimizations using Simplex search method. Penalty faction method.

Text Books:

1. CAD / CAM, Theory and Practice: Ibrahim Zeid.
2. Procedural elements for computer Graphics: D. Rogers.
3. Introduction to Finite Elements in Engineering:Chandrupatla and A.D. Belegundu.
4. Optimization for Engineering Design:Kalyanmoy Deb.
5. Mathematical Elements for Computer Graphics :David F. Rogers, J. Alan Adams.

Reference Books:

1. Concept and applications of Finite element Analysis- David S Malkus, Robert D Cook, Michael E Plesha,4th Edition, John Wiley & Sons Inc (sea) Pte Ltd-2012.
2. The Finite Element Method – A basic introduction for engineers – D.W. Griffiths, D.A. Nethercot, Granada Publishing,1983

SEMSTER-VIII

Elective V: BMEL 418: BMEP 418: COMPUTATIONAL FLUID DYANAMICS

Teaching	Cre	Evaluation Scheme

Scheme				dit s	Theory			Practical		To tal Ma rk s
T h	T u	P r	To tal Ho ur s		T A E	C A E	E S E	Cont. Eval uatio n	E x t	
2	-	2	4	3	1 0	1 5	5 0	25	--	10 0

Course Objectives:

1. To introduce the students to widely use differential equations in computational fluid dynamics
2. To understand various governing equations and boundary conditions.
3. To learn commercial CFD code

Course Outcomes:

After successful completion of course

1. Student should be able to explain basic concepts of finite element method and finite volume method.
2. Student should be able to choose proper solution method of elliptical equation.
3. Student should be able to apply numerical analysis to solve hyperbolic equation.
4. Student should be able to apply various governing equations and boundary conditions to formulate incompressible viscous flow

CO Mapping with PO and PSO:

Cours e Outco mes	Programme Outcomes						Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 9	P S O 1	P S O 2	PS O3
CO1	H	H	M	H	H	H	M	H	-
CO2	M	H	M	H	H	H	M	H	-
CO3	H	H	M	H	H	M	M	H	-
CO4	H	H	M	H	H	M	M	H	-

UNIT 1

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions. Derivation of finite difference equations.

UNIT 2

Solution methods: Solution methods of elliptical equations – finite difference formulations, interactive solution methods, direct method with

Gaussian elimination. Parabolic equations-Explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT 3

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kuttamethod.

UNIT 4

Formulations of incompressible viscous flows: Formulations of incompressible viscous Flows by finite difference methods, pressure correction methods, vortex methods. Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flowfield-dependent variation methods, boundary conditions, example problems. Finite volume method: Finite volume method via finite difference method, formulations for two And three-dimensional problems.

Standard variation methods - 1: Linear fluid flow problems, steady state problems, Standard variation methods – 2: Transient problems.

Text Books:

1. Computational fluid dynamics, T. J.Chung, Cambridge University press,2002.
2. Text book of fluid dynamics, Frank Chorlton, CBS Publishers & distributors, 1985.

Reference Books/Material:

1. Ferziger J. H., Springer P.M, "Computational Methods for fluid Dynamics", Verlag Berlin
2. Anderson J. D. JR, "Computational fluid Dynamics", McGraw Hill Inc, 1995
3. Patankar S. P, " Numerical Heat Transfer & Fluid flow"
4. Sunderarajan M.K., "Computational Fluid Flow and Heat Transfer", 2nd Ed, Narosa Publishing

SEMSTER-VIII

Elective-V:BMEL 419:BMEP 419: Metrology and Quality Control

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Th	Tu	Pr	Total Hours		TA	CA	ES	Cont. Evaluation	Ext	

2	-	-	2	2	10	15	25	--	-	50

Course Objectives:

1. To understand the standards of measurement, system of limits, fits, tolerances and gauging.
2. To understand the principles of measuring instruments.
3. Acquire the knowledge on measurement and measurement systems.
4. To study acceptance sampling and different statistical quality control tools and techniques.

Course Outcomes:

After studying this course, students will be able to:

1. Apply the standards of measurement, system of limits, fits, tolerances and gauging.
2. Identify and use appropriate measuring instruments.
3. Acquire the knowledge on measurement and measurement systems
4. Apply concepts of quality management to manufacturing operations and use various quality and productivity improvement techniques

CO Mapping with PO and PSO:

Course Outcomes ↓ mes	Programme Outcomes				Programme Specific Outcomes		
	PO 1	PO 2	PO 6	PO 7	PS O 1	PS O 2	PS O 3
CO1	H	H	L	M	H	-	-
CO2	H	M	M	L	H	-	-
CO3	H	H	M	M	H	M	-
CO4	H	L	H	H	H	-	-

Contents:

Unit-I: (CO 1)

(8hrs)

System of limits, Fits, Tolerances and gauging:

Definition and Objectives of metrology Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional – tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges. Types of gauges -plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials.

Unit-II(CO2)

(7hrs)

Measurement of surface finish: Introduction, terminology, specifying roughness on drawings, surface roughness parameters, factors affecting surface roughness, ideal surface roughness,

roughness measurement methods, precautions in measurement, surface microscopy, surface finish softwares.

Screw thread metrology: Introduction, screw thread terminology, screw thread measurement.

Unit-III (CO3) (8hrs)

Measurements and Measurement systems:

Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors. Transducers, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers dynamometer.

Unit-IV (CO4) (7hrs)

Organization structure for managing quality, information systems and documentation, quality auditing, ISO 9000 - QS 9000, QMS, quality awards

Text Books:

1. Beckwith Marangoni and Lienhard, John H. Lienhard V "Mechanical Measurements", 6th Ed., 2006, ISBN-13: 978-0201847659.
2. R.K.Jain "Engineering Metrology", Khanna Publishers, 1994, ISBN 13: 9788174091536.
3. Harvid Noori and Russel, 'Production and Operations Management - Total Quality and Responsiveness', McGraw-Hill Inc, 1995

Reference Books:

1. I.C.Gupta "Engineering Metrology" Dhanpat Rai Publications, Delhi, 2013, ISBN 13: 1234567144039.
2. Alsutko, Jerry. D.Faulk "Industrial Instrumentation", Thompson Asia Pvt. Ltd.2002, ISBN-13: 978-0827361256
3. D.S.Kumar, 'Mechanical Measurement & Control', Metropolitan Book Company, 4th edition 2014.
4. Engineering Metrology – K.J. Hume, Macdonald and Co. (publisher) London
5. The Springer handbook of metrology and Testing, Czichos (Ed), 2011

Department of Electronics & Telecommunication

Vision of the Institute

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards with capabilities of accepting new challenges.

Mission of the Institute

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stakeholders. Our strength is directed to create competent professionals. Our endeavor is to provide all possible support to promote research and development activities.

Vision of the Department

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards in electronics & telecommunication engineering with capabilities of accepting new challenges.

Mission of the Department

Mission of the Department is

- To create competent professionals who are trained in the design, implementation of engineering & telecommunication systems
- To contribute towards the advancement of engineering, science and technology
- To impart quality and value based education to raise satisfaction of all stake holders
- To promote research & development activities in the field of electronics & telecommunication engineering and allied areas

Programme Educational Objectives

- **PEO1:** Identify, define and solve problems in the fields of electronics & communication engineering.
- **PEO2:** Employ necessary techniques and tools for advanced engineering applications, engage themselves in research and development, and take up higher education.
- **PEO3:** Use their skills in ethical & professional manner to raise the satisfaction level of the stakeholders.

Programme Outcomes and Programme Specific Outcomes

Graduates of Electronics and Telecommunication Engineering shall be able to

Programme Outcomes

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Programme Specific Outcomes

Graduates of Electronics and Telecommunication Engineering shall be able to

- PSO1:** Demonstrate industrial practices learned through internship and solve the live problems of the industries
- PSO2:** Acquire multidisciplinary knowledge through projects and hands on experience to meet industry needs.
- PSO3:** Demonstrate capability to undertake higher studies and develop leadership qualities to emerge as potential entrepreneur.

B.TECH. ELECTRONICS & TELECOMMUNICATION ENGINEERING

Term-I												
Sub. Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Total
		Th.	Tu	Pr.	Total	Credit	Theory			Practical		
							TAE	CAE	ESE	Int.	Ext.	
BFYL101	Matrices (Maths-I)	1	1	-	2	2	10	15	25	-	-	50
BFYL102	Differential & Vector Calculus (Maths-II)	1	1	-	2	2	10	15	25	-	-	50
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	-	75
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	-	-	50
BEEL103	Energy Sources & Audit	1	-	-	1	1	10	15	-	-	-	25
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	-	100
BECL101 BECF101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	-	75
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	-	-	50
BCSP101	Data Analytics	-	-	2	2	1	-	-	-	25	-	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	-	-	-	25	--	25
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	-	25
BFYP131	Waste Management	-	-	2	2	1	-	-	-	25	-	25
BFYP132	Environmental Science	-	-	1	1	0.5	-	-	--	25	--	25
Total		9	4	16	29	21	80	120	175	225	-	600

Term-II												
Sub. Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Total
		Th .	T u	Pr .	Total	Credit	Theory			Practical		
							TA E	CA E	ES E	Int.	Ext .	
BFYL103	Integral & Multiple Calculus (Maths-III)	1	1	-	2	2	10	15	25	-	-	50
BFYL104	Ordinary & Partial Diffrential Equations (Maths-IV)	1	-	-	1	1	10	15	25	-	-	50
BECL102 BECP102	Engg. Mechanics-(CIVIL)/Analog Circuits - (IT+CSE+ETC+ETRX+EE)	1	1	2	4	3	10	15	25	25	-	75
BFYP152	Internet of Things	-	-	2	2	1	-	-	-	25	-	25
BFYL121 BFYP121	App. Physics	1	1	2	4	3	10	15	25	25	-	75
BCSP102	Data Structure	-	-	4	4	2	-	-	-	50	-	50
BECP103	Embedded Programming	-	-	2	2	1	-	-	-	25	-	25
BMEP102	Digital Fabrication	-	-	4	4	2	-	-	-	50	-	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	-	-	-	50	-	50
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	-	100
BMBP101	Entrepreneurship	-	-	2	2	1	-	-	-	25	-	25
BHUP102	Ethics & Professional Competancies	-	-	2	2	1	-	-	-	25	--	25
Total		4	5	26	35	22	50	75	125	350	-	600

Term-III													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					Total
			Th .	T u	Pr .	Total	Credit	Theory			Practical		
								TA E	CA E	ES E	Int .	Ext .	
BFYL112	Maths-5,Mathematical Modeling		1	1	-	2	2	10	15	25	-	-	50
BHUP203	Quant		-	-	1	1	0.5	-	-	-	25	-	25
BHUP202	Reasoning		-	-	1	1	0.5	-	-	-	25	-	25
BAIP202	Skill Development - 1(Linear Algebra)	Online	-	-	2	2	1	-	-	-	25	25	50
BHUP205	Buisness English Certification -I		-	-	4	4	2	-	-	-	50	-	50
BHUP204	Liberal Arts/Creative Arts (Hobby Module)		-	-	1	1	0.5	-	-	-	25	-	25
BAIP204	Foundation course in ANN	Online	-	-	2	2	1	-	-	-	25	25	50
BECL215 BECP215	Electronic Devices & Circuits	Offline	2	-	2	4	3	10	15	25	25	-	75
BEEL206	Network Theory	Offline	1	1	-	2	2	10	15	25	-	-	50
BECL216 BECP216	Communication Electronics	Offline	2	-	2	4	3	10	15	25	25	-	75
BECL217	Signal & Systems	Offline	1	1	-	2	2	10	15	25	-	-	50
BECL218 BECP218	Embedded Systems Design	Online	2	-	2	4	3	10	15	25	25	25	100
Total			9	3	17	29	20.5	60	90	150	250	75	625

Term-IV													
Sub. Code	Name of the Course	Mode of Conducti on	Teaching Scheme					Evaluation Scheme					Total
			Th .	T u	Pr .	Tot al	Cred it	Theory			Practica l		
								TA E	CA E	ES E	Int .	Ext .	
BFYL113	Maths 6 (Optimization & z transforms)		1	1	-	2	2	10	15	25	-	-	50
BMBP102	Enterprenuers hip Development Practice		-	-	2	2	1	-	-	-	25	-	25
BHUP206	Aptitude 1		-	-	1	1	0.5	-	-	-	25	-	25
BAIL203	Machine Learning Algorithms	Online	2	-	-	2	2	10	15	25	-	-	50
BECL220	Sensor & Actuators	Offline	1	-	-	1	1	10	15	25	-	-	50
BECL221	Electromagneti c Field & Waves	Offline	1	1	-	2	2	10	15	25	-	-	50
BECL222 BECP222	Analog Systems & Design	Offline	2	-	2	4	3	10	15	25	25		75
xxxxx	Open Elective-I	Offline	2	-	-	2	2	10	15	25	-	-	50
BECL223 BECP223	Digital Communication	Offline	2	-	2	4	3	10	15	25	25		75
BECL224 BECP224	Introduction to Drones	Online	1	-	2	3	2	10	15	25	25	-	75
BCSL208 BCSP208	Data Base Management System	Online	2	-	2	4	3	10	15	25	10	15	75
Total			14	2	11	27	21.5	90	135	225	135	15	600

Term-V													
Sub. Code	Name of the Course	Mode of Conducti on	Teaching Scheme					Evaluation Scheme					Total
			T h.	T u	Pr .	Tot al	Cred it	Theory			Practica l		
								TA E	CA E	ES E	Int .	Ex t.	
BFYL14	Maths 7 (Matrix differential equations)		1	1	-	2	2	10	15	25	-	-	50
MBP104	Advanced Communication Skills		-	-	4	4	2	-	-	-	50	-	50
BECP317	Skill Development - 2 (VLSI based Project)			-	2	2	1	-	-	-	25	25	50
BHUP302	Aptitude 2		-	-	1	1	0.5	-	-	-	25	-	25
MBP301	Financial Management for Engineers		-	-	1	1	0.5	-	-	-	25	-	25
BECL318 BECP318	CMOS VLSI Design	Online	1	-	2	3	2	10	15	25	10	15	75
BECL316 BECP316	Digital Signal Processing	Offline	2	-	2	4	3	10	15	25	25	25	100
BECL319	Transmission Line & Antennas	Offline	2	-	-	2	2	10	15	25	-	-	50
BECL320 BECP320	Hardware Description Language	Online	1	-	2	3	2	10	15	25	10	15	75
BCSP213	Java Programming	Online	-	-	4	4	2	-	-	-	25	25	50
XXXX	Departmental Elective-1	Offline	2	-	-	2	2	10	15	25	-	-	50
BECP321	Internship &Technical Report Writing		-	-	2	2	2	-	-	-	50	-	50
Total			9	1	20	30	21	60	90	150	245	105	650

Term-VI													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					
			Th .	T u	Pr .	Total	Credit	Theory			Practical		Total
								TA E	CA E	ES E	Int.	Ext .	
BFYL115	Maths 8 (Probability, FFT, complex variables)		1	1	-	2	2	10	15	25	-	-	50
BECP322	Skill Development - 3 (Machine Learning based Projects)		-	-	2	2	1	-	-	-	25	25	50
BHUP303	Aptitude 3		-	-	1	1	0.5	-	-	-	25	-	25
BHUP207	Soft Employability Skills				1	1	0.5	-	-	-	25	-	25
MBP	Project Management		-	-	2	2	1	-	-	-	50	-	50
BMEP319	Product Development & IPR				2	2	1	-	-	-	25	-	25
xxxx	Open Elective-2		2	-	-	2	2	10	15	25	-	-	50
xxxx	Interdisciplinary Elective-1		2	-	-	2	2	10	15	25	-	-	50
xxxx	Departmental Elective-2 (Modeling)	Online	-	-	4	4	2	-	-	-	25	25	50
xxxx	Departmental Elective-3		2	-	-	2	2	10	15	25	-	-	50
BEEL319 BEEP319	Basic Control System	Offline	1	-	2	3	2	10	15	25	25	-	75
BECL323 BECP323	Digital Image Processing	Online	1	-	2	3	2	10	15	25	25	-	75
xxxxx	Humanities Elective		2	-	-	2	2	10	15	25	-	-	50
Total			11	1	16	28	20	70	105	175	225	50	625

Term-VII													
Sub. Code	Name of the Course	Mode of Conducti on	Teaching Scheme					Evaluation Scheme					Total
			Th.	T u	Pr .	Tot al	Cred it	Theory			Practica l		
								TA E	CA E	ES E	Int .	Ext .	
xxxxx	Science Elective		2	-	-	2	2	10	15	25	-	-	50
BHUP304	Career Development Practice		-	-	2	2	1	-	-	-	25	-	25
xxxx	MOOCS/Open Elective-3		1	-	-	1	1	10	15	-	-	-	25
xxxx	Interdisciplin ary Elective-2		2	-	-	2	2	10	15	25	-	-	50
xxxx	Department Elective-4		2	-	-	2	2	10	15	25	-	-	50
xxxx	Department Elective-5		2	-	-	2	2	10	15	25	-	-	50
xxxx	Department Elective-6		2	-	-	2	2	10	15	25	-	-	50
BCSL315 BCSP315	Cloud Computing	Online	1	-	2	3	2	10	15	25	10	15	75
BECP412	Project Phase-I			-	-	4	4	4	-	-	-	50	
Total			12	0	8	20	18	70	105	150	85	15	425

Term-VIII													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					
			Th.	T u	Pr .	Total	Credit	Theory			Practical		Total
								TA E	CA E	ES E	Int .	Ext .	
BECP420	Project Phase-II		-	-	2	2	2	-	-	-	50	50	100
XXXX	MOOCS/Open Elective-4		3	-	-	3	2	10	15	50	-	-	75
BECP437	Six Month Industry Internship		-	-	24	24	12	-	-	-	100	100	200
Total			3	0	26	29	16	10	15	50	150	150	375
			Total Credit				160		Total Marks				4500

Pool of Elective Vs Tracks					
Communication ,Signal Processing & RF	Machine Learning	Embedded & IoT	BioMedical	VLSI & Quantum	Programming
Track-1	Track-2	Track-3	Track-4	Track-5	Track-6
Television & Multimedia Processing	Soft computing	Systems Programming for Embedded Devices	Biomaterials- Materials in Medicine	Power Electronics	Operating Systems
Microwave & millimeter wave circuits	Pattern Recognition	Mechatronics	Biochemistry & Cell Biology	Analog VLSI Design	Big Data & Hadoop
Wireless & Mobile Communication	Human Computer Interface	Robotics Manipulation	Bio-Informatics/ Algorithm and Application	MEMS & Applications	Data Structure & Algorithms
Audio & Speech Signal Processing	Decision Analytics	Automotive Electronics	Brain Machine Interface	Quantum & Optical Electronics	Information Security & Crypto Currency
Smart Antennas	Natural Language Processing	Industrial Automation	Physics & Instrumentation of Medical Imaging	Integrated Circuits & Fabrication	Advanced Networks
Multi-rate and wavelet Signal Processing	Deep Learning Foundations & Applications	IoT System Design	Neromorphic Computing	Photonics & Nanotubes	Blockchain Technology

SEMSTER-III

BECL215 -Electronic Devices and Circuits

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To gain knowledge of transistor small signal analysis.
2. To study need different types of amplifiers and oscillator.
3. To familiarize the students with the analysis of unipolar devices
4. To use appropriate experimentation techniques to evaluate circuit performance

Course Outcomes:

1. Demonstrate the concept of compensation techniques, Low frequency and High frequency analysis.
2. Interpret the concepts of feedback and apply the concepts for improvement of performance of amplifier and oscillator
3. Analyze and design different types of power amplifiers and use methods for reduction of distortions
4. Compare the operation of the Field Effect Transistor (FET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and design FET circuits
5. Apply concepts of transistors & amplifier Circuits
6. Design simple circuits containing non-linear elements.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3	2			2		2	3	2	2	3
CO2	3	3	3	2	3	2			2		2	3	2	2	3
CO3	3	3	3	2	3	2			2		2	3	2	2	3
CO4	3	3	3	3	3	2			3		2	3	3	3	3
CO5	3	3	3	3	3	2			3		2	3	3	3	3
CO6	3	3	3	3	3	2			3		2	3	3	3	3

Contents:

CO-I: (9hrs)

Transistor Biasing & Small Signal Analysis:

Review of Transistor, Transistor current equations, Thermal Runaway, Transistor Biasing & Stability, Compensation Methods, Two-port Devices & the Transistor Hybrid model, analysis of a transistor amplifier circuit using h parameters, comparison of transistor amplifier configuration, Miller's Theorem, the alpha cut-off frequency, the hybrid pi (II) common-emitter transistor model.

CO-II (8hrs)

Feedback Amplifiers & Oscillators: Types of Feedback, Advantages & Disadvantages of Negative Feedback, Topology, Classification of Oscillators, Stability, Barkhausen Criteria, Design of RC, LC and Crystal Oscillators, Numerical

CO-III (7hrs)

Power Amplifier: Classification A, B, AB, C, Efficiency, Push Pull Configuration (A, B, AB) Complementary symmetry, Second Harmonic

and Cross over Distortion., Design of Power Amplifiers (Class A and Class AB)

CO-IV (6hrs)

Unipolar Devices: Field Effect Transistor, MOSFET, NMOS, PMOS Principles of operation and characteristics, Biasing arrangement, small signal analysis of CG, CB and CD

Text Books:

3. Electronics Devices and Circuits, S. Saliva Hanan, N Suresh Kumar, Tata McGraw-Hill 2008, Third Edition
4. Integrated Electronics Jacob Millman Tata McGraw-Hill, 2009, Second Edition
5. Electronic Devices & Circuits, Sanjiv Gupta

Reference Books:

1. Electronics devices and Circuits and Theory Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, Tenth Edition
2. Microelectronics Circuits A. S. Sedra & K. C. Smith, Oxford University Press, 2013, Seventh Edition
3. Electronics Devices and Circuits, Nagrath I J Phi Learning Pvt Ltd, 2009, Third Edition.

BEEL206- Network Theory

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Tot al Hours	Cred	Theory			Practical		T ot al mark
					TAE	CAE	ESE	Int.	Ext.	
1	1	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

1. The subject aims at basic components
2. To study various sources and circuit analysis method used in electrical system and their behavior.
3. To study various numerical methods

Course Outcomes

Able to understand:

CO1: Analyze circuits with ideal, independent, and controlled voltage and current sources. using Mesh & Nodal analysis.

CO2: Determine the equivalent circuits of a network that include passive devices, dependent sources, and independent sources in combination using network theorems.

CO3: Interpret and measure the transient and sinusoidal Steady-state Responses of simple RC and RLC circuits

CO4 : Determining two port network parameters and one parameter in terms

Course Outcomes ↓	Programme Outcomes												Program me Specific Outcome s		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	2	1	1	1	0	0	0	2	2	2	2	3	2	
CO2	3	3	1	1	1	0	0	0	2	2	2	2	3	2	
CO3	3	2	1	1	1	0	0	0	2	2	2	2	3	2	
CO4	3	2	1	1	1	0	0	0	2	2	2	2	3	2	

CO Mapping with PO and PSO:

Syllabus:

CO I: Nodal and Mesh analysis (8 Hrs)

Nodal and Mesh analysis, basic equilibrium equations, matrix approach for complicated network, containing voltage, current sources, Mutual Inductances, source transformations, Duality.

CO II: Network Theorems (7 Hrs)

Reciprocity, Thevenin's, Norton's, maximum power transfer, compensation, Tellegen's theorem as applied to A.C. Circuits.

CO III: Transfer functions (7Hrs)

Transient behaviors, concept of complex frequency, Driving points and transfer

functions, poles, zeros of admittance function, their properties, sinusoidal response from Pole-zero locations, convolution theorem and integral solution.

CO IV: Two port network and filter(8 Hrs)

Two port network parameters and interconnections, Three Phase unbalanced circuits and power calculations. Introduction of Basic filters (R-C, L-C). Advanced topic on the subject

Text Books:

- Networks & Systems by D Roy Choudhury [partial ebook]
- Engineering Circuit Analysis by W. H. Hayt, J. E. Kemmerly & S. M. Durbin
- Fundamentals of Electric Circuits by C. K. Alexander & M. N. O. Sadiku

Reference Books:

- Network Analysis and Synthesis by Franklin F. Kuo [ebook]
- Network Analysis, M. Van Valkenburg, Pearson Education, 2006
- Introduction to Modern Network Synthesis, M. Van Valkenburg, John Wiley & Sons.

BECL216-Communication Electronics

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To understand the basic concept of communication systems.
2. To understand the concept of analog modulation techniques.
3. To understand theory of analog pulse modulation techniques.
4. To understand working of radio receivers.
5. To understand the classification of multiplexing and multiplexing hierarchy.

Course Outcomes:

1. Demonstrate the fundamentals of communication systems and interpret the

presence of noise in communication systems.

2. Interpret and analyze Amplitude Modulation and Frequency modulation.
3. Analyze FDM and TDM systems.
4. Illustrate the fundamentals of analog pulse modulation techniques.
5. Design and conduct experiments, using modern communication tools necessary for various engineering applications.
6. Demonstrate the basics of Television and Satellite systems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	2	2	3					2	3	3	2	2
CO2	2	3	3	2	2	2					2	3	3	3	2
CO3	2	3	3	2	2	3					2	3	3	3	2
CO4	2	3	3	2	2	3					2	3	3	2	2
CO5	2	3	3	3	3	2					2	3	2	3	3
CO6	2	3	3	3	3	2					2	3	2	3	2

Contents:

CO-I: (8hrs)

Introduction to Analog Communication:

Review of signals and systems, Frequency

domain of signals, Review of probability and random process. Base Band Signals and their bandwidth requirements. Noise in Communication systems, Gaussian and white noise characteristics.

CO-II (8hrs)

Analog Modulation Techniques: Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Envelope detector, Angle Modulation and their types, Reactance tube and FET modulators, Armstrong method, FM discriminator, Super heterodyne Receiver, Performance characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection.

CO-III (7 hrs)

Pulse Modulation Techniques: Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM). Differential pulse code modulation. Delta modulation. Noise considerations in PCM.

CO-IV (7 hrs)

Multiplexers: FDM, TDM, Multiplexing Hierarchy, Digital Multiplexers, Basic concept of Television System, Introduction to satellite systems. Advanced topic on the subject

Text Books:

1. Electronics Communication System, Kennedy, Davis Tata McGraw-Hill, 2010, Fourth Edition
2. Communication Electronics, Roddy & Coolen PHI, 2010, Fourth Edition
3. Communication Electronics Principles and Applications Frenzel, Tata McGraw-Hill, 2011, Third Edition
4. Communication Engineering U. A. Bakshi, A. P. Godse, Technical Publications, 2009, Third Edition

Reference Books:

1. Modern Digital & Analog Communication Systems, B. P. Lathi, Oxford Press Publication, 1998, Third Edition
2. Digital Communication Simon Haykin Wiley and sons, 2003, Third Edition

3. Digital Communication John G. Proakis, Tata McGraw-Hill, 2002, Third Edition
4. Digital Communication Shanmugham Wiley student 2009, Fourth Edition

BECL217- Signals and Systems

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Marks
					T	A	E	Int.	Ext.	
1	1	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To introduce the fundamentals, characteristics, concept techniques of signals & systems.
2. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide
3. Development of the mathematical skills like Fourier series, Fourier transforms, Random theory to solve problems involving convolution, filtering, modulation and sampling
4. To define channel capacities and properties using Shannon's Theorem and calculate the information content

Course Outcomes:

Students will be able to

1. Illustrate & classify signals, systems & identify LTI systems
2. Find Fourier series & Fourier transform for different signals
3. Analyze the Continuous Time systems by performing Convolution
4. Demonstrate Discrete time systems and LTI systems.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	2	3	3	2	2	3					2	3	3	2	2
CO2	2	3	3	2	2	2					2	3	3	3	2
CO3	2	3	3	2	2	3					2	3	3	3	2
CO4	2	3	3	2	2	3					2	3	3	2	2

CO Mapping with PO and PSO:

Contents:

CO-I: (7hrs)

Introduction to Signals and Systems: Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system analysis from these examples. Formalizing signals: energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the CO step, the CO impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. Formalizing systems: system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, Realizability. Examples

CO-II (7hrs)

Continuous Time Fourier Transform: Representation of Aperiodic Signal,

Fourier Transform for Periodic Signals, Properties of CTFT, Convolution and multiplication property of continuous FT, Systems characterized by Linear Constant Coefficient Differential Equations. Convolution Property. Sampling Theorem, Effect of Under Sampling, and Sampling of Discrete -Time Signals

CO-III (8hrs)

Continuous time and discrete time Linear shift-invariant (LSI) systems: Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Parseval's Theorem. The idea of signal space and orthogonal bases of signals. Time de main and Frequency domain aspects of ideal and non-ideal filters.

CO-IV (8hrs)

Discrete Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT): Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations Laplace Transform for continuous time signals and systems: the notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.

Text Books:

1. Signals and Systems(Alan V Oppenheim, Alan S Willsky, S Hamid Nawab)Prentice Hall India 2009-Second Edition
2. Signals and Systems, S. Haykin and B. van Veen, Wiley1998

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	2	2	3	2	3						2	1	3	2	3
CO2	2	2	3	2	3						2	1	3	2	3
CO3	3	2	3	2	3						2	1	3	2	3
CO4	3	2	3	2	3						2	1	3	2	3
CO5	3	2	3	3	3						2	1	3	2	3
CO6	3	2	3	3	3						2	1	3	2	3

Reference Books:

1. Digital Signal Processing, Principles Algorithms, and Applications, John G. Proakis, Dimitris G. Manolakis, PHI, 2007,4
2. Signal Processing, James H. McClellan, Pearson/Prentice Hal,2006,1
3. Signals and System, Third Edition, 2008, P. Ramesh Babu, R. Ananda Natarajan, Scitech,2008,3

BECL218- Embedded Systems Design

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TAE	CAE	ESE	Int.	Ext. Marks

2	-	2	4	3	10	15	25	10	15	75

***Mode of Exam: Practical Application Based Online**

Course Objectives:

1. To study and understand various microcontrollers and embedded systems.
2. To understand the design parameters of embedded systems applications.
3. To study and impart different tools for embedded system and IoT application design.

Course Outcomes:

1. Demonstrate the principle of embedded systems and Microcontroller
2. Develop programming for applications develop real time applications
3. Design the interfacing of devices and peripherals
4. Make Use of ARM7 Controller for Designing of Embedded Applications
5. Develop Different IoT platform for Embedded applications
6. Design and Develop different embedded system and IoT applications.

CO Mapping with PO and PSO:

Contents:

CO-I: (7hrs)

Embedded Systems: Introduction to embedded Systems, Requirements /Components of Embedded Systems, Design Process in Embedded System

Microcontrollers: Introduction to microcontrollers, 8051 architecture, addressing modes and instruction set, 8051 programming in Assembly language and Embedded C.

CO-II (7hrs)

Programming: Timer, Interrupts and serial communications, Serial I/O, Programming Tools

Interfacing with 8051: ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display,

Sensors interfacing (LDR, IR, PIR ,GSM, GPS, GPRS, Bluetooth.etc.)

CO-III (8hrs)

Introduction of 32-bit Microcontroller: Advanced devices and peripheral interfacing with ATmega16: ARM7 Processors, ARM Architecture, Register and Memory organization, addressing modes, Arm Thumb and instruction sets, Basic Assembly Programming,

CO-IV (8hrs)

Embedded IoT Applications: Introduction to Raspberry PI and Intel Galileo Board, Python Programming, OOP's and Modules in Python Programming, Design and perform different embedded system and IoT Applications: Robotic, Industrial Automations& Health care.

Text Books:

1. Muhammad Ali Mazidi, the 8051 Micro-controller & Embedded System using assembly & C, Pearson Education, 2008, Second
2. Muhammad Ali Mazidi, ARM Assembly language programming and Architecture, Second
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education India, 2009, Second

Reference Books:

1. Shibu K. V. Introduction to Embedded System, The McGraw Hill, 2011,
2. Ajay V. Deshmukh, Micro-controllers - Theory and Applications, Tata McGraw Hill,
3. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, 1996, Second

BEC P225 -Artificial Intelligence:

Application in Electronics

Teaching Scheme					Evaluation Scheme		
Th.	Tu	Pr.	Total	Credit	Theory	Practical	Total
			1				1

			Hours		TAE	CAE	ESE	Int.	Ext.	Marks
-	-	2	2	1	-	-	-	25	25	50

*Mode of Exam: Practical Application Based Online

Course Objectives:

1. Be able to formulate machine learning problems corresponding to different applications.
2. Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes: Upon completion of the course students shall be able to:

1. Interpret the basic concepts and techniques of artificial Intelligence
2. Classify machine learning algorithms to solve real time problems of moderate complexity and Apply experience of independent study and research through case studies.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	S1	S2	S3
CO1	3	3	3	1	1	2					2	3	3	3	2
CO2	3	3	3	1	1	2					2	3	3	3	2

Contents

CO-I: Artificial Neural Networks: (8hrs)

Introduction to Artificial Intelligence, Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing, The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptron,

Backpropagation Algorithm, Introduction to Bayesian Function.

CO-II: Applications in Electronics: (7hrs)

This CO provides an intensive introduction to artificial intelligence and its applications to problems of medical diagnosis, therapy selection, and monitoring and learning from databases.

Case Study 1: - Potential use of a causal Bayesian network to support both clinical and pathophysiology tutoring in an intelligent tutoring system for anemias.

Link for problem and solution for case study:

https://ocw.mit.edu/courses/health-sciences-and-technology/hst-947-medical-artificial-intelligence-spring-005/projects/anemias_tutoring.pdf

Text Books:

1. Introduction to machine learning, Ethem Alpaydin. — 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
2. Introduction to artificial neural systems, J. Zurada, St. Paul: West.
3. R in a Nutshell, 2nd Edition - O'Reilly Media.

Reference Books:

4. Machine Learning, Tom M Mitchell.
5. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

Fourth Term

BECL 220- Sensors and Actuators

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total
					TAE	CAE	ESE	Int.	Ext.	Marks
1	-	-	1	1	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To gain knowledge about the measuring instruments, sensors & actuator.
2. To able to calibrate and testing of different sensors

3. To able to understand different sensors & actuators

Course Outcomes:

1. Analyze and use the functions of various instrumentation systems.
2. Interpret fundamental and some special knowledge in process automation in industries

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO1	2	2	3	2	3	3					2	1	3	2	3
CO2	2	2	3	2	3	3					2	1	3	2	3

Contents:

CO-I: (7hrs)

Static and dynamic characteristics - Active and passive transducers, Sensors and transducers, Pressure, Flow, Level, Temperature, humidity, light sensor, piezo electric transducer

CO-II (8hrs)

Sensors: IC sensor, Digital transducers, Smart sensor, MEMS sensors, Fiber optic transducer, Signal conditioning techniques used in various transducers, Linearization, Shielding techniques, Data Acquisition System, Industry Standard Bus architecture, Actuation Systems: ADC, DAC, Pneumatic & hydraulic control Valves, Solid state switches, Motor Control Techniques, PLC controller.

Text Books:

1. Principles of Industrial Instrumentation, D. Patranabis, Tata Mcgraw-Hill, 1999,

2. A course in Electrical and Electronic Measurement and Instrumentation, A.K. Sawhney, Dhanpat Raj and Sons, New Delhi, 1999, 3
3. Getting Started with The Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Cuno Pfister, Oreilly Publication, 2011,

Reference Books:

1. Measurement systems application and design, Ernest O. Doebelin, Tata McGraw Hill Publishing Co. New Delhi, 1999, IV
2. Industrial Instrumentation, Eckman D. P. M, Wiley Eastern Limited, 1990, II
3. Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects, Maneesh Rao, Packet, 2018, I

4. To conceptually understand the UPW Polarization features and Poynting Theorem, and apply them for practical problems.

Course Outcomes:

1. Distinguish between the static and time-varying fields,
2. Make use of Maxwell equations to solve filed problems
3. Analyze the Wave Equations and evaluate the UPW Characteristics with estimation of Polari
4. Apply the concepts of EM theory to solve the engineering problems.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	3	2			2		2	3	2	2	3
CO 2	3	3	3	2	3	2			2		2	3	2	2	3
CO 3	3	3	3	2	3	2			2		2	3	2	2	3
CO 4	3	3	3	3	3	2			3		2	3	3	3	3

BECL 221- Electromagnetic Fields & Waves

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
1	1	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields, and apply them to solve physics and engineering problems.
2. To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
3. To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.

Contents:

CO-I: (8hrs)

Electrostatics: Coordinate Systems – Vector fields, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law, Divergence theorem and applications, Electric Potential, Relations Between E and V, Gradient, Energy Density, Convection and Conduction Currents, Continuity Equation, Isotropic and

Homogeneous Dielectrics, Poisson's and Laplace's Equations.

CO-II (7hrs)

Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Curl, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields

CO-III (8hrs)

Maxwell's Equations and its applications: Maxwell's Equations for static and time varying fields, Maxwell's Equations in differential and integral Forms and their significance, Conditions at a Boundary Surface, Electric and magnetic boundary conditions: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Practical applications.

CO-IV (8hrs)

EM Waves: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin effect, Poynting Vector and Poynting Theorem – Applications, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Snell's law, Brewster Angle, Surface Impedance, Polarization.

Text Books:

1. Engineering Electromagnetics. William H. Hayt Jr. and John A. Buck, Mc Graw Hill Education, 2006, 7
2. Principles of Electromagnetics, Matthew N.O. Sadiku and S.V. Kulkarni, Oxford University Press, 2015, 6
3. Electromagnetic Waves and Radiating Systems., E. C. Jordan and K.G. Balmain, PHI, 2000, 2

Reference Books:

4. Engineering Electromagnetics, Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2005, 2

5. Networks, Lines and Fields. John D. Ryder, PHI, 1999, 2

BECL 222, BECP 222- Analog System

Design

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

1. To understand analog circuits and systems.
2. To know linear and nonlinear applications of operational amplifier ICs.
3. To study frequency response of different circuits based on operational amplifier applications.
4. To study and use different ICs such as timers for applications.

Course Outcomes:

1. Apply knowledge of differential amplifier to design operational amplifier.
2. Design op-amp based circuits required in embedded system design, communications systems
3. Design real time applications using filters & oscillators.
4. Design analog applications using different ICs.
5. Analyze and estimate the low and high frequency behavior of linear circuits, including noise.
6. Apply op-amps fundamentals and computer tools in project design, evaluation, and analysis

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	2	1					2	3	3	2
CO2	3	3	3	1	1	2	2					2	3	3	2
CO3	3	3	3	1	1	2	2					2	3	3	3
CO4	3	3	3	1	1	2	2					2	3	3	3
CO5	3	3	3	1	1	2	1					2	3	3	2
CO6	3	3	3	1	1	2	2					2	3	3	3

Contents:

CO-I: (6hrs)

Differential Amplifier, Cascaded Differential Amplifier Stages and Level Translator, AC and DC Analysis of Cascade Amplifier, Current Mirror, Design of two stage direct-coupled amplifier.

CO-II (8hrs)

OPAMP, inverting, non-inverting, differential amplifier configurations, negative feedback, voltage gain, input & output impedance, Bandwidth. Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR, Frequency response. Linear applications, DC, ac amplifiers, summing differential amplifier, instrumentation amplifier, V to I and I to V converters, Integrator, Differentiator.

CO-III (8hrs)

Classification of Filters, Active Filters, First to Sixth –Order Butterworth filter, IGMF configuration, All Pass Filter, Cascade Design of Filters, Classification of Oscillators, Design of Op-amp based Phase Shift and Wein Bridge Oscillators, Square, Triangular and Saw Tooth Wave Generators, Schmitt Trigger, Voltage

Comparator, Voltage Limiters and Window Detector, Clippers and Clampers, Peak Detector, Precision Rectifiers, sample & Hold, ADC, DAC

CO-IV (8hrs)

The 555 Timer, Phase Locked Loops IC565, ICL8038 & XR2206 Function Generator, Voltage Controlled Oscillator Basic Operation, IC based Voltage Regulator Circuits, Dual Track Voltage Regulator, Three - Terminal Regulator (Fixed Regulator) Voltage Adjustment and Current Boosting of Fixed Regulator, Merits and Drawbacks of Linear Regulators.

Text Books:

1. Operational amplifiers, Design and applications, Tobey, Graeme, Huelsman, McGraw Hill, 1990, 2
2. Operational Amplifiers and Linear Integrated Circuits, Gaikwad R. A, PHI, 2

Reference Books:

1. Design with OPAMPS and Analog ICS Francis S McGraw Hills
2. OPAMPS and Linear ICs Fiore J.M Delmer-Thomson, USA 2001, 2

BECL223, BECP 223- Digital Communication

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TAE	CAE	ESE	Int.	Ext. Marks
2	-	2	4	3	10	15	25	25	- 75

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

1. To understand the basic knowledge of digital communication system & Source coding techniques.
2. To study different modulation schemes, multiple accesses, error probability for digital communication.

3. To impart the knowledge of design, analysis & comparison of digital communication systems.

Course Outcomes:

1. Interpret baseband systems, sampling, quantization and source coding
2. Elaborate different techniques of modern digital communication
3. Evaluate performance of various modulation & demodulation techniques
4. Design digital systems using appropriate mathematical techniques
5. Solve various source/channel coding and error-control coding techniques
6. Evaluate and apply spread spectrum Techniques and its performance parameters

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3
CO5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2
CO6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2

Contents:

CO-I: (8hrs)

Digital Base Band Modulation Techniques:

Bandwidth of digital Data, Base band system, formatting textual Data, Messages, characters, and symbols, Formatting Analog Information, Sources of Corruption, Inter symbol Interference. Uniform and non-uniform quantization, Base band Modulation, Correlative Coding, Formatting analogue information, Line coding, Scrambling, Digital multiplexing.

CO-II (7hrs)

Baseband Modulation and Demodulation Techniques:

Sequential circuit Sequential circuit: Latches and flip-flops, counters, shift register, Finite state machine; representation and synthesis. Digital Band pass Modulation techniques, Coherent & Non coherent detection, Complex envelop, Error performance for Binary system, M-Ary signaling and performance, Symbol error performance for M-ary Systems, Bit error Rate calculations.

CO-III (7hrs)

Block and convolutional channel codes, Linear block codes, generator matrix and parity check matrix, some specific linear block codes, syndrome decoding, cyclic codes, optimum decoding of convolutional codes- Viterbi algorithm.

CO-IV (8hrs)

Advanced Modulation Method & Spread Spectrum techniques: Gram – Schmitt procedure, Spread Spectrum techniques: Spread Spectrum Overview, Pseudo noise Sequences, Direct-Sequence Spread Spectrum systems, Frequency hopping systems, Synchronization, Jamming consideration, Advanced topics on Digital Communication.

Text Books:

1. Digital Communications (Fundamentals and applications), Bernard Sklar, Pearson Education, 2005, 2nd
2. Digital Communication, Simon Haykin, Wiley Eastern, 2001, 4th
3. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University press, 1999, 3rd

Reference Books:

1. Digital Communication, John G. Proakis, Tata Mc –Graw HILLS, 2007, 5
2. Communication Electronics, Roddy & Colin, PHI, Prentice-Hall PTR, 1981, 2
3. Communication Electronics, Kennedy, Tata Mc –Graw HILLS, 2012, 5

BECL224- Introduction to Drones

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					TA	EC	AE	ESE	Int.	Ext.
-	-	4	4	2	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To familiarize with various drone components and understand their properties.
2. To understand basic fundamentals of Drone.
3. To prepare for various engineering applications based on Drones.

Course Outcomes:

1. Examine various drones and its devices.
2. Apply knowledge of drone for related application.
3. Demonstrate the knowledge of Drone and its application
4. Develop the skill to build, and troubleshoot Drone circuits

Basics: Introduction to the Drones and various Applications of Drone, Working Principle and design. Inertial Measurement CO, Sensors and calibration, ID Implementation and Tuning

CO-II (6hrs)

Drone Technology & Networking: Intra-inter Drone Communication, Network Topology & protocol, Cluster-networking

CO-III (6hrs)

Drone Hardware Fabrication: Selection electronics components such sensors, controller, BLDC motor, Battery, Flight controller, Remote Controller and other Assembly accessories.

CO-IV (12hrs)

Drone Designing: Design structure. Designing techniques and optimization, Battery Management, Payload management, Testing and analysis, aero-dynamics & calibration. Hands on project: Precautions while Assembling, Exercises based on Flight controller & boards like Ardupilot APM 2.x, 3.x, hobby kin kk5.0, CC3D, Pixhawk

Reference Books:

1. Theory, Design and Applications of Unmanned Aerial Vehicles- by A. R. Jha, 2016
2. Handbook of Unmanned Aerial Vehicles- Valavanis, K. Vachtsevanos, Geore J, 2014

BCSL208, BCSP208-Database Management System

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3

CO Mapping with PO and PSO:

Contents:

CO-I: (6hrs)

Pre-requisite: Programming for Problem Solving					Evaluation Scheme					
Teaching Scheme					Theory			Practical		Total
Th.	Tu	Pr.	Total Hours	Credit	TA	EC	ESE	Int.	Ext.	Marks
2	-	2	4	3	10	15	25	10	15	75

*Mode of Exam: Practical Application Based Online

Course Objective:

1. This course introduces general idea of database management system.
2. It is aimed at developing skills to design databases using data modeling and design techniques.

3. It is also aimed to developing skills to implement real life applications which involve database handling.
4. This course also provide carrier opportCOies in subject areas of designing, storage techniques and data handling and managing techniques

Course Outcome: Upon successful completion of the course, students shall be able to-

1. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms and design appropriate data model for it.
2. Demonstrate an understanding of various normalization forms and apply knowledge of normalization for creation of database.
3. Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database and perform inferential analysis of data model
4. Demonstrate query processing and able to design optimized query execution plan.
5. Develop basic transaction processing and management and ensure database security, integrity and concurrency control
6. Demonstrate the management of structured and unstructured data management with recent tools and technologies.

CO Mapping with PO and PSO:

Contents:

CO-I: (5hrs)

Introduction to DBMS, DBMS Architecture, Data Models, UML

CO-II: (7hrs)

Relational Database design: Functional Dependency (FD) – Basic concepts, closure of set of FD, closure of attribute set, Decomposition, Normalization – 1NF, 2NF, 3NF, BCNF, 4NF.

CO-III: (9hrs)

SQL Concepts: Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints, Functions - aggregate functions, Built-in functions –numeric, date, string

functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, Save point. Cursors, Stored Procedures, Stored Function, Database Triggers

CO-IV: (9hrs)

Query Processing & Query Optimization: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans and materialized views

Text Books:

- 1 Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2002.
- 2 Jeff Ullman, and Jennifer Widom, A First Course in Database systems, 2nd Ed.

Reference Books:

- 1 G. K. Gupta "Database Management Systems", McGraw – Hill.
- 2 Regina Obe, Leo Hsu, PostgreSQL: Up and Running, 3rd Ed, O'Reilly Media 2017.
- 3 Kristina Chodorow, Shannon Bradshaw, MongoDB: The Definitive Guide, 3rd Ed, O'Reilly Media 2018.
- 4 RamezElmasri and ShamkantNavathe, Fundamentals of Database Systems 2nd Ed, Benjamin Cummings, 1994.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes			
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S
	1	2	3	4	5	6	7	8	9	1	1	1	1	0	2	3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2	
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3	
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2	
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3	
CO5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2	
CO6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2	

Course Outcome ↓	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C O1	3	3	3	1	1	2					2	3	3	3	2
C O2	3	3	3	1	1	2					2	3	3	3	2

BCSP217- MACHINE LEARNING

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					T	A	E	C	A	E
-	-	2	2	1	-	-	-	2	2	50

***Mode of Exam: Practical Application Based Online**

Course Objectives:

1. Be able to formulate machine learning problems corresponding to different applications.
2. Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes:

Upon completion of the course students shall be able to:

1. Develop skills of using recent machine learning software for solving practical problems.

2. Summarize and compare a range of machine learning algorithms along with their strengths and weaknesses

CO Mapping with PO and PSO:

Contents:

CO-I (6 hrs)

Understanding Machine Learning: Introduction, What Is Machine Learning? Examples of Machine Learning Applications, Learning Associations, Supervised & Unsupervised Learning, Reinforcement Learning, Classification, Regression

CO-II (5hrs) Applying R-Programming: R - Basic Syntax, Data Types, Variables, Operators, Decision Making, Loops, Functions, Strings, Vectors, Lists, Matrices, Arrays, Factors, Data Frames, Packages-chart & graphs

CO-III (4hrs)

Clustering & Application of ML: Introduction to clustering, k-Means Clustering, Hierarchical clustering, Introduction to Chat Bot, creation of Chat Bot

Text Books:

1. Introduction to machine learning, Ethem Alpaydin. 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
2. Introduction to artificial neural systems, J. Zurada, St. Paul: West.
3. R in a Nutshell, 2nd Edition - O'Reilly Media.

Reference Books:

1. Machine Learning, Tom M Mitchell.
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

FIFTH Term

BECL318- CMOS VLSI Design

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
1	-	2	3	2	10	15	25	10	15	75

***Mode of Exam: Practical Application Based Online**

Course Objectives:

1. Learn MOS transistor theory.
2. Expose to MOS circuit design & Layout processes.
3. Expose to CMOS logic structures.
4. Learn scaling of MOS circuits.

Course Outcomes:

1. Identify fundamental principles of VLSI (Very Large Scale Integrated) circuit design and layout.
2. Interpret CMOS fabrication technologies.
3. Determine physical VLSI design issues (bottom-up design) and basic CMOS logic gates,
4. Design building blocks of large-scale CMOS digital integrated circuits

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3

Contents:

CO-I: (6hrs)

Basic MOS Technology: MOS Structure, Threshold Equation, Ion Implantation, MOSFET Current-Voltage Characteristics, Channel Length Modulation, Substrate Bias Effect, MOSFET Scaling, Channel Effects, MOSFET Capacitance, Numerical

CO-II (8hrs)

MOS Inverter: Noise ImmCOy, Noise Margin, Inverter with different Loads, CMOS DC Characteristics, Design of CMOS Inverter, Static Load MOS Inverters, Numerical

CO-III (10hrs)

Switching Characteristics: Rise and Fall Time Derivation, Numerical, Inverter Design with delay constraint, MOSFET Capacitance, Estimation of Interconnect Parasitics, Interconnect Delay, Switching Power Dissipation, Power Delay Product

CO-IV (6hrs)

Circuit Design Processes: Combinational MOS Circuits, Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams, Transmission Gates, nMOS fabrication. CMOS fabrication.

Text Books:

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi., McGraw-Hill, Inc., New York, NY, USA.,2000,
2. CMOS Circuit design, Layout and Simulation, R. J. Baker, H W Li, D. E. Boyce, PHI EEE,
3. Principles of CMOS VLSI Design, Neil H. E. Weste, Kamran Eshraghian, Addison Wesley,

Reference Books:

1. CMOS Logic Circuit Design,,John P. Uyemura,,Illustrated, Springer Science & Business Media,,1999,
2. CMOS Digital Integrated Circuits Analysis & Design,,Sung-Mo Kang & Yusuf Leblebici,,Tata McGraw -Hill,2003,
3. Digital integrated circuits: a design perspective, Second Edition,,Jan M. Rabaey, Anantha P. Chandrakasan, Borivoje Nikolic,Illustrated, Pearson Education,2003,
4. Design of Analog CMOS Integrated Circuits,Razavi,McGraw-Hill,2001,

BECL316, BECP 316- Digital Signal Processing

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25		75

Mode of Exam: Paper Pen with 30% Gate*Pattern Questions****Course Objectives:**

1. Analyze the signals in time and frequency domain
2. Be familiar with transformation tools on signals & systems and analyze
3. Learn to design various digital filters and analyze their frequency response
4. Develop DSP technique for various applications

Course Outcomes:

1. Make use of linear time invariant systems.
2. Elaborate discrete parameter signals.
3. Apply knowledge of how to use linear transforms.
4. Apply linear system analysis to engineering problems.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO 2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO 3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO 4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3
CO 5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2
CO 6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2

CO Mapping with PO and PSO:**Contents:****CO-I: (6hrs)**

Introduction: Representations of discrete signals, Discrete time systems & properties, Basic operators and Convolution, Correlation, Z-Transforms & properties, Inverse Z-Transforms Methods.

CO-II (8hrs)

Fourier Analytical Techniques: Frequency analysis of discrete time signals, Discrete Time

Fourier Transform and Discrete Fourier Transform, Properties, Inverse Discrete Fourier Transform, Circular Convolution, Efficient Computation of DFT using FFT algorithms, Linear Filtering approach to computation of DFT.

CO-III (10hrs)

Digital Filters: Structures for FIR Systems and IIR Systems and representation of Structures using Block diagram & Signal Flow Graph, Design of IIR filters from analog filters using Impulse Invariant Method, Bilinear Transformation, Matched Z Transformation, Butterworth Approximation, FIR filters design Methods-Fourier Series, Windowing, DFT, Frequency Sampling.

CO-IV (6hrs)

DSP Processor & Applications: Desirable Features of DSP Processors, Types of Architectures of DSP processor, Application areas: Dual-Tone Multi Frequency Signal Detection, Spectral Analysis Using DFT, Short Term DFT, Musical Sound Processing, Application to Image processing & Radar, Oversampling A/D Converter, Oversampling D/A Converter.

Text Books:

1. Theory and Applications of Digital Signal Processing. R. Rabiner, and B., Gold, Prentice Hall, 2000, 3rd

Reference Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications, J. G. Proakis and D. G. Manolakis, Prentice Hall, 2006, 4th
2. Digital Filters: Analysis Design and Application A. Antonion, Prentice Hall, 1999,
3. Digital Signal Processing, A. V. Oppenheim and R. W. Schaffer, Prentice Hall, 1998, 1998,
4. Digital Image Processing Using MATLAB, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Tata McGraw Hill Pvt. Ltd., 2011, 3rd

BECL319- Transmission Line and Antennas

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. To understand transmission line fundamentals and propagation of signals through lines.
2. Design various impedance matching devices such as stub tuners and multi-stage quarter wave transformers.
3. To solve the electric field and magnetic fields for a given wire antenna.
4. Determination of the fields radiated from antennas; wire antennas; array antennas; parabolic reflectors, antenna radiation pattern & antenna directivity.

Course Outcomes:

1. Demonstrate the fundamentals of transmission line theory and impedance matching in high frequency lines.
2. Interpret & utilization of antenna as required in different communication systems.
3. Determine directions of maximum signal radiations and the nulls in the radiation patterns.
4. Design array antenna systems from specifications.

CO Mapping with PO and PSO:

Contents:**CO-I: (8hrs)**

Introduction: Line parameters, Types of transmission line, skin effect, General solution, physical significance of the equations; the infinite line, Voltages and currents on the Distortion less line & , wavelength, velocity of propagation, the distortion less line, Reflection on a line not terminated in Z_0 , Reflection coefficient, Standing waves Open and Short circuited lines, Reflection loss, Impedance matching, Quarter wave line; Single-Stub, Smith Chart, Application of the Smith chart for calculating impedance and admittance.

CO-II (7hrs)

Antenna Fundamentals: Introduction, Isotropic Radiator, Radiation Mechanism. Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area. Reciprocity Theorem. Radiation Integrals: Retarded Vector potentials A, J.

CO-III (9hrs)

Types of Antenna: Wire Antenna: Infinitesimal Dipole, Its Radiation Field, Radiation Resistance, Radiation Sphere, Near Field, Far Field Small Dipole, Finite Length Dipole, Half Wave Length Dipole, Folded Dipole, Linear Elements Near Or On Infinite Perfect Conductors, Ground Effects And Their Application, Loop Antenna: Small Loop, Comparisons Of Small Loop With Magnetic Dipole, Radiation Pattern, Its Parameters And Their Application, Microstrip Antenna , Broadband and Reflector antennas.

CO-IV (6hrs)

Antenna Array: Antenna Arrays: Two element array, Pattern multiplication, Broad side and End-fire array, N-element array:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	2	3	3	2	3	2	2	1	1	2	2	1	1	3
CO2	3	3	3	3	2	3	2	2	1	1	2	2	1	1	3
CO3	3	3	3	3	3	3	2	2	1	1	2	2	1	1	3
CO4	3	3	3	3	3	3	2	2	1	1	2	2	1	1	3

Uniform spacing, non uniform amplitude, array factor, binomial and Dolph Tchebyshev array. Planar Array, Circular Array, Log Periodic Antenna, Yagi-Uda Antenna Array.

Text Books:

1. Antenna and Wave Propagation. D. Prasad, Satya Prakashan, 2003, 3
2. Antenna Theory and Design, Balanis, C. A, Ed., John Wiley &, 2005, 3

Reference Books:

1. Electromagnetics with, Kraus, J.D. and Fleisch, D. A, McGraw -,

BECL320, BECP 320- Hardware**Description Language**

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
1	-	2	3	2	10	15	25	10	15	75

***Mode of Exam: Practical Application Based Online**

Course Objectives:

1. Apply Boolean algebra and other techniques to express and simplify logic expressions.

2. Analyze and design combinational and sequential digital systems.
3. Use different techniques among them a hardware description language and a programming language, to design digital systems.

Course Outcomes:

1. Summarize digital systems and the use of Boolean algebra in logic analysis and design
2. Interpret RTL design and verification techniques and methodologies
3. Experiment the principles and methodology of digital logic design at the gate and switch level, including both combinational and sequential logic elements.
4. Illustrate basic tools of logic design and provide hands-on experience designing digital circuits

CO Mapping with PO and PSO:

Contents:

CO-I: (6hrs)

Introduction to Hardware Description Languages: Combinational Logic, Structural Modeling, Sequential Logic, More Combinational Logic, Parameterized Modules, Test benches

CO-II (6hrs)

Sequential circuit Sequential circuit: Latches and flip-flops, counters, shift register, Finite state machine; representation and synthesis.

CO-III (8hrs)

FPGA architecture and synthesis Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation

CO-IV (8hrs)

Semiconductor memories, PALs, PLAs and FPGAs; Pipelining and timing issues, PROMs (DRAMs, Flash memory etc.)

Text Books:

1. HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog, Douglas Smith, Doone publications, 1998, 1st
2. Verilog HDL, A guide to Digital Design and Synthesis, Samir Palnitkar, Prentice Hall, 1st

Reference Books:

1. FPGA based Prototyping Methodology Manual, Doug Amos, Austin Lesea, Rene Richter, Synopsys Press,
2. Introduction to Reconfigurable Computing, Architectures, Algorithms, Christophe Bobda, Springer Netherlands.
3. Writing Testbenches: Functional Verification of HDL Model, Janick Bergeron, Springer, 2003, 2nd

BCSP213- Java Programming

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
-	-	4	4	2	-	-	-	25	25	50

***Mode of Exam: Practical Application Based Online**

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO2	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO3	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO4	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3

Course Objective:

1. This course introduces fundamentals of object-oriented programming in Java, including Defining classes, invoking methods, using class libraries.
2. It is aimed at building software development skills using java programming for creating real world applications.
3. Use a development environment to design, code, test, and debug simple programs, including multi-file source projects, in an object-oriented programming language

- **CO 1:** Explain the basic data types and control flow constructs using J2SE.
- **CO 2:** Make use of Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper for program development.
- **CO3:** Design object oriented class structures with parameters, constructors, and utility.

CO4: Implement a final project selected from an approved project chosen by the student

Mapping with PO and PSO

Syllabus

CO I: Introduction to JAVA, Class and Object

Introduction to data types, operators and control statements, Classes: fundamentals of classes, declaring objects, Assigning objects, reference variables, methods, constructor, variable handling. Methods and classes: Overloading methods, understanding static and final.

CO II: Array, Packages, Interface

Introduction to Array, Vectors, Wrapper class & Inheritance, Packages and interface: Packages, access protection, importing packages, interfaces.

CO III: Exception Handling & Multithreaded Programming

Exception handling: Fundamentals exception types, uncaught exception, try-catch, displaying description of an exception, multiple catch clauses, nested try statements, throw, finally, built in exceptions, creating own

exception subclasses, JAVA thread model, creating thread, creating multiple thread.

CO IV: Applet, Graphics Programming and Database Connectivity

Introduction to applet, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling.

Database Connectivity: JDBC (Java Data Base Connection), Introduction to JDBC, Databases and Drivers, Types of Driver, Loading a driver class file, establishing the Connection to Database with different Driver. Executing SQL queries by result Set using Statements

Text Books:

1. The Complete Reference by Herbert Schild, TMH Publication
2. Programming with Java- A Primer by E. Balagurusamy, 3rd Edition, TMH Publication

Reference Books:

1. The Complete Reference- JAVA 2- 3rd Edition By Patrick Naughton, TMH Publication.
2. Java 6 Programming Black Book by Kogent Solution Inc., Dreamtech Press Publication.
3. Java 2 Black Book by Steve Holzner, Paraglyph Press, 2nd Ed.

BEEL319,BEEP319- Basic Control System

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credi	Theory			Practical	
					TA	EC	AE	EE	SE
								Int.	Ext.
1	-	2	3	2	10	15	25	25	-
									50

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objective

1. The students should be able to learn the different types systems and governing differential equations and mathematical representation in terms of output and input correlation.
2. The students should able to learn time response analysis and demonstrate their knowledge to frequency response.
3. Students can be able to learn stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot.

4. To get insight of modern control theory based on matrix approach and state variables.

Course Outcome

The students should be able to

CO1 : To build classical mathematical foundation for control philosophy and time response of systems.

CO2 : To determine performance of system and its stability issues.

CO3 : To evaluate performance of system for broad range of frequency.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	S1	S2	S3
CO1	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO2	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO3	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3

Contents:

CO I Introduction to need for automation and automatic control, use of feedback, broad spectrum of system application, Mathematical modeling, (Electrical & Electromechanical) diff. Equations., transfer functions, block diagram, signal flow graphs, application to elementary systems, simplifications, effect of feedback on parameter variations, disturbance signal. Time response of system, first order and second order system, standard inputs, concept of gain and time constants, Steady state error, type of control system, approximate methods for higher order system.

CO II Stability of control systems, conditions of stability, characteristics equations, Routh Hurwitz criterion, special cases for

determining relative stability, Root location and its effect on time response, elementary idea of root locus, effect of addition of pole and zero on proximity of imaginary axis.

CO III Frequency response method of analyzing linear system, Nyquist and Bode Plots, Stability and accuracy analysis from frequency response, open loop and close loop frequency response, Nyquist Criterion, Effect of variation of gain and addition of pole and zero on response plot, stability margin in frequency response. Design by state variable feedback: Review of state variable representations. Solution of State equations. Controllability & Observability.

Text Books:

1. B. C. Kuo, Automatic Control Systems, 3rd Edition, Prentice Hall India, 1975
2. Nagrath, Gopal, Control System Analysis. 5th Edition, New Age International, 2010

Reference Books:

1. M. Gopal, Control Systems, Principles & Design, 3rd Edition, TMH Publishers, 2010
2. Norman S. Nise, Control Systems Engineering, 5th Edition, John Wiley & Sons, 2008

BECL323, BECP323: Digital Image

Processing

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical	
					TA	EC	AE	Int.	Ext.
2	-	2	4	3	10	15	25	25	-
									75

***Mode of Exam: Practical Application Based Online**

Course Objectives:

1. Learn digital image fundamentals.
2. Be exposed to image processing techniques.
3. Be familiar with segmentation techniques and image compression.
4. Understand applying image processing algorithms to real problems

Course Outcomes:

1. Interpret the need for image transforms and their properties.
2. Apply image enhancement and restoration techniques.
3. Develop algorithm for image segmentation, image compression & coding.
4. Make use of techniques, skills, and modern engineering tools necessary for engineering application to real problems.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	3	2	2	1	3	3	1	1	2	2	2	3	1	2
CO2	3	3	3	3	2	3	3	1	1	2	2	2	3	1	2
CO3	3	3	3	3	2	3	3	1	1	2	2	2	3	1	2
CO4	3	3	2	3	2	3	3	1	1	2	2	2	3	1	2

CO Mapping with PO and PSO:

Contents:

CO-I: (6hrs)

DIGITAL IMAGE FUNDAMENTALS:

Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbours of pixel adjacency connectivity, Distance measures, Color fundamentals, Color models.

CO-II (10hrs)

IMAGE PROCESSING TECHNIQUE:

Image Enhancements:
In spatial domain: Basic gray level transformations, Histogram processing, Using

arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters.

In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Image Restoration:

Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.

CO-III (8hrs)

IMAGE SEGMENTATION: Detection of Discontinuities, Edge linking and boundary Description: Local processing, Global processing, Hough transform, Thresholding & Region based segmentation, Segmentation by Morphological watersheds, Object representation, description and recognition

CO-IV (6hrs)

IMAGE COMPRESSION: Image compression model, Fundamental coding theorem, Lossless compression, Lossy compression.

Text Books:

- R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
- A. K. Jain. Fundamentals of Digital Image Processing. Prentice-Hall, 1989.

Reference Books:

- R. M. Haralick, L. G. Shapiro. *Computer and Robot Vision*. Addison-Wesley, 1993.
- A. Rosenfeld, A. C. Kak. *Digital Picture Processing*. Addison-Wesley, 1983
- D. A. Forsyth, J. Ponce. *Computer Vision: A Modern Approach*. Prentice-Hall, 2003.
- C. R. Giardina, E. R. Dougherty. *Morphological Methods in Image and Signal Processing*. Prentice-Hall, Englewood Cliffs, New Jersey, 1988.
- R. J. Schalkoff. *Digital Image Processing and Computer Vision*. John Wiley & Sons, Singapore, 1989.

BCSL315/BCSP315-Cloud Computing

Pre-requisite: NA

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					TA	CA	EESE	Int.	Ext.	
1	-	2	3	2	10	15	25	10	15	75

***Mode of Exam: Practical Application Based Online**

Course Objective:

1. Understand the new technologies for resources sharing
2. Explain classification of Cloud deployment
3. Discuss capacity planning for cloud configuration
4. Understand Cloud service model
5. Cloud Security and privacy issue
6. Cloud business model for cost effectiveness

Course Outcome: Upon successful completion of the course, students shall be able to-

CO1: State the basics of distributed computing and cloud computing.

CO2: Summarize the technical capabilities and business benefits cloud technology.

CO3: Develop cloud-based application demonstrating its implications

CO4: Develop cost effective solution using cloud technology

CO5 : Develop solution for Society with minimized resources

CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes					Program Specific Outcomes
	PO1	PO2	PO3	PO4	PO5	PSO1
CO1	1	3	3	3	3	-
CO2	-	3	3	3	3	2
CO3	2	3	3	3	3	3
CO4	1	3	2	3	3	3
CO5	1	2	3	2	3	3
CO6	1	3	2	3	3	3

Syllabus

CO- I: Introduction to Cloud Computing

Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy. Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Hardware-as-a-service: (HaaS), Oriented Architecture (SOA)

CO – II: Cloud Computing Architectural Framework

Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment.

CO – III: Cloud Application Development

Role of business analyst, Technical architecture considerations, Service creation environments to develop cloud based applications, Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and

disadvantages, Cloud Economics,

CO – IV: Cloud Security and Risk Management

Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.

Text Books:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012
2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
4. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference Books:

- 1 Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
- 2 Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN:978-0521137355]
3. Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]
4. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
5. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2019

Track 1:-

DEPARTMENT ELECTIVE 1: TELEVISION & MULTIMEDIA PROCESSING

Teaching Scheme					Evaluation Scheme					
Th.	Tu.	Pr.	Total Hours	Week	Theory			Practical		Total Marks
					T	A	E	C	A	
2	-	-	2	2	10	15	25	-	-	50

***Mode of Exam: Pen and paper**

Course Objective:

1. To introduce the study and analyse transmission & reception for audio and video systems in digital television.
2. To study the principle of HDTV, 3D TV, IPTV.
3. To understand ATSC & DVB Modulation.
4. To understand multimedia system architecture & compression techniques.

Course Outcomes:

1. Outline importance of various sections of television receiver & analyse colour difference signals & its components.
2. Demonstrate transmission & reception of digital television & Compare digital television systems used worldwide.
3. Interpret working principles of ATSC & DVB techniques.
4. To provide the student with an understanding of multimedia system design.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	C	C	C	C	C	C	C	C	C	C	C	O	S	S	S
	1	2	3	4	5	6	7	8	9	1	1	1	C	O	O
										0	1	2	1	2	3
CO 1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO 2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO 3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO 4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3
CO 5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2
CO 6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Introduction to Television & Color Television Receiver: Picture transmission, TV transmitter, Colour mixing, video signals for colour, Luminance signal (Y), Compatibility, Colour-difference signals, encoding, Formation of chrominance signals. RF Tuner, IF Subsystem, Video amplifier, Sound section, Sync separation, Deflection circuits, Scanning currents in the yoke, Chroma decoder, Separation of U and V colourphasors, Synchronous demodulators, Sub carrier generation and control, Matrixing for drive circuits

Unit-II: (Mapped CO2) (6 hrs)

Digital Satellite Television, Direct-to-Home Satellite Television, Digital TV Receiver, Basic principles of Digital TV broadcasting, Digitization of video signals, Digitization formats. Digital television systems – ATSC, DVB-T, ISDB, DTMB.

Unit-III: (Mapped CO3) (8 hrs)

ATSC 8-VSB Modulation, ATSC Data Framing, ATSC Concatenated Channel Coder, ATSC Channel Capacity, DVB Modulation, DVB Channel Coding, DVB Channel Capacity, DVB teletext, DVB subtitling system, Global View of transmission and reception process, Composition of Integrated Decoder, Flat panel display TV receiver, Stereo sound in TV, 3D TV Evolution of the set top box, High-Definition Television (HDTV), Digital TV over IP, Digital terrestrial television for mobiles.

Unit-IV: (Mapped CO4) (8 hrs)

Multimedia Elements, Multimedia Applications, Multimedia System, Architecture, Evolving Technologies For Multimedia Systems, Multimedia, Databases, Types Of Compression, Binary Image Compression Schemes, Color, Gray Scale, Still-Video Image Compression, Discrete Cosine Transform, Video Image Compression, MPEG Coding Methodology, Audio Compression, Data and File Format Standards- RTF, TIFF, RIFF, MIDI, JPEG, AVI, JPEG, Twain Architecture. Storage and Retrieval Technologies, Multimedia Application Design

Text Books:

1. R.R. Gulati, "Monochrome & Color TV", PHI Learning, 2014
2. A. M. Dhake, "TV and Video Engineering", Tata McGraw-Hill Education, 2001.
3. Andleigh PK and Thakrar K, "Multimedia Systems", Addison Wesley Longman, 1999.

Reference Books:

1. R. G. Gupta, "Television Engineering and Video Systems", Tata McGraw-Hill Education, 2011
2. Jerry Whitaker, Blair Benson "Standard Handbook of Video and Television Engineering", Tata McGraw-Hill Education

3. Ralf Steinmetz, Klara Nahrstedt, "Multimedia, computing, communications and applications", Prentice Hall, 1995.

DEPARTMENT ELECTIVE 2:
MICROWAVE & MILLIMETER WAVE CIRCUITS

Teaching Scheme					Evaluation Scheme					
Th.	Tu.	Pr.	Total Hours	red	Theory			Practical		Total Marks
					TA	CA	AESE	Int.	Ext.	
1	-	2	3	2	-	-	-	10	15	25

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objective:

1. To understand transmission line fundamentals and apply them to the basic problem
2. To understand the fundamentals of electromagnetic theory and transmission lines
3. To analyze and understand the Uniform plane wave propagation in various media
4. To solve the electric field and magnetic fields for a given wire antenna

Course Outcomes:

1. Interpret and Analyze various parameters and characteristics of the various waveguide components
2. Relate and analyze various passive and active devices.
3. Examine the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.
4. Acquire knowledge about the measurements to be done at microwaves.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes										Programme Specific Outcomes				
	PO 1	PO 2	PO 3	PO 4	PO 5						PO 1	PO 1	PO 1	PO 1	PO 1
CO1	3	2	2	-	-	-	-	-	-	-	1	1	1	1	1
CO2	3	2	2	-	-	-	-	-	-	-	1	1	1	1	1
CO3	2	3	3	-	-	-	-	-	-	-	1	1	1	1	1
CO4	3	2	3	-	2	-	-	-	-	-	3	2	2	2	2

Contents:

Unit-I: (Mapped CO1)

(8

hrs)

Introduction, wave equations, Rectangular waveguide, TE, TM, TEM, Wave Velocity, Guide wavelength, wave impedance, Attenuation in wave guide, introduction to circular waveguide, Dominant mode, Degenerative modes. Introduction to Planar Transmission Lines

Unit-II: (Mapped CO2)

(8hrs) Review of Low frequency parameters:

Impedance, Admittance, Hybrid and ABCD parameters, Scattering parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, Relation of Z,Y,ABCD parameter with S parameter problems on S parameter, RF behavior of Resistors, Capacitors and Inductors, Coaxial Line Components, Coupling mechanisms – Probe, Loop, Aperture types, Wave-guide and MIC component : Directional Couplers, Hybrids , Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, microstrip resonator Re-entrant Cavities, S Matrix Calculations for – 2 port Junction, E plane and H plane Tees, Magic Tee, Directional Coupler, Circulator and Isolator. Related Problems.

Unit-III: (Mapped CO3)

(6hrs)

Crystal and Schottky diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode, parametric amplifier, microwave bipolar junction transistor ,Power frequency limitation, Microwave FET, HEMT

Unit-IV: (Mapped CO4) (8hrs)

Review of conventional vacuum Triodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator. VSWR, Frequency, impedance, power and Q factor measurements. Electromagnetic interference (EMI), electromagnetic compatibility(EMC), Electromagnetic radiation

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO 2	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO 3	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO 4	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3

hazards

Textbooks:

1. Principles of Electromagnetics, Matthew N.O. sadiku and S.V. Kulkarni, Oxford University Press, 2015
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, PHI, 2000

Reference Books:

1. Engineering Electromagnetics, Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2005
2. Networks, Lines and Fields, John D. Ryder, PHI, 2005

3. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, McGraw Hill Education, 2006

DEPARTMENT ELECTIVE 3:

WIRELESS AND MOBILE COMMUNICATION

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TAE	AE	EESE	Int.	Ext.
2	-	-	2	2	-	-	25	-	-

*Mode of Exam: Pen and paper

Course Objective:

1. To Study 2G and 2.5G Fundamentals
2. To study 3G CDMA technology
3. To study Different wireless LAN technologies.
4. To study MIMO and OFDM for wireless communication

Course Outcomes:

1. Apply the concept of GSM/GPRS/EDGE technologies in real time application
2. Interpret the concept of CDMA & leading technologies.
3. Interpret the IEEE 802.11 Wireless LAN technologies
4. Infer the concept of MIMO and OFDM concept

CO Mapping with PO and PSO:

Contents:

Unit-I: (Mapped COs) (7 hrs)

GSM: services, features, architecture, radio link, channel types, Diversity, Path loss Models, frames, call handling, EDGE, GPRS.

Unit-II: (Mapped COs) (8 hrs)

The 3G systems: Introduction, evolution of 3G networks, ITU IMT 2000, CDMA 2000: bandwidth, chip rate, channels, spreading and modulation, power control, soft

handoff, EV-DO, EV-DV UMTS: radio access network, spreading and modulation, channels, core network.

Unit-III: (Mapped COs) (7 hrs)

Wireless LANs IEEE 802.11 system and protocol architecture, physical layer and MAC, options like 802.11b, a g etc. and their purpose.

Unit-IV: (Mapped COs) (8 hrs)

Introduction to MIMO, MIMO Channel Capacity,

SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MIMO Beam forming – MRT, MIMO - OFDM

Text Books:

1. Fundamentals of Wireless Communication, 2005, David Tse and Pramod Viswanath, Cambridge University Press

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	3	2	2	1	3	3	1	1	2	1	1	3	1	2
CO2	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO3	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO4	3	3	2	3	2	3	3	1	1	2	1	1	3	1	2

2. Wireless Communications, Andrea Goldsmith

Reference Books:

1. Wireless and Cellular Telecommunications, William C. Y. Lee, 3rd edition
2. Wireless Telecommunications Systems and Networks, Gary J. Mullett 3rd edition

Departmental Elective 4:

AUDIO & SPEECH SIGNAL PROCESSING

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					TA	EC	EE	SE	Int. Ext.	
2	-	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper and Pen**

Course Objectives:

1. To introduce process of speech production
2. To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients in the analysis of speech
3. To understand analysis of Linear predictive coding for speech
4. To be able to develop speech recognition system.

Course Outcomes:

1. Demonstrate advanced knowledge in
 - Digital model representation of speech signal
 - LPC analysis
 - Homomorphic models.
2. Examine complex engineering problems critically for conducting research in speech signal processing.
3. Solve engineering problems using efficient algorithms for feasible and optimal solutions in Speech signal processing field.
4. Utilize speech and speaker verification techniques to complex engineering activities in the field of speech processing.

CO Mapping with PO and PSO:

Contents:

Unit-I (Mapped COs) (7 hrs)

The process of speech production - the mechanism of speech production, acoustic phonetics. The Acoustic theory of speech production- sound propagation, uniform lossless tubes, Effect of losses in the vocal tract, Effect of radiation at the lips, Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sound in the vocal tract. Digital model for speech signals.

Unit-II (Mapped COs) (8 hrs)

Introduction, Window considerations, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function. properties of the complex Cepstrum, computational considerations. The complex Cepstrum of speech, pitch detection, formant estimation

Unit-III (Mapped COs) (8 hrs)

Basic principles of linear predictive analysis – Auto correlation method, The covariance method. Computation of the gain for the model, solution of LPC Equations – Cholesky Decomposition solution for the covariance method. Durbin's Recursive solution for the autocorrelation equations. Comparison between methods of solutions of LPC analysis equations. Applications of LPC parameters – Pitch detection using LPC parameters, Formant analysis using LPC parameters.

Unit-IV (Mapped COs) (7 hrs)

Speaker recognition system-speaker verification system, speaker identification systems. Speech recognition system- isolated digit recognition system, continuous digit recognition system, LPC distance measure.

Text Books:

1. L R Rabiner and SW Schafer, "Digital processing of speech signals", pearson education, 2006.
2. LR Rabiner ,BHJuang, B Yegnanarayana, "Fundamentals of Speech Recognition", pearson Education, 1993.

Reference Books:

1. Thomas F Quateri, "Discrete time speech signal processing", pearson edition, 2006.
2. Ben Gold & Nelson Morgan, "Speech & audio signal processing", wiley, 2006.
3. Douglas o shaughnessy , " Speech Communications", 2nd Edition , Oxford university press, 2000.

DEPARTMENTAL ELECTIVE 5:**SMART ANTENNA**

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal Hours	Credi	Theory			Practical		To tal Mark
					TA	EC	EE	SEI	Int. Ext.	
2	-	-	2	2	10	15	25	-	-	50

Mode of Exam: Paper and Pen*Course Objectives:**

1. To introduce the students with the concepts of smart antennas.
2. To introduce different algorithms for DOA and beam forming.
3. To introduce architecture and working of smart antenna systems.
4. To have a good knowledge about all the modern smart antenna wireless systems.

Course Outcomes:

1. Outline the fundamental parameters of smart antennas and their applications.
2. Infer the DOA, beam forming methods and their algorithms. Also, they understand basic architecture, features and benefits of smart antennas.
3. Relate how to integrate smart antenna technology with overall communication system design and learn principles, performance.
4. Summarize the complete use of smart antennas in the modern wireless communication systems.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	2	1	3	3	1	1	2	1	1	3	2	2
CO 2	3	3	3	3	2	3	3	1	1	2	1	1	3	2	2
CO 3	3	3	3	3	2	3	3	1	1	2	1	1	3	2	2
CO 4	3	3	2	3	2	3	3	1	1	2	1	1	3	2	2

Contents:

Unit-I (Mapped COs) (6 hrs)

Introduction: Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

Unit-II (Mapped COs) (8 hrs)

DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Auto-covariance, Conventional DOA Estimation Methods, Conventional Beam forming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates.

Unit-III (Mapped COs) (8 hrs)

Beam Forming Fundamentals: Classical Beam former, Statistically Optimum Beam forming Weight Vectors, Maximum SNR Beam former, Multiple Side-lobe Canceller and Maximum,

SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beam forming.

Unit-IV (Mapped COs)

(8 hrs)

Smart Antennas for Wireless Communications: Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Diversity Techniques, Multiple Input- Multiple Output (MIMO) Communications Systems, MIMO for frequency selective scenarios. Integration and simulation of smart antennas.

Text Books:

1. Introduction to Smart Antennas, C. A. Balanis, Morgan and Claypool, 2007.
2. Smart Antennas, L. C. Godra, CRC Press, 2004.
3. Smart Antenna for Wireless Communication, T. S. Rappaport and J. C. Liberti, Prentice Hall, 1999.

Reference Books:

1. Frank Gross, Smart Antennas for Wireless Communications-McGraw Hill.
2. Ahmed El-Zooghby, Smart Antenna Engineering, Artech House Publishers.

Departmental Elective 6:

MULTI-RATE AND WAVELET SIGNAL PROCESSING

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TAE	CAE	ESE	Int.	Ext.
2	-	-	2	2	10	15	25	-	-

*Mode of Exam:

COURSE OBJECTIVES:

1. To acquire the basics of Multirate Signal processing and Multirate Sampling.

2. To comprehend Linear Prediction and Optimum Linear Filters
3. To analyse the Power Spectrum Estimation
4. To comprehend the basics of Continuous and Discrete Wavelet Transform

COURSE OUTCOMES:

1. Design Interpolator, Decimator and I/D Sampling Rate Converter
2. Design Optimum Linear filters and Linear Prediction filters.
3. Interpret the Parametric and Non-Parametric methods for Power Spectrum Estimation.
4. Infer the theory and construction of wavelets

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	3	3	1	1	2	1	1	3	1	2
CO2	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO3	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO4	3	3	2	3	2	3	3	1	1	2	1	1	3	1	2

Contents:

Unit-I (Mapped COs)

(8

hrs)

Multirate Digital Signal Processing:

Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter

Design and Implementation for Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion, Sampling Rate Conversion of Band-pass Signals, Sampling Rate Conversion by an Arbitrary Factor, Applications of Multirate signal Processing

Unit-II (Mapped CO-2)

(7hrs)

Linear Prediction and Optimum Linear Filters:

Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of Normal Equations, Properties of the Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Unit-III (Mapped CO-3)

(7hrs)

Power Spectrum Estimation:

Estimation of Spectra from Finite-Duration Observations of Signals, Non-parametric Methods for Power Spectrum Estimation, Parametric methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation, Eigen analysis Algorithm for Spectral Estimation

Unit-IV (Mapped CO-4)

(8hrs)

Wavelet Transform:

Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain. Discrete Wavelet Transform and Filter banks Orthogonal and bi-orthogonal two-channel filter banks, Design of two-channel filter banks.

Text Books:

1. John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Third Edition, Prentice-Hall International, INC
2. Alan V. Oppenheim, Ronald W. Schaffer, Discrete Time Signal Processing, Prentice-Hall International, INC

3. S. Mallat, A Wavelet Tour of Signal Processing, 2nd edition, Academic Press, 1999.
4. M. Vetterli and J. Kovacevic, Wavelets and Sub band Coding, Prentice Hall, 1995.
5. RaghuvveerRao and AjitS.Bopardikar, Wavelet transforms: Introduction, Theory and Applications, Pearson Education Asia, 2000.

Reference Books:

1. J.C.Goswami and A.K. Chan, Fundamentals of Wavelets: Theory, Algorithms, and Applications, 2nd ed., Wiley, 2011.
2. Michel Misiti, Yves Misiti, Georges Oppenheim, Jean- Michel Poggi, Wavelets and their Applications, John Wiley & Sons, 2010.
3. J S Walker, A premier on Wavelets and their scientific applications, , CRC press, 2002.
4. Gerald keiser, A friendly guide to Wavelets, Springer, 2011.
5. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, 2004.
6. K P Soman and KL Ramachandran, Insight into wavelets from theory to practice, PHI, 2008.

Soft Computing

Teaching Scheme					Evaluation Scheme				
Th	T	P	To	Cr	Theory			Practical	
					TAE	CAE	ESE	Int.	Ext.
2	0	-	2	2	10	15	25	-	-

Mode of exam: offline

Course objectives

1. Develop the skills to gain a basic understanding of neural network theory and support vector machine.

2. Introduce students to radial basis function and associated memory networks, Hopfield networks, and Kohonen networks.

Course outcome

1. Demonstrate the basics concept of artificial neural network.
2. Make use of associated memory networks, Hopfield networks, and Kohonen networks for problem solving.
3. Make use of radial basis function and support vector machine for the classification of different classes of data.
4. Demonstrate the use of fuzzy neural network in the real world problems.
- 5.

Syllabus

UNIT 1

(9 Hrs)

Introduction: Artificial neural networks: feed-forward, recurrent and multi-layer architectures; Supervised and unsupervised learning; Characteristics: adaptability, fault tolerance, generalization; limitations of neuro-computing. **Perceptron:** Linear classifiers; Simple perceptron; Perceptron learning algorithms; ADALINE; MADALINE; Limitation of perceptron dichotomizer. **Multi-Layer Perceptron:** Gradient decent scheme for error minimization; Generalized delta learning rule; Back-propagation learning for multi-layer networks; Multi-layer perceptrons for multidimensional functional mappings.

UNIT 2

(9 Hrs)

Associated Memory Networks: Auto-association; Heteroassociation; Linear associative networks: Hebbian learning, perfect recall, cross-talk; Bidirectional associative memory; Brain-State-in-a-Box network. **Hopfield Networks:** Binary Hopfield network: basic structure, asynchronous updating, convergence, associative memory; Continuous-valued Hopfield network. Advantages and limitations.

Kohonen Networks: Self-organizing networks; Similarity measures; Kohonen's winner-take-all network; Geometrical interpretation of Kohonen's learning; Functional specificity of human brain, Kohonen's self-organizing feature map algorithm; Conscience algorithm.

UNIT 3 (6 Hrs)
Radial Basis Function Networks: Radial Basis Function Networks: radial basis vs. linear basis, Gaussian basis functions, K-means learning, LMS algorithm, comparison with Multi-Layer Perceptron networks.
Support Vector Machines (SVM): Optimal hyperplane for linear separability, quadratic optimization, SVM for pattern recognition, different kernels for hidden-layer, optimal design of SVM.

UNIT 4 (6 Hrs)
Fuzzy Neural Networks
 Fuzzy sets: Basic Definition; Fuzzy-set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning, Fuzzy If-Then Rules Fuzzy-neural networks; Neuro-fuzzy systems; Genetic algorithms: selection schemes, operations.

Suggested Books

1. J.S.R.J ang, C.T. Sun and E. Mizutani, “**Neuro-Fuzzy and Soft Computing**”, Prentice Hall of India and Pearson Education, 2004.
2. S. Rajasekaran and G.A.V. Pai, “**Neural Networks, Fuzzy Logic and Genetic Algorithms**”, Prentice Hall of India, 2003.
3. R. Eberhart, P. Simpson and R. Dobbins, “**Computational Intelligence - PC Tools**”, AP Professional, Boston,

2. To give exposure to various learning algorithms and their applications to various real life applications.

Course outcome

1. Demonstrate the basics concept of pattern recognition.
2. Illustrate the various parametric and non-parametric techniques in pattern recognition.
3. Demonstrate the various dimension reduction techniques.
4. Make use of their learning for the analysis of the real world problems.

Syllabus

UNIT 1 (8 Hrs)
 Definitions, data sets for pattern recognition, representations of patterns and classes, metric and non-metric proximity measures, feature extraction, statistical and syntactic pattern recognition

UNIT 2 (8 Hrs)
Bayesian decision theory: Classifiers, discriminant functions, decision surfaces, normal density and discriminant functions, discrete features
Parameter estimation methods: Maximum-likelihood estimation, expectation-maximization method, Bayesian estimation, Gaussian mixture models

Non-parametric techniques: Density estimation using Parzen-window method, K-nearest neighbor method, nearest neighbor classifier

UNIT 3 (8 Hrs)
Dimension reduction methods: Linear discriminant analysis (LDA), principal component analysis (PCA)
Linear discriminant function based classifiers
Non-metric methods for pattern classification: Non-numeric data or nominal data decision trees
Unsupervised learning and clustering: Criterion functions for clustering, algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation

UNIT 4 (6 Hrs)

Pattern Recognition

Teaching Scheme					Evaluation Scheme				
Th	Tu	Pr	Total Hours	Credit	Theory			Practical	
					TA	CA	EE	Int.	Ext.
2	0	-	2	2	10	15	25	-	-
					50				

Mode of exam: offline

Course objectives

1. To cover the basic concepts for analyzing patterns and their pre-processing techniques.

Applications: Biometrics recognition, handwriting recognition, document recognition, multimedia data retrieval, speech recognition, data mining, web searching, network traffic analysis etc.

Suggested Books

1. R. O. Duda, P. E. Hart and D. G. Stork, **Pattern Classification**, John Wiley, 2001
2. S. Theodoridis and K. Koutroumbas, **Pattern Recognition**, 4th Ed., Academic Press, 2009
3. C. M. Bishop, **Pattern Recognition and Machine Learning**, Springer,

Human Computer Interface

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	Total Hours	Credit	Theory			Practical		Total Marks
					TA E	CA E	ES E	Int.	Ext.	
2	0	-	2	2	10	15	25	-	-	50

Mode of exam: offline

Course objectives

1. Investigate emerging human computer interfaces and paradigms and implement them into prototype and products with original interfaces.
2. To make the students knowledgeable in the area of designing, implementing and using interactive computer systems and how effective design of human computer interfaces influence individuals and organizations..

Course outcome

1. Understand the basic HCI concepts and various design process, standards and guidelines
2. Perform implementation support and evaluation of their design
3. Learn various models like Brain computing
4. Learn various dialogue notations and importance of groupware

UNIT 1

FOUNDATIONS: (8 Hrs)

The Human-Input-output channels-Human Memory, Thinking-emotions-Psychology &

design of interactive systems, Computer-Text entry devices, Positioning, Pointing & drawing, display devices for Virtual reality, 3D, Interaction-models-Frameworks & HCI, Ergonomics-Interaction style, WIMP Interfaces-context, Paradigms for Interaction

UNIT 2 (8 Hrs)
SOFTWARE PROCESS & DESIGN RULES

Interaction design basics-user focus-scenarios, Navigation-screen design & layout, HCI in software process-lifecycle, Usability engineering, Interactive design & prototyping, Design rules-Principles for usability-standards, HCI patterns

UNIT 3 (7 Hrs)
IMPLEMENTATION & USER SUPPORT

Implementation support-Windowing system elements, using tool kits-user interface management, Evaluation techniques-goals, Multimodal interaction, user support, Approaches-adaptive help systems, designing user support system

UNIT 4 (7 Hrs)
COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS

Cognitive models-Goal & task hierarchies, Linguistic models-Physical & device models-architectures, Communication & collaboration models, Face-to-face communication, Conversation-text based, Brain computing Interface concepts, Brain Signals-EEG, Ubiquitous computing application research, Groupware systems

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale (2003): Human-Computer Interaction. 3rd Edition. Prentice Hall, 2003
2. Ben Shneiderman and Catherine Plaisant: Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition) , 5th ed., Pearson Addison-Wesley, 2009

REFERENCE BOOKS

1. John M. Carroll, "Human Computer Interaction in the New Millennium", Pearson Education, 2002
2. Jonathan Worlpa and Elizabeth Winter Wolpaw, "Brain-Computer Interfaces" Oxford University Press 2012.

DECISION ANALYTICS

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	To tal H ou rs	Cr edi t	Theory			Pract ical		To tal M ar ks
					T A E	C A E	E S E	I n t.	E x t.	
2	0	-	2	2	1 0	1 5	2 5	-	-	50

Mode offline

COURSE OBJECTIVE:

1. Introduces the basic principles and techniques of applied mathematical modeling for managerial decision-making.
2. To use some important analytic methods (spreadsheet modeling, optimization, Monte Carlo simulation), to recognize their assumptions and limitations, and to employ them in decision-making.

COURSE OUTCOME:

1. Develop mathematical models that can be used to improve decision making within an organization
2. Ability to structure problems and to perform logical analyses.
3. Translating descriptions of decision problems into formal models, and investigate those models in an organized fashion
4. Identify settings in which models can be used effectively and apply modeling concepts in practical situations.

UNIT 1

(9 Hrs)

Deterministic Models:

Linear Programming- formulating optimization problems, spreadsheet modeling, using Solver and Solver Table, sensitivity analysis, multi-period modeling. Integer Programming – Integer and binary variables,

logical relationships, project selection, facility location, crew scheduling

UNIT 2

(8 Hrs)

Deterministic Models:

Network Optimization – Assignment problem, transportation problem, minimum-cost flow, funds-flow model, project management, currency exchange. Non-linear Optimization – Portfolio optimization, demand estimation, pricing.

UNIT 3

(7 Hrs)

Probabilistic Models:

Stochastic Optimization – Newsvendor model. Simulation – Basic concepts, Crystal Ball software, option pricing.

UNIT 4

(6 Hrs)

Probabilistic Models:

Simulation and Optimization – project management, revenue management, liquidity optimization.

TEXT BOOK

1. Practical Management Science (5th edition), by Winston and Albright.

Natural Language Processing

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	Total Hours	Credit	Theory			Practical		Total Marks
					TA E	CA E	ES E	Int.	Ext.	
2	0	-	2	2	10	15	25	-	-	50

Mode of exam: offline

Course Objective:

1. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.
2. Understand the concepts of morphology, Shallow Parsing and pragmatics of the language

Course Outcome:

1. Understand approaches to syntax and semantics in NLP.
2. Understand current methods for statistical approaches to machine translation.
3. Understand machine learning techniques used in NLP

UNIT I (8 Hrs)

Sound : Biology of Speech Processing; Place and Manner of Articulation; Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

Words and Word Forms : Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

UNIT 2 (8 Hrs)

Structures : Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution

UNIT 3 (8 Hrs)

Meaning : Lexical Knowledge Networks, Wordnet Theory; Indian Language, Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

UNIT 4 (6 Hrs)

Web 2.0 Applications: Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

References:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.

4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Deep Learning Foundations & Applications

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TA	CA	ES	Int.	Ext.	
2	0	-	2	2	10	15	25	-	-	50

Mode of exam: offline

Course Objective:

1. To provide students with foundational concepts required for deep learning across various applications ranging across speech and natural language processing to machine vision to medical imaging.
2. To introduce the fundamental principles of deep neural networks and the important paradigms of deep learning.
3. To build analytics solutions to problems in signal, image and text paradigm using deep neural networks.
4. To understand the concepts of deep neural networks and will be able to develop solutions using deep neural networks

Course outcome

1. Introduce the fundamental principles of deep neural networks and the important paradigms of deep learning.
2. To build analytics solutions to problems in signal, image and text paradigm using deep neural networks.
3. To understand the concepts of deep neural networks
4. To develop solutions using deep neural networks.

UNIT 1 (8 Hrs)

Foundation Concepts

Linear Algebra for Deep Learning: Scalars, vectors, matrices, tensors. Multiplication on matrices and tensors, trace operator and determinant.

Deep Neural Network Design and Learning: Simple exercises with Deep Neural Network Libraries viz. PyTorch/TensorFlow. Acceleration with CUDA on GPUs and MKL/Open MPI on CPUs.

Optimization for Training a Deep Neural Network Gradient descent, Stochastic gradient descent, Adaptive momentum.

UNIT 2 (8 Hrs)

Deep Learning for Speech and Natural Language Processing

Sequence Modeling with Recurrent Networks: Long Short-term Memory (LSTM) and Gated Recurrent Units (GRU), Backpropagation through time (BPTT)

Machine Translation and Text Summarization: Word Vectors, RNN Language Model, attention mechanism for sequence generation with applications to machine translation and text summarization.

UNIT 3 (7 Hrs)

Deep Learning for Machine Vision

Vector Convolutional Networks: Vector Convolution for rotation and scale invariance/equivariance, Learnable Deconvolution.

Digit, Handwriting and Hieroglyph Classification: LeNet-5 for MNIST, Fashion MNIST, NIST SD-19, Egyptian Hieroglyph, Rotation equivariant and scale invariant LeNet-5.

Object Recognition and Classification: AlexNet, VGG, ResNet, DenseNet on CIFAR-10.

Object Localization: Single shot multi-box detection and classification. Regional Proposal CNN (rCNN), Fast rCNN and Faster rCNN, YOLO-9000

UNIT 4 (7 Hrs)

Deep Learning for Healthcare and Medical Imaging

ECG Signal Classification: ECG signal filtering, segmentation and classification using 1D CNN

Digital Pathology: Blood pathology classification on ALL-IDB using transfer learning of Image Net pre-trained models,

Multiple Instance Learning of CNN for Histopathology Whole Slide Classification
Digital Radiology: Chest X-ray Classification, Brain Lesion Classification and Segmentation in MRI.

Text Books:

1. "Deep Learning", I. Goodfellow, Y. Bengio, A. Courville, MIT Press, 2016.

2. "Neural Networks and Learning Machines", S. Haykin, 3rd Edition, Pearson, 2008.

Reference Books:

1. "Neural Networks for Pattern Recognition", C. M. Bishop, Oxford University Press, 1995.

2. "Pattern Classification", R. O. Duda, P. E. Hart, D. G. Stork, 2nd Edition, Wiley, 2001.

3. "A Sampler of Useful Computational Tools for Applied Geometry, Computer Graphics and Image Processing", D. Cohen-Or, C. Greif, T. Ju, N. J. Mitra, A. Shamir, O. Sorkine-Hornung, H. Zhang, CRC Press, 2015.

4. "Machine Learning", T. M. Mitchell, McGraw Hill Education, 1997.

5. "Pattern Recognition and Machine Learning", C.M. Bishop, 2nd Edition, Springer, 2011

Track 3

System Programming for Embedded Devices (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

1. To gain knowledge about the Embedded system & its architecture
2. To able to use-Interface hardware, software tools.
3. To able to understand concept Programming & Tools.

4. To able to understand Perform programming & application design.

Course Outcomes:

1. Analyze different embedded system & its architecture.
2. Interpret functioning of microcontroller & Processor using new architecture.
3. Design the system programming using embedded tool.
4. Interpret embedded advance programming & simulation.

CO Mapping with PO and PSO:

Contents:

Unit-I: (CO1) Introduction of Microcontroller and architecture: (8Hrs)

Microcontrollers : Microprocessors and Micro-controllers, Types of Micro-controllers, External memory, Processor Architecture – Harvard v/s Van Neumann; CISC v/s RISC, Micro-controller, Memory types, Software development tools like assembler, cross- compiler, emulator, and simulator, 8051 controller, Block Diagram & Architecture.

Unit-II (CO2) Embedded system and languages

(6hrs)

8051 Instruction Set, Addressing modes & programming. 8051 Timers, Serial I/O, Embedded C programming, AVR addressing modes, RISC, CISC Programming set of instruction.

Unit-III (CO3) Embedded internal programming

(8hrs)

Simulator vs Emulator, Memory Addressing Program Memory, ROM, Data Memory, RAM, Internal RAM, Registers, Bit addressable memory, Special Function Register, Classic and Extended 8051 Devices, ARM7 and ARM9 based Microcontrollers, Cortex-Mx based Microcontrollers, Code Comparison, Software Development Cycle, µVision IDE, µVision Device Database, µVision Debugger, Assembler, C/C++ Compiler, Object-HEX Converter.

Unit-IV (CO4) Embedded software Tools & Advance application (8hrs)

Programming & debugging, Hex code creation, Logic analyzer, Serial I/O interface, UART interface, Programming Flash Devices, Configuring External Tools, ISIS AND PCB DESIGN, ISIS AND SIMULATION, Bitmap Generation Interfacing in Proteus, Classic and Extended 8051 Devices, ARM7 and ARM9 based Microcontrollers, Cortex-Mx based Microcontrollers, Code Comparison, Software Development Cycle, µVision IDE, µVision Device Database, µVision Debugger, Assembler, C/C++ Compiler, Object-HEX Converter.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2
CO2	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2
CO3	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2
CO4	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2

Text Books:

1. Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using assembly & C Pearson Education second edition 2008
2. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
3. Maneesh Rao, Internet of Things with Raspberry Pi 3, Packt Publisher, Second edition 2018

Reference Books:

1. Ajay V. Deshmukh Micro-controllers - Theory and Applications, Tata McGraw Hill
2. The Arduini Project Book, Designed, printed and bound in Torino, Italy, September 2012

Products, and design. Comparison between Traditional and Mechatronics approach.

Mechatronics (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal	Credit	Theory			Practical		T ot al Mark
					TAE	CAE	ESE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

1. To gain knowledge about the electromechanical system & its automation
2. To able to use-Interface hardware, software tools.
3. To able to understand concept Programming & Tools.
4. To able to understand Perform programming & application design.

Course Outcomes:

1. Analyze different embedded system & its architecture.
2. Interpret functioning of microcontroller & sensor interfacing
3. Illustrate the system design for stepper motor & transfer function mechanisms.
4. Illustrate & develop embedded application using Hydraulic systems.

CO Mapping with PO and PSO:

Course Outcomes ▼	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Content

Unit-I (CO1) Introduction: Definition of Mechatronics, Mechatronics in manufacturing,

Unit-II (CO2): Review of fundamentals of electronics. Data conversion devices, sensors, micro sensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

Unit-III (CO3) Module III: Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Unit-IV (CO4): Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic circuits. Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. Description, Description of PID controllers. CNC machines and part programming. Industrial Robotics.

Text Book:

1. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
2. Groover, M. P., Automation, Production System & Computer Integrated Manufacturing, Pearson Education Asia (2009).
3. Nakra, B. C., Theory and Applications of Automatic Controls, Revised 2nd Edition, New Age International Publishers (2014).

Reference Books:

1. Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using assembly & C Pearson Education second edition 2008
2. Morriss, S. B., Automated Manufacturing Systems, McGraw Hill (2006).

3. Auslander, D. M. and Kempf, C. J.,

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Mechatronics: Mechanical System Interfacing, Prentice Hall., New Jersey (1996). John W. Webb & Ronald A. Reis,

4. Programmable Logic Controllers – Principles and Applications, Fifth Edition, Pearson Education (2008).
5. John R. Hackworth & Frederick D. Hackworth Jr, Programmable Logic Controllers – Programming Methods and Applications, Pearson (2011).

Mechatronics (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

1. To gain knowledge about the electromechanical system & its automation
2. To able to use-Interface hardware, software tools.
3. To able to understand concept Programming & Tools.
4. To able to understand Perform programming & application design.

Course Outcomes:

1. Analyze different embedded system & its architecture.
2. Interpret functioning of microcontroller & sensor interfacing
3. Illustrate the system design for stepper motor & transfer function mechanisms.

4. Illustrate & develop embedded application using Hydraulic systems.

CO Mapping with PO and PSO:

Content

Unit-I : Introduction: (7 Hours)

Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach.

Unit-II: (7 Hours)

Review of fundamentals of electronics. Data conversion devices, sensors, micro sensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

Unit-III: (7 Hours)

Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Unit-IV: (9 Hours)

Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic circuits. Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. Description, Description of PID controllers. CNC machines and part programming. Industrial Robotics.

Text Book:

1. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
2. Groover, M. P., Automation, Production System & Computer Integrated Manufacturing, Pearson Education Asia (2009).
3. Nakra, B. C., Theory and Applications of Automatic Controls, Revised 2nd Edition, New Age International Publishers (2014).

Reference Books:

1. Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using assembly & C Pearson Education second edition 2008
2. Morriss, S. B., Automated Manufacturing Systems, McGraw Hill (2006).
3. Auslander, D. M. and Kempf, C. J., Mechatronics: Mechanical System Interfacing, Prentice Hall., New Jersey (1996). John W. Webb & Ronald A. Reis,
4. Programmable Logic Controllers – Principles and Applications, Fifth Edition, Pearson Education (2008).
5. John R. Hackworth & Frederick D. Hackworth Jr, Programmable Logic Controllers – Programming Methods and Applications, Pearson (2011).

2. To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
3. To understand, design and model various automotive control systems using Model based development technique. & Microcontrollers in ECU design and choice of appropriate Hardware and Software.
4. To describe various communication systems, wired and wireless protocols used in vehicle networking & Safety standards, advances in towards autonomous vehicles.

Course Outcomes:

1. Obtain an overview of automotive components, subsystems, design cycles, communication protocols.
2. Interface automotive sensors and actuators with microcontrollers.
3. Develop, simulate and integrate control algorithms for ECUs with hardware.
4. Safety systems employed in today's automotive industry.

CO Mapping with PO and PSO:

Content

Unit-I: Overview of Automotive Industry: (7 Hours)

Leading players, Automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes, Lead acid and alkaline batteries, battery rating, and battery charging characteristics, battery testing and maintenance, gel battery.

Unit-II: Systems Approach to Control and Instrumentation: (8 Hours)

Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Sensor

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Automotive Electronics (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory		Practical		Total Marks	
					TA	EC	AE	EE	Int.	Ext.
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

1. To understand the concepts of Automotive Electronics and its evolution and trends & Automotive systems & subsystems overview.

modeling, Smart Nodes, Ignition system, magneto coil ignition system, spark plug types, electronic ignition system-transistor ignition system, and capacitor discharge ignition system, distributor less ignition system and solid state ignition system.

Unit-III : STARTING AND CHARGING SYSTEM:

(7 Hours)

Principle and construction of starter motor, working of different starter drive units. DC and AC Generators – principle, construction and working, regulation, automotive transmissions: Transmission fundamentals, Types MT, AT, CVT and DCT. Vehicle Braking Fundamentals: Vehicle dynamics during braking, Hydraulic brake system components, Introduction to antilock braking systems.

Unit-IV: SENSORS AND ACTUATORS: (8 Hours)

Classification of sensors, sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors and relay. ELECTRONIC ENGINE CONTROLS: Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, engine mapping, and on-board diagnostics – engine control module and power train control module. Communication protocols: Overview of automotive communication protocols, CAN, LIN, Flex Ray, MOST, Ethernet, D2B and DSI, Communication interface with ECUs

Text Books:

1. Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes Publication, 2003.
2. Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.

Reference books:

1. Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
3. Terence Rybak & Mark Stefika: "Automotive Electromagnetic Compatibility (EMC)", Springer, 2004.
4. Allan Bonnick: "Automotive Computer Controlled Systems, Diagnostic Tools and Techniques", Elsevier Science, 2001.
5. Uwe Kiencke and Lars Nielsen: "Automotive Control Systems: Engine, Driveline and Vehicle", 2nd Edition, Springer Verlag, 2005.
6. David Alciatore & Michael Hstand: "Introduction to Mechatronics and Measurement Systems (SIE)", TMH, 2007.
7. Iqbal Husain: "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
8. Tom Denton: "Advanced Automotive Diagnosis", 2nd Edition, Elsevier, 2006.
9. G. Meyer, J. Valldorf and W. Gessner: "Advanced Microsystems for Automotive Applications", Springer, 2009.
10. Tracy Martin: "How to Diagnose and Repair Automotive Electrical Systems" Motor Books / MBI Publishing Company, 2005.
11. Mehrdad Ebsani, Ali Emadi & Yimin Gao: "Modern Electronic Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2nd Edition, CRC Press, 2009.
12. Marc E. Herniter and Zac Chambers: "Introduction to Model Based System Design", Rose-Hulman Institute of Technology.

Industrial Automation (Elective Track)

Teaching Scheme	Evaluation Scheme

Th.	Tu	Pr.	Total	Cred	Theory			Practical		Total Marks
					TA	EA	EE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

1. To gain knowledge about the Industrial system & its automation
2. To able to use-Interface hardware, software tools.
3. To able to understand concept Programming & Tools.
4. To able to understand Perform programming & application design.

Course Outcomes:

1. Analyze different embedded system & its architecture.
2. Interpret functioning of microcontroller & Processor using new architecture.
3. Illustrate the system programming using embedded tool.
4. Illustrate & develop embedded application using advanced IDE tools for simulation.

CO Mapping with PO and PSO:

Content

Unit-I: COMPUTER BASED CONTRO: (7 Hours)

Implementing control system using computer or microprocessor; computer based controller: hardware configuration and software requirements. DISTRIBUTED CONTROL SYSTEM-Meaning and necessity of distributed control; hardware components of DCS; DCS software.

Unit-II: INTRODUCTION PROGRAMMABLE LOGIC CONTROLLER (PLC): (7 Hours)

What is PLC? PLC versus microprocessor/microcontroller/computer, advantages and disadvantages of PLC, architecture and physical forms of PLC, BASIC PLC FUNCTIONS-Registers: holding, input and output registers; Timers and timer functions; counters and counter functions

Unit-III: INTERMEDIATE PLC FUNCTIONS: (9 Hours)

Arithmetic functions: addition, subtraction, multiplication, division and other arithmetic functions; Number comparison and conversion,

DATA HANDLING FUNCTIONS OF PLC: Skip function and applications; master control relay function and applications; jump with non-return and return; data table, register and other move functions, BIT FUNCTIONS OF PLC: Digital bit functions and applications; sequencer functions and applications, ADVANCED FUNCTIONS OF PLC: Analog input and output functions, analog input and output modules, analog signal processing in PLC; PID control function, network communication function, PLC PROGRAMMING: PLC programming languages, ladder programming, mnemonic programming and high level language programming.

Unit-IV: SCADA:

(7 Hours)

Supervisory control versus distributed control; Layout and parts of SCADA system, detailed block schematic of SCADA system; Functions of SCADA system: data acquisition, monitoring, control, data collection and storage, data processing and calculation, report generation; MTU: functions, single and dual computer configurations of MTU; RTU: functions, architecture / layout; MTU-RTU communication and RTU-field device communication.

BOOKS RECOMMENDED:

1. Johnson CD, Process Control Instrumentation Technology, Prentice Hall

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

2. Webb JW and Reis RA, Programmable Logic Controllers, Prentice Hall
3. Hackworth JR and Hackworth FD, "Programmable Logic Controllers," Pearson Edition
4. Boyer SA, Supervisory Control and Data Acquisition (SCADA), International Society of Automation

IoT System Design

Teaching Scheme	Evaluation Scheme

Th.	Tu	Pr.	Total	Cred	Theory			Practical		Total Marks
					TA	EC	AE	EE	SE	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

1. To gain knowledge about the Embedded system & its architecture
2. To able to use-Interface hardware, software tools.
3. To able to understand concept of IOT & its system architecture
4. To able to understand sensory system analysis on Cloud using IoT platform

Course Outcomes:

1. Analyze different embedded system & its architecture.
2. Interpret functioning of microcontroller & Processor using new architecture.
3. Design the embedded system software & Hardware interfacing.
4. Analyze IOT concept & architecture.
5. Interpret IOT DATA LINK LAYER & IOT Hardware.
6. Design & develop IoT based application using advanced technology

CO Mapping with PO and PSO:

Contents:

Unit-I: (CO1) INTRODUCTION TO EMBEDDED CONCEPTS

(6hrs)

Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software

Unit-II : Embedded system architecture

(8hrs)

Classifications of embedded systems, challenges and design issues in embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC,

fundamentals of Vonneuman/Harvard architectures, and types of microcontrollers, MP vs MC 8051, MC-8051 & 89s52 architecture– pin diagram, Simulator vs Emulator, Memory Addressing Program Memory, ROM, Data Memory, RAM, Internal RAM, Registers, Bit addressable memory, Special Function Register, Motor driver – Manual robot Interfacing.

Unit-III : IOT Architecture

(8hrs)

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management UNIT

Unit-IV (CO4) IOT DATA LINK LAYER & IOT Hardware

(8hrs)

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP, Arduino, Raspberry Pi, Sensors Interfacing, and Wi-Fi ESP8266 interfacing ,WSN node, Power supply, Antenna concept, Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	3	1	1	1	1	1	1	2	1	1	3
CO2	2	2	1	1	3	1	1	1	1	1	1	2	1	1	3
CO3	2	2	1	1	3	1	1	1	1	1	1	2	1	1	3
CO4	2	2	1	1	3	1	1	1	1	1	1	2	1	1	3

Standards – Cloud Providers and Systems, Mobile Cloud Computing, Think speak, carrot, Amazon Web Services for IoT, Skynet IoT Messaging Platform. Case Studies: Home Intrusion Detection, Weather Monitoring System, Air Pollution Monitoring, Smart Irrigation, Alexa services.

Text Books:

1. Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using assembly & C Pearson Education second edition 2008
2. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
3. Maneesh Rao, Internet of Things with Raspberry Pi 3, Packt Publisher, Second edition 2018
4. Peter Waher, Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3, Packt Publisher, First edition 2018
5. Internet of Things A to Z: Technologies and Applications June 2018 with 6,388 Reads Publisher: 978-1-119-45674-2, Publisher: Wiley-IEEE Press.

Reference Books:

1. John C. Shovic, Raspberry Pi IoT Projects: Prototyping Experiments for Makers, Apress Publisher, First edition 2018
2. Ajay V. Deshmukh Micro-controllers - Theory and Applications, Tata McGraw Hill
3. Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Series in Signal, Image and Speech Processing John Soldatos Athens Information Technology Greece, River Publishers Alsbjergvej 10 9260 Gistrup Denmark.

TRACK 4:

Department Elective –I:

Biomaterials- Materials in Medicine

(Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu.	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					T	A	E	C	A	E
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

1. Description of classes of biomaterials used in medicine and specific requirements.
2. Understanding of the concept of biocompatibility and the methods for biomaterials testing.
3. Learn how to design, synthesize, evaluate and analyze biomaterials.

Course outcomes:

1. Demonstrate the fundamental of biomaterials.
2. Interpret the bioinformatics.
3. Design, synthesize, evaluate, and analyze biomaterials.
4. Make use of their learning for clinical trials, and manufacturing.

Contents:

UNIT-I: (7 Hours)

Fundamentals of biomaterial science, concept of biocompatibility, classes of biomaterials used in medicine, basic properties, medical requirements and clinical significance, disinfection and sterilization of biomaterials.

UNIT-II: (8 Hours)

Physico-chemical properties of biomaterials: mechanical (elasticity, yield stress, ductility, toughness, strength, fatigue, hardness, wear resistance), tribological (friction, wear, lubricity), morphology and texture, physical (electrical, optical, magnetic, thermal), chemical and biological properties.

UNIT-III: (7 Hours)

Elements in contact with the surface of a biomaterial: blood composition, plasma

proteins, cells, tissues. Phenomena at the bio-interfaces. molecular and cellular processes with living environment, blood-materials interaction, short and long term reactions to the body.

UNIT-IV: (8 Hours)

FDA requirements, standards on the biological evaluation of medical devices (ISO-10993) and implications to applications in human. Practical aspects of biomedical devices: manufacturing, storage quality, regulatory and ethical issues, price of implants and allocation of resources.

Text Books:

1. H.Boenig, Fundamentals of Plasma Chemistry and Tehnology, Technomic Publishing Co.Inc. Lancaster Basel, 1990.
2. Practical Surface Analysis, 2- edition, Edited by D.Briggs, M.P.Seah, J.Wiley & Sons Ltd, 1990.
3. Biomaterials Science, An Intoduction to Materials in medicine, Eds. B. D. Ratner and A. S. Hoffman, Academic Press, New York, 1996.
4. Plasma-surface modification of biomaterials, P.K.Chua, J.Y.Chena, L.P.Wanga, N.Huang, Elsevier Science B.V, 2002.
5. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2004, USA.

Department Elective -2:

Biochemistry & Cell Biology

(Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal Hours	Credit	Theory			Practical		T o t a l mark
					T	A	E	C	A	
					E	E	S	E	Int.	Ext.
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

The course should give awareness about the basic molecular mechanisms in a living cell and its main components.

Course outcomes:

1. Interpret the general structures of the macromolecules of the cell (protein, nucleic acid, carbohydrate and lipid).
2. Describe the different parts of the eukaryotic cell, their cellular functions and the basic energy metabolism.
3. Demonstrate the renewal of glucose, fatty acids, amino acids and nucleotides.
4. Explain the flow of genetic information in the cell; including replication, transcription and translation and their regulation.

Contents:

UNIT-I: (8 Hours)

Biochemistry Protein structure, enzymology, cellular renewal of glucose, fatty acids, amino acids and nucleotides, basic cell energy metabolism, biological membranes, reactive oxygen forms, methods for isolation and analysis of proteins (lectures). The structure and function of haemoglobin (seminar).

UNIT-II: (7 Hours)

The structure of nucleic acids, function and synthesis. The cell biology central dogma about the information flow in the cell. The structure of the genome. The gene concept and gene structure.

UNIT -III: (7 Hours)

DNA replication and DNA repair. Genetic recombination. Transcription and its regulation. Translation and its regulation. Basic recombinant DNA techniques.

UNIT -IV: (8 Hours)

The structure and ultrastructure of the cell. Organelles and membrane systems and their structure and function. Cell division: mitosis and meiosis. Intracellular protein sorting and secretion and endocytosis. Cell skeletons and cell motility.

Text Books:

1. Champe, Pamela C.; Harvey, Richard A.; Ferrier, Densise R, Biochemistry 4. Ed.: Baltimore, MD: Lippincott Williams & Wilkins, cop. 2008
2. Lodish, Harvey F., Molecular cell biology, 7th ed., International ed.: New York: W.H. Freeman, 2012

Department Elective -3:
Bioinformatics: Algorithms and Applications
(Total Hours: 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Mark
					TA	EC	AE	EE	SE	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

To give students an introduction to the basic practical techniques of bioinformatics.

Course outcomes:

1. Illustrate the basic concepts of bioinformatics
2. Analyse protein structures and protein sequence
3. Explain Finite Volume Method
4. Develop algorithms by using machine learning techniques and programming.

Contents:

UNIT –I: (7 Hours)

Introduction, DNA sequence analysis, DNA Databases, Protein structure and function, protein sequence databases, sequence alignment, PAM matrix, Global and local alignment, BLAST: features and scores.

UNIT –II: (8 Hours)

Multiple sequence alignment, Conservation score, phylogenetic trees. Protein sequence analysis, hydrophobicity profiles, non-redundant datasets. Protein secondary structures, Ramachandran plot, propensity, secondary structure prediction.

UNIT –III: (7 Hours)

Protein tertiary structure, Protein Data Bank, visualization tools, structural classification, contact maps. Protein structural analysis, protein structure prediction, Finite Volume Method (FVM) – I

UNIT-IV: (8 Hours)

Protein stability, energetic contributions, database, stabilizing residues, stability upon mutations, Computer aided drug design, docking, screening, QSAR, Development of algorithms, AWK programming, machine learning techniques, applications using WEKA.

Text Books:

1. M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Academic Press, 2010
2. D.E. Krane and M.L. Raymer, Fundamental concepts of bioinformatics, Pearson Education Inc. 2006

Department Elective -4:

Brain Machine Interface

(Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Marks
					TA	EC	AE	EE	SE	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

1. To introduce the basic concepts of brain computer interface.
2. To study the various signal acquisition methods.
3. To study the signal processing methods used in BCI.

Course outcomes:

1. Demonstrate the basics concept in the field of brain sensing for human-computer interaction research.
2. Make use of the various tools used in brain sensing.
3. Illustrate the steps required to use real-time brain sensing data as input to an interactive system.
4. Make use of the required features and classify the signal for applications.

Contents:

Unit I: Introduction to Brain Machine Interface (8 Hours)

Fundamentals, structure and classification of brain machine interface system, Non-invasive and Partially Invasive Brain signal acquisition, Signal Pre-processing, artefacts removal.

Unit –II: Electrophysiological Sources (8 Hours)

Sensorimotor, Neuronal activity in motor cortex and related areas, Electric and magnetic fields produced by the brain, signals reflecting brain metabolic activity, Mu rhythm, Movement Related Potentials, Slow Cortical

Potentials, P300 Event related potential, Visual Evoked Potential, Activity of Neural Cells, Multiple Neuro-mechanisms

Unit –III: Feature Extraction Methods (7 Hours)

Time/Space Methods – Fourier Transform, Wavelets, Auto-regressive, Moving average, AR-MA models, Bandpass filtering, Template matching, Kalman filter, PCA, Laplacian filter – Linear and Non-Linear Features

Unit –IV: Feature Translation Methods (7 Hours)

Linear Discriminant Analysis – Nearest neighbours, Support Vector Machines, Regression, Learning Vector Quantization, Gaussian Mixture Modeling, Hidden Markov Modeling, Neural Networks.

Text Books:

- Jonathan Wolpaw, Elizabeth Winter Wolpaw, 'Brain Computer Interfaces: Principles and practice', Edition 1, Oxford University Press, USA, January 2012.
- Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010
- Wolpaw J.R, N.Birbaumer et al, "Brain control interface for Communication and control", Clinical Neurophysiology, 113, 2002.

Department Elective -5:

Physics and instrumentation in medical imaging (Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credi	Theory			Practical		Total Marks
					TA	CA	ESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

Course Objectives:

- To understand the physics behind different instruments in medical imaging
- To learn how to design a simple review paper

Course Outcomes:

- Demonstrate the basics concept and physics behind of X-ray technique
- Illustrate the importance of nuclear magnetic resonance in MRI
- Explain the concept of generation of ultrasound
- Design a term paper on one of the given topics

Contents:

Unit -I: Planar X-rays (8 Hours)

Electromagnetic radiation, generation and characteristics of x-rays, x-ray tubes, interaction of x-rays with tissues.

Unit -II: Magnetic Resonance Imaging (MRI) (9 Hours)

Concept of spin and nuclear magnetic resonance, spin decay through interaction with tissues, use of different magnets in MRI systems, one or two simple imaging sequences.

UNIT –III: Ultrasound (9 Hours)

Characteristics of sound waves, piezoelectricity and generation of ultrasound, interaction of ultrasound with tissues, Doppler effect and its uses.

UNIT –IV: Term Paper (4 Hours)

Write a term paper on one of the given topics.

Text Books:

- William R. Hendee and E. Russell Ritenour, Medical Imaging Physics, Wiley-Liss, 4th edition, 2002
- Nadine Barrie Smith and Andrew Webb, Introduction to Medical Imaging: Physics, Engineering and Clinical Applications, Cambridge University Press, 1st edition, 2011

Department Elective -6:

Neuromorphic Computing (Total Hours: 30)

Teaching Scheme					Evaluation Scheme					
Th	T	P	Total Hour	Cred	Theory			Practical		Total Mark
					TA	CA	ES	In	Ex	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

To introduce a number of mathematical and computational concepts and techniques that can

be used for the mathematical modelling of the real world problem.

Course outcomes:

1. Demonstrate the basics concept in the field neuromorphic computing.
2. Illustrate the organization of nervous system and neuroanatomy.
3. Demonstrate the biophysical models of single neuron and simplified neural models.
4. Make use of the various models based on the neural networks to solve the real world problems.

Contents:

UNIT -1: (6 Hours)

Linear algebra – eigenvalues and eigenvectors for symmetric matrices. Quadratic forms, solving a system of linear equations, Dynamical systems - types of fixed pts, bifurcation map in terms of trace and determinant. Dynamical systems - types of fixed pts, bifurcation map in terms of trace and determinant.

UNIT -2: (8 Hours)

Neuron - axons, dendrites etc, the four components of Neural Signalling. Neurotransmission: neurotransmitter, receptor, ion channel, channel gating. Electrophysiology - Nernst potential, resting potential, Goldman-Hodgkin-Katz voltage equation, outline of the Hodgkin-Huxley model. Modeling ion channel kinetics, activation and inactivation gates. Complete formulation of Hodgkin-Huxley model. Relation between output firing and constant input current. Discussion of regimes.

UNIT -3: (8 Hours)

Derivation of the cable equation - defining axial, radial resistance and membrane capacitance, defining quantities in terms of per unit length. Steady state Solution for Infinite cable and semi-infinite cable. Solution for Finite cable: sealed end, killed end and arbitrary boundary conditions. Time-dependent solution for impulse input. Propagation delay, pseudo-velocity. Relation between cable diameter and conduction velocity. Branched cables and Rall's condition. Modeling synaptic transmission.

UNIT -4: (7 Hours)

Fitzhugh-Nagumo neuron model - phase-plane analysis, showing excitability, bistability and

oscillations. Integrate and fire neuron, resonate and fire neuron, Izhikevich models. Classical conditioning and instrumental condition. Sensitization, habituation and priming, Cellular correlates of learning. Hebbian learning, Long-term Potentiation (LTP) and Long-term Depression (LTD).

Text Books:

1. Peter Dayan & LF Abbot, Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, MIT Press. ISBN 0-262-04199-5.
2. Patricia Churcland & Terence Sejnowski, Computational Brain, MIT Press.
3. Christof Koch, Biophysics of computation: information processing in single neurons, Oxford University Press, 2005
4. Eric Kandel, James Thomas Schwartz, Jessel, Principles of Neural Science, 4th ed. McGraw-Hill, New York.
5. Computational neuroscience: a comprehensive approach, Edited by J. Feng, Chapman & Hall/CRC, 2004.
6. Randall C. O'Reilly, Yuko Munakata, Computational explorations in cognitive neuroscience: understanding the mind, MIT Press, 2000.

**DEPARTMENTAL ELECTIVE 1:
OPERATING SYSTEMS:**

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Tot al Hou rs	Cred its	TA E	CA E	ES E	I nt	E xt	
2	-	2	4	3	10	15	25	10	15	75

Mode of exam: Paper and pen-Offline

Course Objective:

1. Introduces general idea, structure and functions of operating system
2. Making students aware of basic mechanisms used to handle processes, memory, storage devices and files.

Course Outcome:

1. Identify basic structure and purpose of operating system.
2. Interpret the concepts of process and illustrate various CPU scheduling algorithms.
3. Interpret the concepts of inter process communication.
4. Schematize Deadlock & security mechanisms in operating systems.
5. Analyze different memory management techniques with advantages and disadvantages.

CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	P02	P03	P04	P05	PSO1	PSO2
CO1	2	-	1	3	-	1
CO2	2	-	3	-	2	2
CO3	3	3	-	-	2	3
CO4	3	-	2	-	2	2

Contents

Unit-I (8 hrs)

Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation.

Unit-II (8 hrs)

Process & Its Scheduling : Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms,

Unit-III (7 hrs)

Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems

Unit-IV (7 hrs)

Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation

TEXT BOOKS :

1. Operating System concepts – Silberchatz& Galvin, Addison Wesley, 6 thEdn.
2. Modern Operating Systems – Tanenbaum, Pearson Edn. 2 ndedn.

REFERENCE BOOKS :

1. Operating Systems – S R Sathe, Macmillan Publishers, India, 2008
2. Operating System –Milan Milenkovic, McGraw-Hill, 1987
3. Operating Systems - 3 rd Edition by Gary Nutt, Pearson Education.

DEPARTMENTAL ELECTIVE 2: BIG DATA & HADOOP:

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I nt	E xt	
1	-	2	3	2	10	15	25	10	15	75

Mode of exam: Paper and pen-Offline

Course Objective:

1. Understand the various parts of Hadoop condition, for instance, Hadoop 2.7, Impala, Yarn, MapReduce, Pig, Hive, HBase, Sqoop, Flume, and Apache Spark
2. Learn Hadoop Distributed File System (HDFS) and YARN building, and make sense of how to function with them for limit and resource organization
3. understand MapReduce and its qualities and retain advanced MapReduce thoughts.

Course Outcome:

1. Interpret basic concepts and techniques of Hadoop ecosystem and Big data.
2. Design different component of Hadoop ecosystem.
3. Interpret the domain of data science and analysis of big data
4. Gain experience of doing independent study and research through case studies.

CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	P02	P03	P04	P05	PSO1	PSO2
CO1	1	1	1	1	1	1
CO2	1	1	2	1	1	2

CO3	2	1	2	2	1	1
CO4	1	1	1	1	1	1

Contents

Unit-I: (Mapped CO1) (8 hrs)

Introduction to Hadoop and Big Data, Big data, challenges for processing big data, technologies support big data, History of Hadoop, Use cases of Hadoop, RDBMS vs Hadoop When to use and when not to use Hadoop.

Unit-II: (Mapped CO2) (8 hrs)

Hadoop Distributed File System, Significance of HDFS in Hadoop, Features of HDFS, Data Storage in HDFS :Introduction about Blocks, Data replication. Accessing HDFS:CLI (Command Line Interface) and admin commands, Java Based Approach, Fault tolerance. Download Hadoop, Installation and set-up of Hadoop, Start-up & Shut down process.

Unit-III: (Mapped CO3) (7 hrs)

Map Reduce: Map Reduce Story, Map Reduce Architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Different phases of Map Reduce Algorithm, Different Data types in Map Reduce

Unit-IV: (Mapped CO4) (7 hrs)

PIG: Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Execution in Pig, Loading data, Exploring Pig Latin commands,

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 3rd edition, O'Reilly Media.
2. Big Data (Black Book), Wiley
3. V. Prajapati, "Big Data Analytics with R and Hadoop", PacktPub.

Reference Books:

1. V. Ankam, Big Data Analytics, Packt Pub Ltd.
2. N. Dasgupta, Practical Big Data Analytics, Packt Pub Ltd.

DEPARTMENTAL ELECTIVE 3: DATA STRUCTURE & ALGORITHMS:

Teaching Scheme				Credits	Continuous Evaluation Scheme						Total
					Theory				Practical		
Th.	Tu.	Pr.	Total Hr.		TA	CA	ES	Exam Mo	Int	Ext	

			urs					de			
2	-	2	4	3	10	15	25	Online	10	15	75

Mode of exam: Paper and pen-Offline Course Objective:

1. This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
2. It's also aimed at developing skill to implement methods to solve specific problems using basic data structures.
3. The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.

Course Outcome:

1. Describe data structures and understand when it is appropriate to use.
2. Infer algorithms for data searching and sorting.
3. Make use of linear and nonlinear data structures to solve various real world computing problems.
4. Inspecting to Relate use of Abstract data types & ways in which they can be stored, accessed and manipulated.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	3	2	3	1	-
CO2	2	3	3	2	-
CO3	3	3	3	2	1
CO4	3	3	3	3	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Arrays & Pointers

Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Multidimensional Arrays, Pointers; Pointer Arrays, Dynamic Memory Management.

Unit-II: (Mapped CO2) (8 hrs)

Sorting and Searching

Introduction: Sorting; Bubble Sort, Insertion Sort, Selection Sort, Merging, Searching; Linear Search, Binary Search.

Unit-III: (Mapped CO3) (7 hrs)
Linked List

Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation and Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Circularly Linked Lists, Doubly Linked Lists.

Unit-IV: (Mapped CO4) (7 hrs)
Stacks, Queue and Recursion

Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Application of Stacks, Recursion, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques and Applications of Queues.

Text Books:

1. AVAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
2. THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.

Reference Books:

1. Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman, Person.
2. MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)

DEPARTMENTAL ELECTIVE 4:
INFORMATION SECURITY & CRYPTO
CURRENCY:

Teaching Scheme				Credits	Continuous Evaluation Scheme					Total
Th	Tu	Pr	Total Hours		Theory			Practical		
					TAE	CAE	ESE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Mode of exam: Paper and pen-Offline

Course Objectives:

1. This course covers the fundamentals of computer systems security.
2. It introduces many different areas of security such as encryption, malicious code, authentication and access control, trusted

computer systems, operating system and network security.

3. The objective of this course is to provide students with a comprehensive overview of the threats to computer security, technologies for security assurance, and engineering approaches to security solutions.

4. Create an ability to understand and use various open source security tools to improve personal information security & network security.

Course Outcomes:

1. Use the fundamentals of Cryptography and standard algorithms to provide confidentiality, integrity and authenticity.
2. Use symmetric and asymmetric key encryption systems
3. Analyze various message authentication codes and hash functions.
4. Analyze detection and prevention of various attacks

CO Mapping with PO and PSO

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	1	2	1	1	-
CO2	2	1	2	2	-
CO3	1	2	1	-	1
CO4	1	2	2	-	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Introduction: Introduction to information and network security, Attacks, services, mechanisms, security attacks, security services, a model for internet work security, encryption model, steganography, classical encryption techniques, modern techniques - simplified DES, block cipher principles, data encryption standard, strength of DES, block cipher design principles, block cipher modes of operation.

(CO2) (7 hrs)

Confidentiality and Key Management: Confidentiality using conventional encryption: placement of encryption function, random number generation. Public key cryptography: principles, RSA algorithm, key management, diffie-hellman key exchange, elliptic curve cryptography, Chinese remainder theorem, Euclidean algorithm, extended Euclidean

Unit-II: (Mapped CO2) (8 hrs)
Introduction to Software Defined Networking (SDN)

Evolution of Switches and Control Planes, Centralized and Distributed Control and Data Planes Concepts, Advantages and Disadvantages, Open Flow protocol. SDN Controller: General Concepts, Layer 3 Centric, Plexxi, CiscoOnePK, Network Programmability

Unit-III: (Mapped CO3) (6 hrs)
Data Center Concepts and Constructs

Technologies for the Data Center, The Multitenant Data Center, The Virtualized Multitenant Data Center, SDN Solutions for the Data Center Network, VLANs, EVPN, VxLan, NVGRE Network Topology and Topological Information Abstraction: Introduction, Network Topology, Traditional Methods, LLDP, BGP-TE/LS, ALTO, I2RS Topology

Unit-IV: (Mapped CO3) (8 hrs)

Building an SDN Framework: Introduction The Juniper SDN Framework IETF SDN Framework(s) Open Daylight Controller/Framework Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring, Use Cases for Input Traffic Monitoring, Classification, and Triggered Actions, Firewalls as a Service, Network Access Control Replacement, Extending the Use Case with a Virtual Firewall, Feedback and Optimization, Intrusion Detection/Threat Mitigation

Textbooks

1. SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.
2. Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844

References Books:

1. SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.

2. Network Innovation through Open Flow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
3. Open Networking Foundation (ONF) Documents, <https://www.opennetworking.org>, 2015.
4. Open Flow standards, <http://www.openflow.org>, 2015.
5. Online Reading Lists, including: <http://www.nec-labs.com/~lume/sdn-reading-list.html>, 2015.

DEPARTMENTAL ELECTIVE 6:
BLOCKCHAIN TECHNOLOGY
(Total hours – 30)

Teaching Scheme				Credits		Continuous Evaluation Scheme					
					Theory				Practical		Total
Th.	Tu	Pr.	Total Hours		TA	CA	SE	Exam Mode	Int	Ext	
2	-	2	4	3	10	15	25	Online	10	15	75

Mode of exam: Offline

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	1	1	1
CO2	2	2	3	1	1
CO3	1	1	1	2	1
CO4	1	1	2	3	2

Course Objective:

1. To understand the concept of blockchain.
2. To be able to implement blockchain in security and other applications

Course Outcomes:

1. Demonstrate Basic Cryptographic primitives used in Blockchain
2. Illustrate hyperledger fabric in blockchain
3. Experiment with different applications of blockchain
4. Apply blockchain for research in AI, Big Data

Contents

UNIT –I: (8 Hours)

Introduction to Blockchain, Crypto Primitives and Bitcoin, Consensus algorithms and their

scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

UNIT –II: (8 Hours)

Permissioned Blockchain, Hyperledger Fabric, Fabric Demo, Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

UNIT –III: (7 Hours)

Blockchain Use Cases – Finance, Blockchain Use Cases – Industry, Blockchain in Government and Blockchain Security

UNIT –IV: (7 Hours)

Security and Research Aspects, Research Aspects in Blockchain, AI and Blockchain and Big Data

Text Books:

1. Draft version of “S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, ‘Blockchain Technology: Cryptocurrency and Applications’, Oxford University Press, 2019.
2. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.



G H RAISONI COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

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DEPARTMENT OF ELECTRONICS ENGINEERING

Vision of the Institute

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards with capabilities of accepting new challenges.

Mission of the Institute

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stake-holders. Our strength is directed to create competent professionals. Our endeavor is to provide all possible support to promote research and development activities.

Vision of the Department

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards in electronics & telecommunication engineering with capabilities of accepting new challenges.

Mission of the Department

Mission of the Department is

- To create competent professionals who are trained in the design, implementation of engineering & telecommunication systems
- To contribute towards the advancement of engineering, science and technology
- To impart quality and value based education to raise satisfaction of all stake holders
- To promote research & development activities in the field of electronics & telecommunication engineering and allied areas

Programme Educational Objectives

- **PEO1:** Identify, define and solve problems in the fields of electronics & communication engineering.
- **PEO2:** Employ necessary techniques and tools for advanced engineering applications, engage themselves in research and development, and take up higher education.
- **PEO3:** Use their skills in ethical & professional manner to raise the satisfaction level of the stakeholders.

Programme Outcomes and Programme Specific Outcomes

Graduates of Electronics and Telecommunication Engineering shall be able to

Programme Outcomes

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Programme Specific Outcomes

Graduates of Electronics and Telecommunication Engineering shall be able to

PSO1: Demonstrate industrial practices learned through internship and solve the live problems of the industries

PSO2: Acquire multidisciplinary knowledge through projects and hands on experience to meet industry needs.

PSO3: Demonstrate capability to undertake higher studies and develop leadership qualities to emerge as potential entrepreneur.

B.TECH. ELECTRONICS ENGINEERING

Term-I												
Sub. Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Total
		Th.	Tu	Pr.	Total	Credit	Theory			Practical		
							TAE	CAE	ESE	Int.	Ext.	
BFYL101	Matrices (Maths-I)	1	1	-	2	2	10	15	25	-	-	50
BFYL102	Differential & Vector Calculus (Maths-II)	1	1	-	2	2	10	15	25	-	-	50
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	-	75
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	-	-	50
BEEL103	Energy Sources & Audit	1	-	-	1	1	10	15	-	-	-	25
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	-	100
BECL101 BECF101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	-	75
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	-	-	50
BCSP101	Data Analytics	-	-	2	2	1	-	-	-	25	-	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	-	-	-	25	--	25
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	-	25
BFYP131	Waste Management	-	-	2	2	1	-	-	-	25	-	25
BFYP132	Environmental Science	-	-	1	1	0.5	-	-	--	25	--	25
Total		9	4	16	29	21	80	120	175	225	-	600

Term-II												
Sub. Code	Name of the Course	Teaching Scheme					Evaluation Scheme					Total
		Th .	T u	Pr .	Total	Credit	Theory			Practical		
							TA E	CA E	ES E	Int.	Ext .	
BFYL103	Integral & Multiple Calculus (Maths-III)	1	1	-	2	2	10	15	25	-	-	50
BFYL104	Ordinary & Partial Differential Equations (Maths-IV)	1	-	-	1	1	10	15	25	-	-	50
BECL102 BECP10 2	Engg. Mechanics-(CIVIL)/Analog Circuits - (IT+CSE+ETC+ETRX+E E)	1	1	2	4	3	10	15	25	25	-	75
BFYP152	Internet of Things	-	-	2	2	1	-	-	-	25	-	25
BFYL121 BFYP121	App. Physics	1	1	2	4	3	10	15	25	25	-	75
BCSP10 2	Data Structure	-	-	4	4	2	-	-	-	50	-	50
BECP10 3	Embedded Programming	-	-	2	2	1	-	-	-	25	-	25
BMEP10 2	Digital Fabrication	-	-	4	4	2	-	-	-	50	-	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	-	-	-	50	-	50
BHUL101 BHUP10 1	Communication Skills	-	2	2	4	3	10	15	25	50	-	100
BMBP10 1	Entrepreneurship	-	-	2	2	1	-	-	-	25	-	25
BHUP10 2	Ethics & Professional Competancies	-	-	2	2	1	-	-	-	25	--	25
Total		4	5	26	35	22	50	75	125	350	-	600

Term-III													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					Total
			Th .	T u	Pr .	Total	Credit	Theory			Practical		
								TA E	CA E	ES E	Int.	Ext .	
BFYL112	Maths-5,Mathematical Modeling		1	1	-	2	2	10	15	25	-	-	50
BHUP203	Quant		-	-	1	1	0.5	-	-	-	25	-	25
BHUP202	Reasoning		-	-	1	1	0.5	-	-	-	25	-	25
BAIP202	Skill Development - 1(Linear Algebra)	Online	-	-	2	2	1	-	-	-	25	25	50
BHUP205	Buisness English Certification -I		-	-	4	4	2	-	-	-	50	-	50
BHUP204	Liberal Arts/Creative Arts (Hobby Module)		-	-	1	1	0.5	-	-	-	25	-	25
BAIP204	Foundation course in ANN	Online	-	-	2	2	1	-	-	-	25	25	50
BECL215 BECP215	Electronic Devices & Circuits	Offline	2	-	2	4	3	10	15	25	25	-	75
BEEL206	Network Theory	Offline	1	1	-	2	2	10	15	25	-	-	50
BECL216 BECP216	Communication Electronics	Offline	2	-	2	4	3	10	15	25	25	-	75
BECL217	Signal & Systems	Offline	1	1	-	2	2	10	15	25	-	-	50
BECL218 BECP218	Embedded Systems Design	Online	2	-	2	4	3	10	15	25	25	25	100
Total			9	3	17	29	20.5	60	90	150	250	75	625

Term-IV													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					Total
			Th .	T u	Pr .	Total	Credit	Theory			Practical		
								TA E	CA E	ES E	Int.	Ext .	
BFYL113	Maths 6 (Optimization & z transforms)		1	1	-	2	2	10	15	25	-	-	50
BMBP102	Enterprenuership Development Practice		-	-	2	2	1	-	-	-	25	-	25
BHUP206	Aptitude 1		-	-	1	1	0.5	-	-	-	25	-	25
BAIL203	Machine Learning Algorithms	Online	2	-	-	2	2	10	15	25	-	-	50
BECL220	Sensor & Actuators	Offline	1	-	-	1	1	10	15	25	-	-	50
BECL221	Electromagneti c Field & Waves	Offline	1	1	-	2	2	10	15	25	-	-	50
BECL222 BECP222	Analog Systems & Design	Offline	2	-	2	4	3	10	15	25	25		75
xxxxx	Open Elective-I	Offline	2	-	-	2	2	10	15	25	-	-	50
BECL223 BECP223	Digital Communication	Offline	2	-	2	4	3	10	15	25	25		75
BECL224 BECP224	Introduction to Drones	Online	1	-	2	3	2	10	15	25	25	-	75
BCSL208 BCSP208	Data Base Management System	Online	2	-	2	4	3	10	15	25	10	15	75
Total			14	2	11	27	21.5	90	135	225	135	15	600

Term-V													
Sub. Code	Name of the Course	Mode of Conducti on	Teaching Scheme					Evaluation Scheme					Tot al
			Th .	T u	Pr .	Tot al	Cred it	Theory			Practica l		
								TA E	CA E	ES E	Int .	Ex t.	
BFYL114	Maths 7 (Matrix differential equations)		1	1	-	2	2	10	15	25	-	-	50
MBP104	Advanced Communication Skills		-	-	4	4	2	-	-	-	50	-	50
BECP317	Skill Development - 2 (VLSI based Project)			-	2	2	1	-	-	-	25	25	50
BHUP302	Aptitude 2		-	-	1	1	0.5	-	-	-	25	-	25
MBP301	Financial Management for Engineers		-	-	1	1	0.5	-	-	-	25	-	25
BECL318 BECP318	CMOS VLSI Design	Online	1	-	2	3	2	10	15	25	10	15	75
BECL316 BECP316	Digital Signal Processing	Offline	2	-	2	4	3	10	15	25	25	25	100
BECL319	Transmission Line & Antennas	Offline	2	-	-	2	2	10	15	25	-	-	50
BECL320 BECP320	Hardware Description Language	Online	1	-	2	3	2	10	15	25	10	15	75
BCSP213	Java Programming	Online	-	-	4	4	2	-	-	-	25	25	50
XXXX	Departmental Elective-1	Offline	2	-	-	2	2	10	15	25	-	-	50
BECP321	Internship &Technical Report Writing		-	-	2	2	2	-	-	-	50	-	50
Total			9	1	20	30	21	60	90	150	245	105	650

Term-VI													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					
			Th .	T u	Pr .	Total	Cred it	Theory			Practical		Total
								TA E	CA E	ES E	Int.	Ext .	
BFYL115	Maths 8 (Probability, FFT, complex variables)		1	1	-	2	2	10	15	25	-	-	50
BECP322	Skill Development - 3 (Machine Learning based Projects)		-	-	2	2	1	-	-	-	25	25	50
BHUP303	Aptitude 3		-	-	1	1	0.5	-	-	-	25	-	25
BHUP207	Soft Employability Skills				1	1	0.5	-	-	-	25	-	25
MBP	Project Management		-	-	2	2	1	-	-	-	50	-	50
BMEP319	Product Development & IPR				2	2	1	-	-	-	25	-	25
xxxx	Open Elective-2		2	-	-	2	2	10	15	25	-	-	50
xxxx	Interdisciplinary Elective-1		2	-	-	2	2	10	15	25	-	-	50
xxxx	Departmental Elective-2 (Modeling)	Online	-	-	4	4	2	-	-	-	25	25	50
xxxx	Departmental Elective-3		2	-	-	2	2	10	15	25	-	-	50
BEEL319 BEEP319	Basic Control System	Offline	1	-	2	3	2	10	15	25	25	-	75
BECL323 BECP323	Digital Image Processing	Online	1	-	2	3	2	10	15	25	25	-	75
xxxxx	Humanities Elective		2	-	-	2	2	10	15	25	-	-	50
Total			11	1	16	28	20	70	105	175	225	50	625

Term-VII													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					Total
			Th.	Tu	Pr.	Total	Credit	Theory			Practical		
								TA	CA	ES	Int.	Ext.	
xxxxx	Science Elective		2	-	-	2	2	10	15	25	-	-	50
BHUP304	Career Development Practice		-	-	2	2	1	-	-	-	25	-	25
xxxx	MOOCS/Open Elective-3		1	-	-	1	1	10	15	-	-	-	25
xxxx	Interdisciplinary Elective-2		2	-	-	2	2	10	15	25	-	-	50
xxxx	Department Elective-4		2	-	-	2	2	10	15	25	-	-	50
xxxx	Department Elective-5		2	-	-	2	2	10	15	25	-	-	50
xxxx	Department Elective-6		2	-	-	2	2	10	15	25	-	-	50
BCSL315 BCSP315	Cloud Computing	Online	1	-	2	3	2	10	15	25	10	15	75
BECP412	Project Phase-I		-	-	4	4	4	-	-	-	50		50
Total			12	0	8	20	18	70	105	150	85	15	425

Term-VIII													
Sub. Code	Name of the Course	Mode of Conduction	Teaching Scheme					Evaluation Scheme					
			Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total
								TA E	CA E	ES E	Int.	Ext.	
BECP420	Project Phase-II		-	-	2	2	2	-	-	-	50	50	100
XXXX	MOOCS/Open Elective-4		3	-	-	3	2	10	15	50	-	-	75
BECP437	Six Month Industry Internship		-	-	24	24	12	-	-	-	100	100	200
Total			3	0	26	29	16	10	15	50	150	150	375
			Total Credit				160		Total Marks			4500	

Board of Studies of Electronics and Electronics and Telecommunication Engineering
Pool of Elective Vs Tracks

Elective / Track	Communication, Signal Processing & RF	Machine Learning	Embedded & IoT	BioMedical	VLSI & Quantum	Programming
	Track-1	Track-2	Track-3	Track-4	Track-5	Track-6
Departmental Elective-1	Television & Multimedia Processing	Soft computing	Systems Programming for Embedded Devices	Biomaterials- Materials in Medicine	Power Electronics	Operating Systems
Departmental Elective-2	Microwave & millimeter wave circuits	Pattern Recognition	Mechatronics	Biochemistry & Cell Biology	Analog VLSI Design	Big Data & Hadoop
Departmental Elective-3	Wireless & Mobile Communication	Human Computer Interface	Robotics Manipulation	Bio-Informatics/ Algorithm and Application	MEMS & Applications	Data Structure & Algorithms
Departmental Elective-4	Audio & Speech Signal Processing	Decision Analytics	Automotive Electronics	Brain Machine Interface	Quantum & Optical Electronics	Information Security & Cryptocurrency
Departmental Elective-5	Smart Antennas	Natural Language Processing	Industrial Automation	Physics & Instrumentation of Medical Imaging	Integrated Circuits & Fabrication	Advanced Networks
Departmental Elective-6	Multi-rate and wavelet Signal Processing	Deep Learning Foundations & Applications	IoT System Design	Neuromorphic Computing	Photonics & Nanotubes	Blockchain Technology

SEMSTER-III

BECL215 -Electronic Devices and Circuits

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

- To gain knowledge of transistor small signal analysis.
- To study need different types of amplifiers and oscillator.
- To familiarize the students with the analysis of unipolar devices
- To use appropriate experimentation techniques to evaluate circuit performance

Course Outcomes:

- Demonstrate the concept of compensation techniques, Low frequency and High frequency analysis.
- Interpret the concepts of feedback and apply the concepts for improvement of performance of amplifier and oscillator
- Analyze and design different types of power amplifiers and use methods for reduction of distortions
- Compare the operation of the Field Effect Transistor (FET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and design FET circuits
- Apply concepts of transistors & amplifier Circuits
- Design simple circuits containing non-linear elements.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes															Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3
CO1	3	3	3	2	3	2			2		2	3	2	2	3			
CO2	3	3	3	2	3	2			2		2	3	2	2	3			
CO3	3	3	3	2	3	2			2		2	3	2	2	3			
CO4	3	3	3	3	3	2			3		2	3	3	3	3			
CO5	3	3	3	3	3	2			3		2	3	3	3	3			
CO6	3	3	3	3	3	2			3		2	3	3	3	3			

Contents:

CO-I: (9hrs)

Transistor Biasing & Small Signal Analysis:

Review of Transistor, Transistor current equations, Thermal Runaway, Transistor Biasing & Stability, Compensation Methods, Two-port Devices & the Transistor Hybrid model, analysis of a transistor amplifier circuit using h parameters, comparison of transistor amplifier configuration, Miller's Theorem, the alpha cut-off frequency, the hybrid pi (II) common-emitter transistor model.

CO-II (8hrs)

Feedback Amplifiers & Oscillators: Types of Feedback, Advantages & Disadvantages of Negative Feedback, Topology, Classification of Oscillators, Stability, Barkhausen Criteria, Design of RC, LC and Crystal Oscillators, Numerical

CO-III (7hrs)

Power Amplifier: Classification A, B, AB, C, Efficiency, Push Pull Configuration (A, B, AB) Complementary symmetry, Second Harmonic

and Cross over Distortion., Design of Power Amplifiers (Class A and Class AB)

CO-IV (6hrs)

Unipolar Devices: Field Effect Transistor, MOSFET, NMOS, PMOS Principles of operation and characteristics, Biasing arrangement, small signal analysis of CG, CB and CD

Text Books:

6. Electronics Devices and Circuits, S. Saliva Hanan, N Suresh Kumar, Tata McGraw-Hill 2008, Third Edition
7. Integrated Electronics Jacob Millman Tata McGraw-Hill, 2009, Second Edition
8. Electronic Devices & Circuits, Sanjiv Gupta

Reference Books:

4. Electronics devices and Circuits and Theory Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, Tenth Edition
5. Microelectronics Circuits A. S. Sedra & K. C. Smith, Oxford University Press, 2013, Seventh Edition
6. Electronics Devices and Circuits, Nagrath I J Phi Learning Pvt Ltd, 2009, Third Edition.

BEEL206- Network Theory

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	red	Theory			ractic		Total Marks
					T	A	E	C	A	E
					Int	Ext				
1	1	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

1. The subject aims at basic components
2. To study various sources and circuit analysis method used in electrical system and their behavior.
3. To study various numerical methods

Course Outcomes

Able to understand:

CO1: Analyze circuits with ideal, independent, and controlled voltage and current sources. using Mesh & Nodal analysis.

CO2: Determine the equivalent circuits of a network that include passive devices, dependent sources, and independent sources in combination using network theorems.

CO3: Interpret and measure the transient and sinusoidal Steady-state Responses of simple RC and RLC circuits

CO4 : Determining two port network parameters and one parameter in terms

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	2	1	1	1	0	0	0	2	2	2	2	3	2	
CO2	3	3	1	1	1	0	0	0	2	2	2	2	3	2	
CO3	3	2	1	1	1	0	0	0	2	2	2	2	3	2	
CO4	3	2	1	1	1	0	0	0	2	2	2	2	3	2	

CO Mapping with PO and PSO:

Syllabus:

CO I: Nodal and Mesh analysis (8 Hrs)

Nodal and Mesh analysis, basic equilibrium equations, matrix approach for complicated network, containing voltage, current sources, Mutual Inductances, source transformations, Duality.

CO II: Network Theorems (7 Hrs)

Reciprocity, Thevenin's, Norton's, maximum power transfer, compensation, Tellegen's theorem as applied to A.C. Circuits.

CO III: Transfer functions (7Hrs)

Transient behaviors, concept of complex frequency, Driving points and transfer functions, poles, zeros of admittance function, their properties, sinusoidal response from Pole-

zero locations, convolution theorem and integral solution.

CO IV: Two port network and filter(8 Hrs)

Two port network parameters and interconnections, Three Phase unbalanced circuits and power calculations. Introduction of Basic filters (R-C, L-C). Advanced topic on the subject

Text Books:

- Networks & Systems by D Roy Choudhury [partial ebook]
- Engineering Circuit Analysis by W. H. Hayt, J. E. Kemmerly & S. M. Durbin
- Fundamentals of Electric Circuits by C. K. Alexander & M. N. O. Sadiku

Reference Books:

- Network Analysis and Synthesis by Franklin F. Kuo [ebook]
- Network Analysis, M. Van Valkenburg, Pearson Education, 2006
- Introduction to Modern Network Synthesis, M. Van Valkenburg, John Wiley & Sons.

BECL216-Communication Electronics

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

6. To understand the basic concept of communication systems.
7. To understand the concept of analog modulation techniques.
8. To understand theory of analog pulse modulation techniques.
9. To understand working of radio receivers.
10. To understand the classification of multiplexing and multiplexing hierarchy.

Course Outcomes:

7. Demonstrate the fundamentals of communication systems and interpret the presence of noise in communication systems.
8. Interpret and analyze Amplitude Modulation and Frequency modulation.
9. Analyze FDM and TDM systems.
10. Illustrate the fundamentals of analog pulse modulation techniques.
11. Design and conduct experiments, using modern communication tools necessary for various engineering applications.
12. Demonstrate the basics of Television and Satellite systems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	2	2	3					2	3	3	2	2
CO2	2	3	3	2	2	2					2	3	3	3	2
CO3	2	3	3	2	2	3					2	3	3	3	2
CO4	2	3	3	2	2	3					2	3	3	2	2
CO5	2	3	3	3	3	2					2	3	2	3	3
CO6	2	3	3	3	3	2					2	3	2	3	2

Contents:**CO-I: (8hrs)****Introduction to Analog Communication:**

Review of signals and systems, Frequency domain of signals, Review of probability and random process. Base Band Signals and their bandwidth requirements. Noise in Communication systems, Gaussian and white noise characteristics.

CO-II (8hrs)

Analog Modulation Techniques: Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Envelope detector, Angle Modulation and their types, Reactance tube and FET modulators, Armstrong method, FM discriminator, Super heterodyne Receiver, Performance characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection.

CO-III (7 hrs)

Pulse Modulation Techniques: Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM). Differential pulse code modulation. Delta modulation. Noise considerations in PCM.

CO-IV (7 hrs)

Multiplexers: FDM, TDM, Multiplexing Hierarchy, Digital Multiplexers, Basic concept of Television System, Introduction to satellite systems. Advanced topic on the subject

Text Books:

5. Electronics Communication System, Kennedy, Davis Tata McGraw-Hill, 2010, Fourth Edition
6. Communication Electronics, Roddy & Coolen PHI, 2010, Fourth Edition
7. Communication Electronics Principles and Applications Frenzel, Tata McGraw-Hill, 2011, Third Edition
8. Communication Engineering U. A. Bakshi, A. P. Godse, Technical Publications, 2009, Third Edition

Reference Books:

5. Modern Digital & Analog Communication Systems, B. P. Lathi,

Oxford Press Publication, 1998, Third Edition

6. Digital Communication Simon Haykin Wiley and sons, 2003, Third Edition
7. Digital Communication John G. Proakis, Tata McGraw-Hill, 2002, Third Edition
8. Digital Communication Shanmugham Wiley student 2009, Fourth Edition

BECL217- Signals and Systems

Teaching Scheme					Evaluation Scheme					
Th.	Tu.	Pr.	Total Hours	red	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int	Ext	
1	1	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

5. To introduce the fundamentals, characteristics, concept techniques of signals & systems.
6. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide
7. Development of the mathematical skills like Fourier series, Fourier transforms, Random theory to solve problems involving convolution, filtering, modulation and sampling
8. To define channel capacities and properties using Shannon's Theorem and calculate the information content

Course Outcomes:

Students will be able to

5. Illustrate & classify signals, systems & identify LTI systems

6. Find Fourier series & Fourier transform for different signals
7. Analyze the Continuous Time systems by performing Convolution
8. Demonstrate Discrete time systems and LTI systems.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	2	3	3	2	2	3						2	3	3	2
CO2	2	3	3	2	2	2						2	3	3	3
CO3	2	3	3	2	2	3						2	3	3	3
CO4	2	3	3	2	2	3						2	3	3	2

CO Mapping with PO and PSO:

Contents:

CO-I: (7hrs)

Introduction to Signals and Systems: Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system analysis from these examples. Formalizing signals: energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the CO step, the CO impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. Formalizing systems:

system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, Realizability. Examples

CO-II (7hrs)

Continuous Time Fourier Transform: Representation of Aperiodic Signal, Fourier Transform for Periodic Signals, Properties of CTFT, Convolution and multiplication property of continuous FT, Systems characterized by Linear Constant Coefficient Differential Equations. Convolution Property. Sampling Theorem, Effect of Under Sampling, and Sampling of Discrete -Time Signals

CO-III (8hrs)

Continuous time and discrete time Linear shift-invariant (LSI) systems: Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections.

Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Parseval's Theorem. The idea of signal space and orthogonal bases of signals. Time de main and Frequency domain aspects of ideal and non-ideal filters.

CO-IV (8hrs)

Discrete Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT): Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations Laplace Transform for continuous time signals and systems: the notion of eigen functions of LSI systems, a basis of eigen functions, region

of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.

Text Books:

3. Signals and Systems(Alan V Oppenheim, Alan S Willsky, S Hamid Nawab)Prentice Hall India 2009-Second Edition
4. Signals and Systems, S. Haykin and B. van Veen, Wiley1998

Reference Books:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	2	2	3	2	3						2	1	3	2	3
CO2	2	2	3	2	3						2	1	3	2	3
CO3	3	2	3	2	3						2	1	3	2	3
CO4	3	2	3	2	3						2	1	3	2	3
CO5	3	2	3	3	3						2	1	3	2	3
CO6	3	2	3	3	3						2	1	3	2	3

4. Digital Signal Processing, Principles Algorithms, and Applications, John G. Prokis, Dimitris G. Manolakis, PHI, 2007,4
5. Signal Processing, James H. McClellan, Pearson/Prentice Hal,2006,1
6. Signals and System, Third Edition, 2008, P. Ramesh Babu, R. Ananda Natarajan, Scitech,2008,3

BECL218- Embedded Systems Design

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	10	15	75

***Mode of Exam: Practical Application Based Online**

Course Objectives:

4. To study and understand various microcontrollers and embedded systems.
5. To understand the design parameters of embedded systems applications.
6. To study and impart different tools for embedded system and IoT application design.

Course Outcomes:

7. Demonstrate the principle of embedded systems and Microcontroller
8. Develop programming for applications develop real time applications
9. Design the interfacing of devices and peripherals
10. Make Use of ARM7 Controller for Designing of Embedded Applications
11. Develop Different IoT platform for Embedded applications
12. Design and Develop different embedded system and IoT applications.

CO Mapping with PO and PSO:

Contents:

CO-I: (7hrs)

Embedded Systems: Introduction to embedded Systems, Requirements /Components of Embedded Systems, Design Process in Embedded System

Microcontrollers: Introduction to microcontrollers, 8051 architecture, addressing modes and instruction set, 8051 programming in Assembly language and Embedded C.

CO-II (7hrs)

Programming: Timer, Interrupts and serial communications, Serial I/O, Programming Tools

Interfacing with 8051: ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display, Sensors interfacing (LDR, IR, PIR, GSM, GPS, GPRS, Bluetooth.etc.)

CO-III (8hrs)

Introduction of 32-bit Microcontroller: Advanced devices and peripheral interfacing with ATmega16: ARM7 Processors, ARM Architecture, Register and Memory organization, addressing modes, Arm Thumb and instruction sets, Basic Assembly Programming,

CO-IV (8hrs)

Embedded IoT Applications: Introduction to Raspberry PI and Intel Galileo Board, Python Programming, OOP's and Modules in Python Programming, Design and perform different embedded system and IoT Applications: Robotic, Industrial Automations & Health care.

Text Books:

4. Muhammad Ali Mazidi, the 8051 Micro-controller & Embedded System using assembly & C, Pearson Education, 2008, Second
5. Muhammad Ali Mazidi, ARM Assembly language programming and Architecture, Second
6. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education India, 2009, Second

Reference Books:

4. Shibu K. V. Introduction to Embedded System, The McGraw Hill, 2011,
5. Ajay V. Deshmukh, Micro-controllers - Theory and Applications, Tata McGraw Hill,
6. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, 1996, Second

BEC P225 -Artificial Intelligence:

Application in Electronics

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
-	-	2	2	1	-	-	-	25	25	50

***Mode of Exam: Practical Application Based Online**

Course Objectives:

3. Be able to formulate machine learning problems corresponding to different applications.
4. Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes: Upon completion of the course students shall be able to:

3. Interpret the basic concepts and techniques of artificial Intelligence
4. Classify machine learning algorithms to solve real time problems of moderate complexity and Apply experience of independent study and research through case studies.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes										Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
	1	2	3	4	5	6	7	8	9	10	11	12	13
CO1	3	3	3	1	1	2					2	3	3
CO2	3	3	3	1	1	2					2	3	3

Contents

CO-I: Artificial Neural Networks: (8hrs)

Introduction to Artificial Intelligence, Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing, The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptron, Backpropagation Algorithm, Introduction to Bayesian Function.

CO-II: Applications in Electronics: (7hrs)

This CO provides an intensive introduction to artificial intelligence and its applications to problems of medical diagnosis, therapy selection, and monitoring and learning from databases.

Case Study 1: - Potential use of a causal Bayesian network to support both clinical and pathophysiology tutoring in an intelligent tutoring system for anemias.

Link for problem and solution for case study:
https://ocw.mit.edu/courses/health-sciences-and-technology/hst-947-medical-artificial-intelligence-spring-005/projects/anemias_tutoring.pdf

Text Books:

- Introduction to machine learning, Ethem Alpaydin. — 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
- Introduction to artificial neural systems, J. Zurada, St. Paul: West.
- R in a Nutshell, 2nd Edition - O'Reilly Media.

Reference Books:

- Machine Learning, Tom M Mitchell.
- The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

Fourth Term

BECL 220- Sensors and Actuators

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
1	-	-	1	1	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

- To gain knowledge about the measuring instruments, sensors & actuator.
- To able to calibrate and testing of different sensors
- To able to understand different sensors & actuators

Course Outcomes:

- Analyze and use the functions of various instrumentation systems.
- Interpret fundamental and some special knowledge in process automation in industries

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	3	3					2	1	3	2	3
CO2	2	2	3	2	3	3					2	1	3	2	3

Contents:

CO-I: (7hrs)

Static and dynamic characteristics - Active and passive transducers, Sensors and transducers, Pressure, Flow, Level, Temperature, humidity, light sensor, piezo electric transducer

CO-II (8hrs)

Sensors: IC sensor, Digital transducers, Smart sensor, MEMS sensors, Fiber optic transducer, Signal conditioning techniques used in various transducers, Linearization, Shielding techniques, Data Acquisition System, Industry Standard Bus architecture, Actuation Systems: ADC, DAC, Pneumatic & hydraulic control Valves, Solid state switches, Motor Control Techniques, PLC controller.

Text Books:

- Principles of Industrial Instrumentation, D. Patranabis, Tata McGraw-Hill, 1999, 2
- A course in Electrical and Electronic Measurement and Instrumentation, A.K. Sawhney, Dhanpat Raj and Sons, New Delhi, 1999, 3
- Getting Started with The Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Cuno Pfister, Oreilly Publication, 2011,

Reference Books:

- Measurement systems application and design, Ernest O. Doebelin, Tata McGraw Hill Publishing Co. New Delhi, 1999, IV
- Industrial Instrumentation, Eckman D. P. M, Wiley Eastern Limited, 1990, II
- Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects, Maneesh Rao, Packet, 2018, I

BECL 221- Electromagnetic Fields & Waves

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
1	1	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

- To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields, and apply them to solve physics and engineering problems.
- To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.

- To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
- To conceptually understand the UPW Polarization features and Poynting Theorem, and apply them for practical problems.

Course Outcomes:

- Distinguish between the static and time-varying fields,
- Make use of Maxwell equations to solve filed problems
- Analyze the Wave Equations and evaluate the UPW Characteristics with estimation of Polari
- Apply the concepts of EM theory to solve the engineering problems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	3	2			2		2	3	2	2	3
CO 2	3	3	3	2	3	2			2		2	3	2	2	3
CO 3	3	3	3	2	3	2			2		2	3	2	2	3
CO 4	3	3	3	3	3	2			3		2	3	3	3	3

Contents:**CO-I: (8hrs)**

Electrostatics: Coordinate Systems – Vector fields, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law, Divergence

theorem and applications, Electric Potential, Relations Between E and V, Gradient, Energy Density, Convection and Conduction Currents, Continuity Equation, Isotropic and Homogeneous Dielectrics, Poisson's and Laplace's Equations.

CO-II (7hrs)

Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Curl, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields

CO-III (8hrs)

Maxwell's Equations and its applications: Maxwell's Equations for static and time varying fields, Maxwell's Equations in differential and integral Forms and their significance, Conditions at a Boundary Surface, Electric and magnetic boundary conditions: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Practical applications.

CO-IV (8hrs)

EM Waves: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin effect, Poynting Vector and Poynting Theorem – Applications,, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Snell's law, Brewster Angle, Surface Impedance, Polarization.

Text Books:

6. Engineering Electromagnetics. William H. Hayt Jr. and John A. Buck, Mc Graw Hill Education, 2006, 7
7. Principles of Electromagnetics, Matthew N.O. Sadiku and S.V. Kulkarni, Oxford University Press, 2015, 6
8. Electromagnetic Waves and Radiating Systems., E. C. Jordan and K.G. Balmain, PHI, 2000, 2

Reference Books:

9. Engineering Electromagnetics, Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2005, 2
10. Networks, Lines and Fields. John D. Ryder, PHI, 1999, 2

BECL 222, BECP 222- Analog System

Design

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

5. To understand analog circuits and systems.
6. To know linear and nonlinear applications of operational amplifier ICs.
7. To study frequency response of different circuits based on operational amplifier applications.
8. To study and use different ICs such as timers for applications.

Course Outcomes:

7. Apply knowledge of differential amplifier to design operational amplifier.
8. Design op-amp based circuits required in embedded system design, communications systems
9. Design real time applications using filters & oscillators.
10. Design analog applications using different ICs.
11. Analyze and estimate the low and high frequency behavior of linear circuits, including noise.
12. Apply op-amps fundamentals and computer tools in project design, evaluation, and analysis

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	2	1					2	3	3	2
CO2	3	3	3	1	1	2	2					2	3	3	2
CO3	3	3	3	1	1	2	2					2	3	3	3
CO4	3	3	3	1	1	2	2					2	3	3	3
CO5	3	3	3	1	1	2	1					2	3	3	2
CO6	3	3	3	1	1	2	2					2	3	3	3

Contents:

CO-I: (6hrs)

Differential Amplifier, Cascaded Differential Amplifier Stages and Level Translator, AC and DC Analysis of Cascade Amplifier, Current Mirror, Design of two stage direct-coupled amplifier.

CO-II (8hrs)

OPAMP, inverting, non-inverting, differential amplifier configurations, negative feedback, voltage gain, input & output impedance, Bandwidth. Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR, Frequency response. Linear applications, DC, ac amplifiers, summing differential amplifier, instrumentation amplifier, V to I and I to V converters, Integrator, Differentiator.

CO-III (8hrs)

Classification of Filters, Active Filters, First to Sixth –Order Butterworth filter, IGMF configuration, All Pass Filter, Cascade Design of Filters, Classification of Oscillators, Design of Op-amp based Phase Shift and Wein Bridge Oscillators, Square, Triangular and Saw Tooth Wave Generators, Schmitt Trigger, Voltage

Comparator, Voltage Limiters and Window Detector, Clippers and Clampers, Peak Detector, Precision Rectifiers, sample & Hold, ADC, DAC

CO-IV (8hrs)

The 555 Timer, Phase Locked Loops IC565, ICL8038 & XR2206 Function Generator, Voltage Controlled Oscillator Basic Operation, IC based Voltage Regulator Circuits, Dual Track Voltage Regulator, Three - Terminal Regulator (Fixed Regulator) Voltage Adjustment and Current Boosting of Fixed Regulator, Merits and Drawbacks of Linear Regulators.

Text Books:

- Operational amplifiers, Design and applications, Tobey, Graeme, Huelsman, McGraw Hill, 1990, 2
- Operational Amplifiers and Linear Integrated Circuits, Gaikwad R. A, PHI, 2

Reference Books:

- Design with OPAMPS and Analog ICS Francis S McGraw Hills
- OPAMPS and Linear ICs Fiore J.M Delmer-Thomson, USA 2001, 2

BECL223, BECP 223- Digital Communication

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TAE	CAE	ESE	Int.	Ext. Marks
2	-	2	4	3	10	15	25	25	- 75

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

- To understand the basic knowledge of digital communication system & Source coding techniques.
- To study different modulation schemes, multiple accesses, error probability for digital communication.

- To impart the knowledge of design, analysis & comparison of digital communication systems.

Course Outcomes:

- Interpret baseband systems, sampling, quantization and source coding
- Elaborate different techniques of modern digital communication
- Evaluate performance of various modulation & demodulation techniques
- Design digital systems using appropriate mathematical techniques
- Solve various source/channel coding and error-control coding techniques
- Evaluate and apply spread spectrum Techniques and its performance parameters

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3
CO5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2
CO6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2

Contents:

CO-I: (8hrs)

Digital Base Band Modulation Techniques:

Bandwidth of digital Data, Base band system, formatting textual Data, Messages, characters, and symbols, Formatting Analog Information, Sources of Corruption, Inter symbol Interference. Uniform and non-uniform quantization, Base band Modulation, Correlative Coding, Formatting analogue information, Line coding, Scrambling, Digital multiplexing.

CO-II (7hrs)

Baseband Modulation and Demodulation Techniques:

Sequential circuit Sequential circuit: Latches and flip-flops, counters, shift register, Finite state machine; representation and synthesis. Digital Band pass Modulation techniques, Coherent & Non coherent detection, Complex envelop, Error performance for Binary system, M-Ary signaling and performance, Symbol error performance for M-ary Systems, Bit error Rate calculations.

CO-III (7hrs)

Block and convolutional channel codes, Linear block codes, generator matrix and parity check matrix, some specific linear block codes, syndrome decoding, cyclic codes, optimum decoding of convolutional codes- Viterbi algorithm.

CO-IV (8hrs)

Advanced Modulation Method & Spread Spectrum techniques: Gram – Schmitt procedure, Spread Spectrum techniques: Spread Spectrum Overview, Pseudo noise Sequences, Direct-Sequence Spread Spectrum systems, Frequency hopping systems, Synchronization, Jamming consideration, Advanced topics on Digital Communication.

Text Books:

- Digital Communications (Fundamentals and applications), Bernard Sklar, Pearson Education, 2005, 2nd
- Digital Communication, Simon Haykin, Wiley Eastern, 2001, 4th
- Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University press, 1999, 3rd

Reference Books:

- Digital Communication, John G. Proakis, Tata Mc –Graw HILLS, 2007, 5
- Communication Electronics, Roddy & Colin, PHI, Prentice-Hall PTR, 1981, 2
- Communication Electronics, Kennedy, Tata Mc –Graw HILLS, 2012, 5

BECL224- Introduction to Drones

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					T	A	E	C	A	E
-	-	4	4	2	10	15	25	25	-	75

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**

Course Objectives:

- To familiarize with various drone components and understand their properties.
- To understand basic fundamentals of Drone.
- To prepare for various engineering applications based on Drones.

Course Outcomes:

- Examine various drones and its devices.
- Apply knowledge of drone for related application.
- Demonstrate the knowledge of Drone and its application
- Develop the skill to build, and troubleshoot Drone circuits

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3

CO Mapping with PO and PSO:

Contents:

CO-I: (6hrs)

Basics: Introduction to the Drones and various Applications of Drone, Working Principle and design. Inertial Measurement CO, Sensors and calibration, ID Implementation and Tuning

CO-II (6hrs)

Drone Technology & Networking: Intra-inter Drone Communication, Network Topology & protocol, Cluster-networking

CO-III (6hrs)

Drone Hardware Fabrication: Selection electronics components such sensors, controller, BLDC motor, Battery, Flight controller, Remote Controller and other Assembly accessories.

CO-IV (12hrs)

Drone Designing: Design structure. Designing techniques and optimization, Battery Management, Payload management, Testing and analysis, aero-dynamics & calibration. Hands on project: Precautions while Assembling, Exercises based on Flight controller & boards like Ardupilot APM 2.x, 3.x, hobby kin kk5.0, CC3D, Pixhawk

Reference Books:

- Theory, Design and Applications of Unmanned Aerial Vehicles- by A. R. Jha, 2016
- Handbook of Unmanned Aerial Vehicles- Valavanis, K. Vachtsevanos, Geore J, 2014

BCSL208, BCSP208-Database Management System

Pre-requisite: Programming for Problem Solving					Evaluation Scheme					
Teaching Scheme					Theory			Practical		Total Marks
Th.	Tu	Pr.	Total Hours	Credit	T	A	E	Int.	Ext.	
2	-	2	4	3	10	15	25	10	15	75

*Mode of Exam: Practical Application Based Online

Course Objective:

- This course introduces general idea of database management system.
- It is aimed at developing skills to design databases using data modeling and design techniques.

7. It is also aimed to developing skills to implement real life applications which involve database handling.
8. This course also provide carrier opportCOies in subject areas of designing, storage techniques and data handling and managing techniques

Course Outcome: Upon successful completion of the course, students shall be able to-

7. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms and design appropriate data model for it.
8. Demonstrate an understanding of various normalization forms and apply knowledge of normalization for creation of database.
9. Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database and perform inferential analysis of data model
10. Demonstrate query processing and able to design optimized query execution plan.
11. Develop basic transaction processing and management and ensure database security, integrity and concurrency control
12. Demonstrate the management of structured and unstructured data management with recent tools and technologies.

CO Mapping with PO and PSO:

Contents:

CO-I: (5hrs)

Introduction to DBMS, DBMS Architecture, Data Models, UML

CO-II: (7hrs)

Relational Database design: Functional Dependency (FD) – Basic concepts, closure of set of FD, closure of attribute set, Decomposition, Normalization – 1NF, 2NF, 3NF, BCNF, 4NF.

CO-III: (9hrs)

SQL Concepts: Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints, Functions - aggregate functions, Built-in functions –numeric, date, string

functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, Save point. Cursors, Stored Procedures, Stored Function, Database Triggers

CO-IV: (9hrs)

Query Processing & Query Optimization: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans and materialized views

Text Books:

- 3 Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2002.
- 4 Jeff Ullman, and Jennifer Widom, A First Course in Database systems, 2nd Ed.

Reference Books:

- 5 G. K. Gupta "Database Management Systems", McGraw – Hill.
- 6 Regina Obe, Leo Hsu, PostgreSQL: Up and Running, 3rd Ed, O'Reilly Media 2017.
- 7 Kristina Chodorow, Shannon Bradshaw, MongoDB: The Definitive Guide, 3rd Ed, O'Reilly Media 2018.
- 8 RamezElmasri and ShamkantNavathe, Fundamentals of Database Systems 2nd Ed, Benjamin Cummings, 1994.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes			
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3	P S O 4
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2	
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3	
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2	
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3	
CO5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2	
CO6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2	

Course Outcome ↓	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C O1	3	3	3	1	1	2					2	3	3	3	2
C O2	3	3	3	1	1	2					2	3	3	3	2

BCSP217- MACHINE LEARNING

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					T	A	E	C	A	E
-	-	2	2	1	-	-	-	2	2	50

***Mode of Exam: Practical Application Based Online**

Course Objectives:

3. Be able to formulate machine learning problems corresponding to different applications.
4. Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes:

Upon completion of the course students shall be able to:

3. Develop skills of using recent machine learning software for solving practical problems.

4. Summarize and compare a range of machine learning algorithms along with their strengths and weaknesses

CO Mapping with PO and PSO:

Contents:

CO-I (6 hrs)

Understanding Machine Learning:

Introduction, What Is Machine Learning? Examples of Machine Learning Applications, Learning Associations, Supervised & Unsupervised Learning, Reinforcement Learning, Classification, Regression

CO-II (5hrs) Applying R-Programming:

R - Basic Syntax, Data Types, Variables, Operators, Decision Making, Loops, Functions, Strings, Vectors, Lists, Matrices, Arrays, Factors, Data Frames, Packages-chart & graphs

CO-III (4hrs)

Clustering & Application of ML:

Introduction to clustering, k-Means Clustering, Hierarchical clustering, Introduction to Chat Bot, creation of Chat Bot

Text Books:

4. Introduction to machine learning, Ethem Alpaydin. 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
5. Introduction to artificial neural systems, J. Zurada, St. Paul: West.
6. R in a Nutshell, 2nd Edition - O'Reilly Media.

Reference Books:

3. Machine Learning, Tom M Mitchell.
4. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

FIFTH Term

BECL318- CMOS VLSI Design

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
1	-	2	3	2	10	15	25	10	15	75

*Mode of Exam: Practical Application Based Online

Course Objectives:

- Learn MOS transistor theory.
- Expose to MOS circuit design & Layout processes.
- Expose to CMOS logic structures.
- Learn scaling of MOS circuits.

Course Outcomes:

- Identify fundamental principles of VLSI (Very Large Scale Integrated) circuit design and layout.
- Interpret CMOS fabrication technologies.
- Determine physical VLSI design issues (bottom-up design) and basic CMOS logic gates,
- Design building blocks of large-scale CMOS digital integrated circuits

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	PO1	PO2	PO3
CO1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3

Contents:

CO-I: (6hrs)

Basic MOS Technology: MOS Structure, Threshold Equation, Ion Implantation, MOSFET Current-Voltage Characteristics, Channel Length Modulation, Substrate Bias Effect, MOSFET Scaling, Channel Effects, MOSFET Capacitance, Numerical

CO-II (8hrs)

MOS Inverter: Noise ImmCOy, Noise Margin, Inverter with different Loads, CMOS DC Characteristics, Design of CMOS Inverter, Static Load MOS Inverters, Numerical

CO-III (10hrs)

Switching Characteristics: Rise and Fall Time Derivation, Numerical, Inverter Design with delay constraint, MOSFET Capacitance, Estimation of Interconnect Parasitics, Interconnect Delay, Switching Power Dissipation, Power Delay Product

CO-IV (6hrs)

Circuit Design Processes: Combinational MOS Circuits, Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams, Transmission Gates, nMOS fabrication. CMOS fabrication.

Text Books:

- Design of Analog CMOS Integrated Circuits, Behzad Razavi., McGraw-Hill, Inc., New York, NY, USA.,2000,
- CMOS Circuit design, Layout and Simulation, R. J. Baker, H W Li, D. E. Boyce, PHI EEE,
- Principles of CMOS VLSI Design, Neil H. E. Weste, Kamran Eshraghian, Addison Wesley,

Reference Books:

- CMOS Logic Circuit Design,,John P. Uyemura,,Illustrated, Springer Science & Business Media,,1999,
- CMOS Digital Integrated Circuits Analysis & Design,,Sung-Mo Kang & Yusuf Leblebici,,Tata McGraw -Hill,2003,
- Digital integrated circuits: a design perspective, Second Edition,,Jan M. Rabaey, Anantha P. Chandrakasan, Borivoje Nikolic,Illustrated, Pearson Education,2003,
- Design of Analog CMOS Integrated Circuits,Razavi,McGraw-Hill,2001,

BECL316, BECP 316- Digital Signal Processing

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	2	4	3	10	15	25	25		75

***Mode of Exam: Paper Pen with 30% Gate Pattern Questions**
Course Objectives:

- Analyze the signals in time and frequency domain
- Be familiar with transformation tools on signals & systems and analyze
- Learn to design various digital filters and analyze their frequency response
- Develop DSP technique for various applications

Course Outcomes:

- Make use of linear time invariant systems.
- Elaborate discrete parameter signals.
- Apply knowledge of how to use linear transforms.
- Apply linear system analysis to engineering problems.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
CO 2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
CO 3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
CO 4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3
CO 5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2
CO 6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2

CO Mapping with PO and PSO:**Contents:****CO-I: (6hrs)**

Introduction: Representations of discrete signals, Discrete time systems & properties, Basic operators and Convolution, Correlation, Z-Transforms & properties, Inverse Z-Transforms Methods.

CO-II (8hrs)

Fourier Analytical Techniques: Frequency analysis of discrete time signals, Discrete Time

Fourier Transform and Discrete Fourier Transform, Properties, Inverse Discrete Fourier Transform, Circular Convolution, Efficient Computation of DFT using FFT algorithms, Linear Filtering approach to computation of DFT.

CO-III (10hrs)

Digital Filters: Structures for FIR Systems and IIR Systems and representation of Structures using Block diagram & Signal Flow Graph, Design of IIR filters from analog filters using Impulse Invariant Method, Bilinear Transformation, Matched Z Transformation, Butterworth Approximation, FIR filters design Methods-Fourier Series, Windowing, DFT, Frequency Sampling.

CO-IV (6hrs)

DSP Processor & Applications: Desirable Features of DSP Processors, Types of Architectures of DSP processor, Application areas: Dual-Tone Multi Frequency Signal Detection, Spectral Analysis Using DFT, Short Term DFT, Musical Sound Processing, Application to Image processing & Radar, Oversampling A/D Converter, Oversampling D/A Converter.

Text Books:

2. Theory and Applications of Digital Signal Processing. R. Rabiner, and B., Gold, Prentice Hall, 2000, 3rd

Reference Books:

5. Digital Signal Processing, Principles, Algorithms, and Applications, J. G. Proakis and D. G. Manolakis, Prentice Hall, 2006, 4th
6. Digital Filters: Analysis Design and Application A. Antonion, Prentice Hall, 1999,
7. Digital Signal Processing, A. V. Oppenheim and R. W. Schaffer, Prentice Hall, 1998, 1998,
8. Digital Image Processing Using MATLAB, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Tata McGraw Hill Pvt. Ltd., 2011, 3rd

BECL319- Transmission Line and Antennas

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Tot al Hours	Credit	Theory			Practical		Tot al Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objectives:

5. To understand transmission line fundamentals and propagation of signals through lines.
6. Design various impedance matching devices such as stub tuners and multi-stage quarter wave transformers.
7. To solve the electric field and magnetic fields for a given wire antenna.
8. Determination of the fields radiated from antennas; wire antennas; array antennas; parabolic reflectors, antenna radiation pattern & antenna directivity.

Course Outcomes:

5. Demonstrate the fundamentals of transmission line theory and impedance matching in high frequency lines.
6. Interpret & utilization of antenna as required in different communication systems.
7. Determine directions of maximum signal radiations and the nulls in the radiation patterns.
8. Design array antenna systems from specifications.

CO Mapping with PO and PSO:

Contents:**CO-I: (8hrs)**

Introduction: Line parameters, Types of transmission line, skin effect, General solution, physical significance of the equations; the infinite line, Voltages and currents on the Distortion less line & , wavelength, velocity of propagation, the distortion less line, Reflection on a line not terminated in Z_0 , Reflection coefficient, Standing waves Open and Short circuited lines, Reflection loss, Impedance matching, Quarter wave line; Single-Stub, Smith Chart, Application of the Smith chart for calculating impedance and admittance.

CO-II (7hrs)

Antenna Fundamentals: Introduction, Isotropic Radiator, Radiation Mechanism. Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area. Reciprocity Theorem. Radiation Integrals: Retarded Vector potentials A, J.

CO-III (9hrs)

Types of Antenna: Wire Antenna: Infinitesimal Dipole, Its Radiation Field, Radiation Resistance, Radiation Sphere, Near Field, Far Field Small Dipole, Finite Length Dipole, Half Wave Length Dipole, Folded Dipole, Linear Elements Near Or On Infinite Perfect Conductors, Ground Effects And Their Application, Loop Antenna: Small Loop, Comparisons Of Small Loop With Magnetic Dipole, Radiation Pattern, Its Parameters And Their Application, Microstrip Antenna , Broadband and Reflector antennas.

CO-IV (6hrs)

Antenna Array: Antenna Arrays: Two element array, Pattern multiplication, Broad side and End-fire array, N-element array: Uniform spacing, non uniform amplitude, array factor, binomial and Dolph Tchebyshev array.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	2	3	3	2	3	2	2	1	1	2	2	1	1	3
CO2	3	3	3	3	2	3	2	2	1	1	2	2	1	1	3
CO3	3	3	3	3	3	3	2	2	1	1	2	2	1	1	3
CO4	3	3	3	3	3	3	2	2	1	1	2	2	1	1	3

Planar Array, Circular Array, Log Periodic Antenna, Yagi-Uda Antenna Array.

Text Books:

3. Antenna and Wave Propagation. D. Prasad, Satya Prakashan, 2003, 3
4. Antenna Theory and Design, Balanis, C. A, Ed., John Wiley &, 2005, 3

Reference Books:

2. Electromagnetics with, Kraus, J.D. and Fleisch, D. A, McGraw -,

BECL320, BECP 320- Hardware**Description Language**

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total
					TAE	CAE	ESE	Int.	Ext.	Marks
1	-	2	3	2	10	15	25	10	15	75

Mode of Exam: Practical Application Based Online*Course Objectives:**

4. Apply Boolean algebra and other techniques to express and simplify logic expressions.
5. Analyze and design combinational and sequential digital systems.

- Use different techniques among them a hardware description language and a programming language, to design digital systems.

Course Outcomes:

- Summarize digital systems and the use of Boolean algebra in logic analysis and design
- Interpret RTL design and verification techniques and methodologies
- Experiment the principles and methodology of digital logic design at the gate and switch level, including both combinational and sequential logic elements.
- Illustrate basic tools of logic design and provide hands-on experience designing digital circuits

CO Mapping with PO and PSO:

Contents:

CO-I: (6hrs)

Introduction to Hardware Description Languages: Combinational Logic, Structural Modeling, Sequential Logic, More Combinational Logic, Parameterized Modules, Test benches

CO-II (6hrs)

Sequential circuit Sequential circuit: Latches and flip-flops, counters, shift register, Finite state machine; representation and synthesis.

CO-III (8hrs)

FPGA architecture and synthesis Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation

CO-IV (8hrs)

Semiconductor memories, PALs, PLAs and FPGAs; Pipelining and timing issues, PROMs (DRAMs, Flash memory etc.)

Text Books:

- HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using

VHDL or Verilog, Douglas Smith, Doone publications, 1998, 1st

- Verilog HDL, A guide to Digital Design and Synthesis, Samir Palnitkar, Prentice Hall, 1st

Reference Books:

- FPGA based Prototyping Methodology Manual, Doug Amos, Austin Lesea, Rene Richter, Synopsys Press,
- Introduction to Reconfigurable Computing, Architectures, Algorithms, Christophe Bobda, Springer Netherlands.
- Writing Testbenches: Functional Verification of HDL Model, Janick Bergeron, Springer, 2003, 2nd

BCSP213- Java Programming

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
-	-	4	4	2	-	-	-	25	25	50

***Mode of Exam: Practical Application**

Based Online

Course Objective:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO2	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO3	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO4	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3

- This course introduces fundamentals of

object-oriented programming in Java, including
Defining classes, invoking methods, using class
libraries.

2. It is aimed at building software development skills using java programming for creating real world applications.

3. Use a development environment to design, code, test, and debug simple programs, including multi-file source projects, in an object-oriented programming language

- **CO 1:** Explain the basic data types and control flow constructs using J2SE.
- **CO 2:** Make use of Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper for program development.
- **CO3:** Design object oriented class structures with parameters, constructors, and utility.

CO4: Implement a final project selected from an approved project chosen by the student
Mapping with PO and PSO

Syllabus

CO I: Introduction to JAVA, Class and Object

Introduction to data types, operators and control statements, Classes: fundamentals of classes, declaring objects, Assigning objects, reference variables, methods, constructor, variable handling. Methods and classes: Overloading methods, understanding static and final.

CO II: Array, Packages, Interface
Introduction to Array, Vectors, Wrapper class & Inheritance, Packages and interface: Packages, access protection, importing packages, interfaces.

CO III: Exception Handling & Multithreaded Programming

Exception handling: Fundamentals exception types, uncaught exception, try-catch, displaying description of an exception, multiple catch clauses, nested try statements, throw, finally, built in exceptions, creating own exception subclasses, JAVA thread model, creating thread, creating multiple thread.

CO IV: Applet, Graphics Programming and Database Connectivity

Introduction to applet, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling.

Database Connectivity: JDBC (Java Data Base Connection), Introduction to JDBC, Databases and Drivers, Types of Driver, Loading a driver class file, establishing the Connection to Database with different Driver. Executing SQL queries by result Set using Statements

Text Books:

1. The Complete Reference by Herbert Schild, TMH Publication
2. Programming with Java- A Primer by E. Balagurusamy, 3rd Edition, TMH Publication

Reference Books:

4. The Complete Reference- JAVA 2- 3rd Edition By Patrick Naughton, TMH Publication.
5. Java 6 Programming Black Book by Kogent Solution Inc., Dreamtech Press Publication.
6. Java 2 Black Book by Steve Holzner, Paraglyph Press, 2nd Ed.

BEEL319,BEEP319- Basic Control System

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal Hours	Credi	Theory			Practical		To tal Mark
					TAE	CAE	ESE	Int.	Ext.	
1	-	2	3	2	10	15	25	25	-	50

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objective

1. The students should be able to learn the different types systems and governing differential equations and mathematical representation in terms of output and input correlation.
2. The students should able to learn time response analysis and demonstrate their knowledge to frequency response.
3. Students can be able to learn stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot.
4. To get insight of modern control theory based on matrix approach and state variables.

Course Outcome

The students should be able to

CO1 : To build classical mathematical foundation for control philosophy and time response of systems.

CO2 : To determine performance of system and its stability issues.

CO3 : To evaluate performance of system for broad range of frequency.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO2	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO3	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3

Contents:

CO I Introduction to need for automation and automatic control, use of feedback, broad spectrum of system application, Mathematical modeling, (Electrical & Electromechanical) diff. Equations., transfer functions, block diagram, signal flow graphs, application to elementary systems, simplifications, effect of feedback on parameter variations, disturbance signal. Time response of system, first order and second order system, standard inputs, concept of gain and time constants, Steady state error, type of control system, approximate methods for higher order system.

CO II Stability of control systems, conditions of stability, characteristics equations, RouthHurwitz criterion, special cases for determining relative stability, Root location and its effect on time response, elementary idea of root locus, effect of addition of pole and zero on proximity of imaginary axis.

CO III Frequency response method of analyzing linear system, Nyquist and Bode Plots, Stability and accuracy analysis from frequency response, open loop and close loop frequency response, Nyquist Criterion, Effect of variation of gain and addition of pole and zero on response plot, stability margin in frequency response. Design by state variable feedback: Review of state variable representations. Solution of State equations. Controllability & Observability.

Text Books:

1. B. C. Kuo, Automatic Control Systems, 3rd Edition, Prentice Hall India, 1975
2. Nagrath, Gopal, Control System Analysis. 5th Edition, New Age International, 2010

Reference Books:

1. M.Gopal, Control Systems, Principles & Design, 3rd Edition, TMH Publishers, 2010
2. Norman S. Nise, Control Systems Engineering, 5th Edition, John Wiley & Sons, 2008

BECL323, BECP323: Digital Image Processing

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TA	EC	AE	Int.	Ext.
									Mark
2	-	2	4	3	10	15	25	25	-
									75

*Mode of Exam: Practical Application Based Online

Course Objectives:

5. Learn digital image fundamentals.
6. Be exposed to image processing techniques.
7. Be familiar with segmentation techniques and image compression.
8. Understand applying image processing algorithms to real problems

Course Outcomes:

5. Interpret the need for image transforms and their properties.
6. Apply image enhancement and restoration techniques.

7. Develop algorithm for image segmentation, image compression & coding.
8. Make use of techniques, skills, and modern engineering tools necessary for engineering application to real problems.

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3
CO1	3	3	2	2	1	3	3	1	1	2	2	2	3	1	2
CO2	3	3	3	3	2	3	3	1	1	2	2	2	3	1	2
CO3	3	3	3	3	2	3	3	1	1	2	2	2	3	1	2
CO4	3	3	2	3	2	3	3	1	1	2	2	2	3	1	2

CO Mapping with PO and PSO:

Contents:

CO-I: (6hrs)

DIGITAL IMAGE FUNDAMENTALS:

Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbours of pixel adjacency connectivity, Distance measures, Color fundamentals, Color models.

CO-II (10hrs)

IMAGE PROCESSING TECHNIQUE:

Image Enhancements:

In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters.

In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Image Restoration:

Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.

CO-III (8hrs)

IMAGE SEGMENTATION: Detection of Discontinuities, Edge linking and boundary Description: Local processing, Global processing, Hough transform, Thresholding & Region based segmentation, Segmentation by Morphological watersheds, Object representation, description and recognition

CO-IV (6hrs)

IMAGE COMPRESSION: Image compression model, Fundamental coding theorem, Lossless compression, Lossy compression.

Text Books:

- R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
- A. K. Jain. Fundamentals of Digital Image Processing. Prentice-Hall, 1989.

Reference Books:

- R. M. Haralick, L. G. Shapiro. *Computer and Robot Vision*. Addison-Wesley, 1993.
- A. Rosenfeld, A. C. Kak. *Digital Picture Processing*. Addison-Wesley, 1983
- D. A. Forsyth, J. Ponce. *Computer Vision: A Modern Approach*. Prentice-Hall, 2003.
- C. R. Giardina, E. R. Dougherty. *Morphological Methods in Image and Signal Processing*. Prentice-Hall, Englewood Cliffs, New Jersey, 1988.
- R. J. Schalkoff. *Digital Image Processing and Computer Vision*. John Wiley & Sons, Singapore, 1989.

BCSL315/BCSP315-Cloud Computing**Pre-requisite: NA**

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Mark
					TA	CA	EESE	Int.	Ext.	
1	-	2	3	2	10	15	25	10	15	75

***Mode of Exam: Practical Application Based Online**

Course Objective:

1. Understand the new technologies for resources sharing
2. Explain classification of Cloud deployment
3. Discuss capacity planning for cloud configuration
4. Understand Cloud service model
5. Cloud Security and privacy issue
6. Cloud business model for cost effectiveness

Course Outcome: Upon successful completion of the course, students shall be able to-

CO1: State the basics of distributed computing and cloud computing.

CO2: Summarize the technical capabilities and business benefits cloud technology.

CO3: Develop cloud-based application demonstrating its implications

CO4: Develop cost effective solution using cloud technology

CO5 : Develop solution for Society with minimized resources

CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes					Program Specific Outcomes
	PO1	PO2	PO3	PO4	PO5	PSO1
CO1	1	3	3	3	3	-
CO2	-	3	3	3	3	2
CO3	2	3	3	3	3	3
CO4	1	3	2	3	3	3
CO5	1	2	3	2	3	3
CO6	1	3	2	3	3	3

Syllabus**CO- I: Introduction to Cloud Computing**

Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy. Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Hardware-as-a-service: (HaaS), Oriented Architecture (SOA)

CO – II: Cloud Computing Architectural Framework

Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment.

CO – III: Cloud Application Development

Role of business analyst, Technical architecture considerations, Service creation environments to develop cloud based applications, Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and

disadvantages, Cloud Economics,

CO – IV: Cloud Security and Risk Management

Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.

Text Books:

5. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012
6. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
7. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
8. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference Books:

- 1 Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
- 2 Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN:978-0521137355]
3. Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]
4. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
5. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2019

Track 1:-

DEPARTMENT ELECTIVE 1: TELEVISION & MULTIMEDIA PROCESSING

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total
			Hours		TA	EC	AE	EE	SE	Int. Ext. Mark
2	-	-	2	2	10	15	25	-	-	50

***Mode of Exam: Pen and paper**

Course Objective:

5. To introduce the study and analyse transmission & reception for audio and video systems in digital television.
6. To study the principle of HDTV, 3D TV, IPTV.
7. To understand ATSC & DVB Modulation.
8. To understand multimedia system architecture & compression techniques.

Course Outcomes:

5. Outline importance of various sections of television receiver & analyse colour difference signals & its components.
6. Demonstrate transmission & reception of digital television & Compare digital television systems used worldwide.
7. Interpret working principles of ATSC & DVB techniques.
8. To provide the student with an understanding of multimedia system design.

CO Mapping with PO and PSO:

C o u r s e O u t c o m e s ↓	Programme Outcomes												Progr amme Specifi c Outco mes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3
C O 1	2	2	3	2	2	2	2	2	1	3	1	3	3	2	2
C O 2	2	2	3	2	2	2	2	2	1	3	2	3	3	3	3
C O 3	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2
C O 4	2	2	3	2	2	2	2	2	1	3	1	3	3	3	3
C O 5	2	2	3	2	2	2	2	2	1	3	2	3	3	2	2
C O 6	2	2	3	2	2	2	2	2	1	3	3	3	3	2	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Introduction to Television & Color Television Receiver: Picture transmission, TV transmitter, Colour mixing, video signals for colour, Luminance signal (Y), Compatibility, Colour-difference signals, encoding, Formation of chrominance signals. RF Tuner, IF Subsystem, Video amplifier, Sound section, Sync separation,

Deflection circuits, Scanning currents in the yoke, Chroma decoder, Separation of U and V colourphasors, Synchronous demodulators, Sub carrier generation and control, Matrixing for drive circuits

Unit-II: (Mapped CO2) (6 hrs)

Digital Satellite Television, Direct-to-Home Satellite Television, Digital TV Receiver, Basic principles of Digital TV broadcasting, Digitization of video signals, Digitization formats. Digital television systems – ATSC, DVB-T, ISDB, DTMB.

Unit-III: (Mapped CO3) (8 hrs)

ATSC 8-VSB Modulation, ATSC Data Framing, ATSC Concatenated Channel Coder, ATSC Channel Capacity, DVB Modulation, DVB Channel Coding, DVB Channel Capacity, DVB teletext, DVB subtitling system, Global View of transmission and reception process, Composition of Integrated Decoder, Flat panel display TV receiver, Stereo sound in TV, 3D TV Evolution of the set top box, High-Definition Television (HDTV), Digital TV over IP, Digital terrestrial television for mobiles.

Unit-IV: (Mapped CO4) (8 hrs)

Multimedia Elements, Multimedia Applications, Multimedia System, Architecture, Evolving Technologies For Multimedia Systems, Multimedia, Databases, Types Of Compression, Binary Image Compression Schemes, Color, Gray Scale, Still-Video Image Compression, Discrete Cosine Transform, Video Image Compression, MPEG Coding Methodology, Audio Compression, Data and File Format Standards- RTF, TIFF, RIFF, MIDI, JPEG, AVI, JPEG, Twain Architecture. Storage and Retrieval Technologies, Multimedia Application Design

Text Books:

1. R.R. Gulati, "Monochrome & Color TV", PHI Learning, 2014
2. A. M. Dhake, "TV and Video Engineering", Tata McGraw-Hill Education, 2001.
3. Andleigh PK and Thakrar K, "Multimedia Systems", Addison Wesley Longman, 1999.

Reference Books:

1. R. G. Gupta, "Television Engineering and Video Systems", Tata McGraw-Hill Education, 2011
2. Jerry Whitaker, Blair Benson "Standard Handbook of Video and Television Engineering", Tata McGraw-Hill Education
3. Ralf Steinmetz, KlaraNahrstedt, "Multimedia, computing, communications and applications", Prentice Hall, 1995.

DEPARTMENT ELECTIVE 2: MICROWAVE & MILLIMETER WAVE CIRCUITS

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal Hours	Credi	Theory			Practical		To tal
					T	A	E	C	A	Mark
					Int.	Ext.				
1	-	2	3	2	-	-	-	1 0	1 5	25

***Mode of Exam: Paper Pen with 30% Gate**

Pattern Questions

Course Objective:

1. To understand transmission line fundamentals and apply them to the basic problem
2. To understand the fundamentals of electromagnetic theory and transmission lines
3. To analyze and understand the Uniform plane wave propagation in various media
4. To solve the electric field and magnetic fields for a given wire antenna

Course Outcomes:

1. Interpret and Analyze various parameters and characteristics of the various waveguide components
2. Relate and analyze various passive and active devices.
3. Examine the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.
4. Acquire knowledge about the measurements to be done at microwaves.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes					Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO12	PSO1	PSO2
CO1	3	2	2	-	-	1	1	1
CO2	3	2	2	-	-	1	1	1
CO3	2	3	3	-	-	1	1	1
CO4	3	2	3	-	2	3	2	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Introduction, wave equations, Rectangular waveguide, TE, TM, TEM, Wave Velocity, Guide wavelength, wave impedance, Attenuation in wave guide, introduction to circular waveguide, Dominant mode, Degenerative modes. Introduction to Planar Transmission Lines

Unit-II: (Mapped CO2)

(8hrs) Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Scattering parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, Relation of Z,Y,ABCD parameter with S parameter problems on S parameter, RF behavior of Resistors, Capacitors and Inductors. Coaxial Line Components, Coupling mechanisms – Probe, Loop, Aperture types, Wave-guide and MIC component : Directional Couplers, Hybrids , Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, microstrip resonator Re-entrant Cavities, S Matrix Calculations for – 2 port Junction, E plane and H plane Tees, Magic Tee, Directional Coupler, Circulator and Isolator. Related Problems.

Unit-III: (Mapped CO3) (6hrs)

Crystal and Schottky diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode, , parametric amplifier, microwave bipolar junction transistor ,Power frequency limitation, Microwave FET, HEMT

Unit-IV: (Mapped CO4) (8hrs)

Review of conventional vacuum Triodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator. VSWR, Frequency, impedance, power and Q factor measurements. Electromagnetic interference (EMI), electromagnetic compatibility(EMC), Electromagnetic radiation

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PO1	PO2	PO3
CO1	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO2	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO3	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3
CO4	3	3	2	3	3	1	1	1	1	2	1	2	2	3	3

hazards

Textbooks:

1. Principles of Electromagnetics, Matthew N.O. sadiku and S.V. Kulkarni, Oxford University Press, 2015
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, PHI, 2000

Reference Books:

1. Engineering Electromagnetics, Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2005
2. Networks, Lines and Fields, John D. Ryder, PHI, 2005
3. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, McGraw Hill Education, 2006

DEPARTMENT ELECTIVE 3:

WIRELESS AND MOBILE COMMUNICATION

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Mark
					TAE	AE	EESE	Int.	Ext.	
2	-	-	2	2	-	-	25	-	-	25

***Mode of Exam: Pen and paper**

Course Objective:

1. To Study 2G and 2.5G Fundamentals
2. To study 3G CDMA technology
3. To study Different wireless LAN technologies.
4. To study MIMO and OFDM for wireless communication

Course Outcomes:

1. Apply the concept of GSM/GPRS/EDGE technologies in real time application
2. Interpret the concept of CDMA & leading technologies.
3. Interpret the IEEE 802.11 Wireless LAN technologies
4. Infer the concept of MIMO and OFDM concept

CO Mapping with PO and PSO:

Contents:

Unit-I: (Mapped COs) (7 hrs)

GSM: services, features, architecture, radio link, channel types, Diversity, Path loss Models, frames, call handling, EDGE, GPRS.

Unit-II: (Mapped COs) (8 hrs)

The 3G systems: Introduction, evolution of 3G networks, ITU IMT 2000, CDMA 2000: bandwidth, chip rate, channels, spreading and modulation, power control, soft handoff, EV-DO, EV-DV UMTS: radio access network, spreading and modulation, channels, core network.

Unit-III: (Mapped COs) (7 hrs)

Wireless LANs IEEE 802.11 system and protocol architecture, physical layer and MAC, options like 802.11b, a g etc. and their purpose.

Unit-IV: (Mapped COs) (8 hrs)

Introduction to MIMO, MIMO Channel Capacity,

SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MIMO Beam forming – MRT, MIMO - OFDM

Text Books:

3. Fundamentals of Wireless Communication, 2005, David Tse and Pramod Viswanath,

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	3	2	2	1	3	3	1	1	2	1	1	3	1	2
CO2	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO3	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO4	3	3	2	3	2	3	3	1	1	2	1	1	3	1	2

Cambridge University Press

4. Wireless Communications, Andrea Goldsmith

Reference Books:

3. Wireless and Cellular Telecommunications, William C. Y. Lee, 3rd edition
4. Wireless Telecommunications Systems and Networks, Gary J. Mullett 3rd edition

Departmental Elective 4:

AUDIO & SPEECH SIGNAL PROCESSING

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credits	Theory			Practical		Total Mark
					TA	EC	EESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

***Mode of Exam: Paper and Pen**

Course Objectives:

5. To introduce process of speech production
6. To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients in the analysis of speech
7. To understand analysis of Linear predictive coding for speech
8. To be able to develop speech recognition system.

Course Outcomes:

1. Demonstrate advanced knowledge in
 - Digital model representation of speech signal
 - LPC analysis
 - Homomorphic models.
2. Examine complex engineering problems critically for conducting research in speech signal processing.
3. Solve engineering problems using efficient algorithms for feasible and optimal solutions in Speech signal processing field.
4. Utilize speech and speaker verification techniques to complex engineering activities in the field of speech processing.

CO Mapping with PO and PSO:

Contents:

Unit-I (Mapped COs) (7 hrs)

The process of speech production - the mechanism of speech production, acoustic phonetics. The Acoustic theory of speech production- sound propagation, uniform lossless tubes, Effect of losses in the vocal tract, Effect of radiation at the lips, Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sound in the vocal tract. Digital model for speech signals.

Unit-II (Mapped COs) (8 hrs)

Introduction, Window considerations, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function. properties of the complex Cepstrum, computational considerations. The complex Cepstrum of speech, pitch detection, formant estimation

Unit-III (Mapped COs) (8 hrs)

Basic principles of linear predictive analysis – Auto correlation method, The covariance method. Computation of the gain for the model, solution of LPC Equations – Cholesky Decomposition solution for the covariance method. Durbin's Recursive solution for the autocorrelation equations. Comparison between methods of solutions of LPC analysis equations. Applications of LPC parameters – Pitch detection using LPC parameters, Formant analysis using LPC parameters.

Unit-IV (Mapped COs) (7 hrs)

Speaker recognition system-speaker verification system, speaker identification systems. Speech recognition system- isolated digit recognition system, continuous digit recognition system, LPC distance measure.

Text Books:

3. L R Rabiner and SW Schafer, “ Digital

processing of speech signals”, pearson education, 2006.

4. LR Rabiner ,BHJuang, B Yegnanarayana, “ Fundamentals of Speech Recognition”, pearson Education, 1993.

Reference Books:

1. Thomas F Quateri, “Discrete time speech signal processing”, pearson edition, 2006.
2. Ben Gold & Nelson Morgan, “Speech & audio signal processing”, wiley, 2006.
3. Douglas o shaughnessy , “ Speech Communications”, 2nd Edition , Oxford university press, 2000.

DEPARTMENTAL ELECTIVE 5: SMART ANTENNA

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	To tal Hours	Credi	Theory			Practical		To tal Mark
					TA	EC	AE	SE	Int.	
2	-	-	2	2	10	15	25	-	-	50

*Mode of Exam: Paper and Pen

Course Objectives:

1. To introduce the students with the concepts of smart antennas.
2. To introduce different algorithms for DOA and beam forming.
3. To introduce architecture and working of smart antenna systems.
4. To have a good knowledge about all the modern smart antenna wireless systems.

Course Outcomes:

1. Outline the fundamental parameters of smart antennas and their applications.
2. Infer the DOA, beam forming methods and their algorithms. Also, they understand basic architecture, features and benefits of smart antennas.
3. Relate how to integrate smart antenna technology with overall communication system design and learn principles, performance.
4. Summarize the complete use of smart antennas in the modern wireless communication systems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	PS1	PS2	PS3
CO1	3	3	2	2	1	3	3	1	1	2	1	1	3	2	2
CO2	3	3	3	3	2	3	3	1	1	2	1	1	3	2	2
CO3	3	3	3	3	2	3	3	1	1	2	1	1	3	2	2
CO4	3	3	2	3	2	3	3	1	1	2	1	1	3	2	2

Contents:**Unit-I (Mapped COs) (6 hrs)**

Introduction: Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

Unit-II (Mapped COs) (8 hrs)

DOA Estimation Fundamentals: Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Auto-covariance, Conventional DOA Estimation Methods, Conventional Beam forming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates.

Unit-III (Mapped COs) (8 hrs)

Beam Forming Fundamentals: Classical Beam former, Statistically Optimum Beam forming Weight Vectors, Maximum SNR Beam former, Multiple Side-lobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beam forming.

Unit-IV (Mapped COs)**(8 hrs)**

Smart Antennas for Wireless Communications: Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Diversity Techniques, Multiple Input- Multiple Output (MIMO) Communications Systems, MIMO for frequency selective scenarios. Integration and simulation of smart antennas.

Text Books:

1. Introduction to Smart Antennas, C. A. Balanis, Morgan and Claypool, 2007.

2. Smart Antennas, L. C. Godra, CRC Press, 2004.

3. Smart Antenna for Wireless Communication, T. S. Rappaport and J. C. Liberti, Prentice Hall, 1999.

Reference Books:

1. Frank Gross, Smart Antennas for Wireless Communications-McGraw Hill.

2. Ahmed El-Zooghby, Smart Antenna Engineering, Artech House Publishers.

Departmental Elective 6:**MULTI-RATE AND WAVELET SIGNAL PROCESSING**

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical	
					TAE	CAE	ESE	Int.	Ext.
2	-	-	2	2	10	15	25	-	-
									Total Marks
									50

Mode of Exam:*COURSE OBJECTIVES:**

- To acquire the basics of Multirate Signal processing and Multirate Sampling.
- To comprehend Linear Prediction and Optimum Linear Filters
- To analyse the Power Spectrum Estimation
- To comprehend the basics of Continuous and Discrete Wavelet Transform

COURSE OUTCOMES:

- Design Interpolator, Decimator and I/D Sampling Rate Converter
- Design Optimum Linear filters and Linear Prediction filters.
- Interpret the Parametric and Non-Parametric methods for Power Spectrum Estimation.
- Infer the theory and construction of wavelets

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3
CO1	3	3	2	2	1	3	3	1	1	2	1	1	3	1	2
CO2	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO3	3	3	3	3	2	3	3	1	1	2	1	1	3	1	2
CO4	3	3	2	3	2	3	3	1	1	2	1	1	3	1	2

Contents:

Unit-I (Mapped COs) (8 hrs)

Multirate Digital Signal Processing:

Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion, Sampling Rate Conversion of Band-pass Signals, Sampling Rate Conversion by an Arbitrary Factor, Applications of Multirate signal Processing

Unit-II (Mapped CO-2) (7hrs)

Linear Prediction and Optimum Linear Filters:

Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of Normal Equations, Properties of the Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Unit-III (Mapped CO-3) (7hrs)

Power Spectrum Estimation:

Estimation of Spectra from Finite-Duration Observations of Signals, Non-parametric Methods for Power Spectrum Estimation, Parametric methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation, Eigen analysis Algorithm for Spectral Estimation

Unit-IV (Mapped CO-4) (8hrs)

Wavelet Transform:

Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets: Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy of CWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelet transform domain. Discrete Wavelet Transform and Filter banks Orthogonal and bi-orthogonal two-channel filter banks, Design of two-channel filter banks.

Text Books:

- John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Third Edition, Prentice-Hall International, INC
- Alan V. Oppenheim, Ronald W. Schaffer, Discrete Time Signal Processing, Prentice-Hall International, INC
- S. Mallat, A Wavelet Tour of Signal Processing, 2nd edition, Academic Press, 1999.
- M. Vetterli and J. Kovacevic, Wavelets and Sub band Coding, Prentice Hall, 1995.
- Raghuveer Rao and Ajit S. Bopardikar, Wavelet transforms: Introduction, Theory and Applications, Pearson Education Asia, 2000.

Reference Books:

- J.C. Goswami and A.K. Chan, Fundamentals of Wavelets: Theory, Algorithms, and Applications, 2nd ed., Wiley, 2011.
- Michel Misiti, Yves Misiti, Georges Oppenheim, Jean- Michel Poggi, Wavelets and their Applications, John Wiley & Sons, 2010.

9. J S Walker, A premier on Wavelets and their scientific applications, , CRC press, 2002.
10. erald keiser, A friendly guide to Wavelets, Springer, 2011.
11. . P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, 2004.
12. K P Soman and KL Ramachandran, Insight into wavelets from theory to practice, PHI, 2008.

Soft Computing

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	Total Hours	Credit	Theory			Practical		Total Marks
					TA E	CA E	ES E	Int.	Ext.	
2	0	-	2	2	10	15	25	-	-	50

Mode of exam: offline

Course objectives

1. Develop the skills to gain a basic understanding of neural network theory and support vector machine.
2. Introduce students to radial basis function and associated memory networks, Hopfield networks, and Kohonen networks.

Course outcome

6. Demonstrate the basics concept of artificial neural network.
7. Make use of associated memory networks, Hopfield networks, and Kohonen networks for problem solving.
8. Make use of radial basis function and support vector machine for the classification of different classes of data.
9. Demonstrate the use of fuzzy neural network in the real world problems.
- 10.

Syllabus

UNIT 1

(9 Hrs)

Introduction: Artificial neural networks: feed-forward, recurrent and multi-layer architectures; Supervised and unsupervised

learning; Characteristics: adaptability, fault tolerance, generalization; limitations of neural computing. **Perceptron:** Linear classifiers; Simple perceptron; Perceptron learning algorithms; ADALINE; MADALINE; Limitation of perceptron dichotomizer. **Multi-Layer Perceptron:** Gradient decent scheme for error minimization; Generalized delta learning rule; Back-propagation learning for multi-layer networks; Multi-layer perceptrons for multidimensional functional mappings.

UNIT 2

(9 Hrs)

Associated Memory Networks: Auto-association; Heteroassociation; Linear associative networks: Hebbian learning, perfect recall, cross-talk; Bidirectional associative memory; Brain-State-in-a-Box network. **Hopfield Networks:** Binary Hopfield network: basic structure, asynchronous updating, convergence, associative memory; Continuous-valued Hopfield network. Advantages and limitations.

Kohonen Networks: Self-organizing networks; Similarity measures; Kohonen's winner-take-all network; Geometrical interpretation of Kohonen's learning; Functional specificity of human brain, Kohonen's self-organizing feature map algorithm; Conscience algorithm.

UNIT 3

(6 Hrs)

Radial Basis Function Networks: Radial Basis Function Networks: radial basis vs. linear basis, Gaussian basis functions, K-means learning, LMS algorithm, comparison with Multi-Layer Perceptron networks.

Support Vector Machines (SVM): Optimal hyperplane for linear separability, quadratic optimization, SVM for pattern recognition, different kernels for hidden-layer, optimal design of SVM.

UNIT 4

(6 Hrs)

Fuzzy Neural Networks

Fuzzy sets: Basic Definition; Fuzzy-set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning, Fuzzy If-Then Rules Fuzzy-neural networks; Neuro-fuzzy

systems; Genetic algorithms: selection schemes, operations.

Suggested Books

1. J.S.R.J ang, C.T. Sun and E. Mizutani, “**Neuro-Fuzzy and Soft Computing**”, Prentice Hall of India and Pearson Education, 2004.
2. S. Rajasekaran and G.A.V. Pai, “**Neural Networks, Fuzzy Logic and Genetic Algorithms**”, Prentice Hall of India, 2003.
3. R. Eberhart, P. Simpson and R. Dobbins, “**Computational Intelligence - PC Tools**”, AP Professional, Boston,

Pattern Recognition

Teaching Scheme					Evaluation Scheme				
Th	T	P	To	Cr	Theory			Practical	
					T	C	E	I	E
			tal	edi	A	A	S	n	x
			H	t	E	E	E	t.	t.
			ou						
			rs						arks
2	0	-	2	2	1	1	2	-	-
					0	5	5		50

Mode of exam: offline

Course objectives

1. To cover the basic concepts for analyzing patterns and their pre-processing techniques.
2. To give exposure to various learning algorithms and their applications to various real life applications.

Course outcome

5. Demonstrate the basics concept of pattern recognition.
6. Illustrate the various parametric and non-parametric techniques in pattern recognition.
7. Demonstrate the various dimension reduction techniques.
8. Make use of their learning for the analysis of the real world problems.

Syllabus

UNIT 1 (8 Hrs)

Definitions, data sets for pattern recognition, representations of patterns and classes, metric and non-metric proximity measures, feature extraction,

statistical and syntactic pattern recognition

UNIT 2 (8 Hrs)

Bayesian decision theory: Classifiers, discriminant functions, decision surfaces, normal density and discriminant functions, discrete features

Parameter estimation methods: Maximum-likelihood estimation, expectation-maximization method, Bayesian estimation, Gaussian mixture models

Non-parametric techniques: Density estimation using Parzen-window method, K-nearest neighbor method, nearest neighbor classifier

UNIT 3 (8 Hrs)

Dimension reduction methods: Linear discriminant analysis (LDA), principal component analysis (PCA)

Linear discriminant function based classifiers

Non-metric methods for pattern classification: Non-numeric data or nominal data decision trees

Unsupervised learning and clustering: Criterion functions for clustering, algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation

UNIT 4 (6 Hrs)

Applications: Biometrics recognition, handwriting recognition, document recognition, multimedia data retrieval, speech recognition, data mining, web searching, network traffic analysis etc.

Suggested Books

1. R. O. Duda, P. E. Hart and D. G. Stork, **Pattern Classification**, John Wiley, 2001
2. S. Theodoridis and K. Koutroumbas, **Pattern Recognition**, 4th Ed., Academic Press, 2009
3. C. M. Bishop, **Pattern Recognition and Machine Learning**, Springer,

Human Computer Interface

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	Total Hours	Credit	Theory			Practical		Total Marks
					TA E	CA E	ES E	Int.	Ext.	
2	0	-	2	2	10	15	25	-	-	50

Mode of exam: offline

Course objectives

- Investigate emerging human computer interfaces and paradigms and implement them into prototype and products with original interfaces.
- To make the students knowledgeable in the area of designing, implementing and using interactive computer systems and how effective design of human computer interfaces influence individuals and organizations..

Course outcome

- Understand the basic HCI concepts and various design process, standards and guidelines
- Perform implementation support and evaluation of their design
- Learn various models like Brain computing
- Learn various dialogue notations and importance of groupware

UNIT 1

FOUNDATIONS: (8 Hrs)

The Human-Input-output channels-Human Memory, Thinking-emotions-Psychology & design of interactive systems, Computer-Text entry devices, Positioning, Pointing & drawing, display devices for Virtual reality, 3D, Interaction-models-Frameworks & HCI, Ergonomics-Interaction style, WIMP Interfaces-context, Paradigms for Interaction

UNIT 2 SOFTWARE PROCESS & DESIGN RULES (8 Hrs)

Interaction design basics-user focus-scenarios, Navigation-screen design & layout, HCI in

software process-lifecycle, Usability engineering, Interactive design & prototyping, Design rules-Principles for usability-standards, HCI patterns

UNIT 3 (7 Hrs)

IMPLEMENTATION & USER SUPPORT

Implementation support-Windowing system elements, using tool kits-user interface management, Evaluation techniques-goals, Multimodal interaction, user support, Approaches-adaptive help systems, designing user support system

UNIT 4 (7 Hrs)

COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS

Cognitive models-Goal & task hierarchies, Linguistic models-Physical & device models-architectures, Communication & collaboration models, Face-to-face communication, Conversation-text based, Brain computing Interface concepts, Brain Signals-EEG, Ubiquitous computing application research, Groupware systems

TEXT BOOKS:

- Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale (2003): Human-Computer Interaction. 3rd Edition. Prentice Hall, 2003
- Ben Shneiderman and Catherine Plaisant: Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition) , 5th ed., Pearson Addison-Wesley, 2009

REFERENCE BOOKS

- John M. Carrol, "Human Computer Interaction in the New Millenium", Pearson Education, 2002
- Jonathan Worlpaw and Elizabeth Winter Wolpaw, "Brain-Computer Interfaces" Oxford University Press 2012.

DECISION ANALYTICS

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	Total Hours	Credit	Theory			Practical		Total Marks
					TA	CA	ES	In	Ex	

					E	E	E	t.	t.	
2	0	-	2	2	10	15	25	-	-	50

Mode offline

COURSE OBJECTIVE:

1. Introduces the basic principles and techniques of applied mathematical modeling for managerial decision-making.
2. To use some important analytic methods (spreadsheet modeling, optimization, Monte Carlo simulation), to recognize their assumptions and limitations, and to employ them in decision-making.

COURSE OUTCOME:

1. Develop mathematical models that can be used to improve decision making within an organization
2. Ability to structure problems and to perform logical analyses.
3. Translating descriptions of decision problems into formal models, and investigate those models in an organized fashion
4. Identify settings in which models can be used effectively and apply modeling concepts in practical situations.

UNIT 1 (9 Hrs)

Deterministic Models:

Linear Programming- formulating optimization problems, spreadsheet modeling, using Solver and Solver Table, sensitivity analysis, multi-period modeling. Integer Programming – Integer and binary variables, logical relationships, project selection, facility location, crew scheduling

UNIT 2 (8 Hrs)

Deterministic Models:

Network Optimization –Assignment problem, transportation problem, minimum-cost flow, funds-flow model, project management, currency exchange. Non-linear Optimization – Portfolio optimization, demand estimation, pricing.

UNIT 3 (7 Hrs)

Probabilistic Models:

Stochastic Optimization – Newsvendor model. Simulation –Basic concepts, Crystal Ball software, option pricing.

UNIT4 (6 Hrs)

Probabilistic Models:

Simulation and Optimization – project management, revenue management, liquidity optimization.

TEXT BOOK

1. Practical Management Science (5th edition), by Winston and Albright.

Natural Language Processing

Teaching Scheme					Evaluation Scheme					
Th .	Tu	Pr .	To tal H ou rs	Cr edi t	Theory			Pract ical		To tal M ar ks
					T A E	C A E	E S E	I n t.	E x t.	
2	0	-	2	2	10	15	25	-	-	50

Mode of exam: offline

Course Objective:

1. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.
2. Understand the concepts of morphology, Shallow Parsing and pragmatics of the language

Course Outcome:

1. Understand approaches to syntax and semantics in NLP.
2. Understand current methods for statistical approaches to machine translation.
3. Understand machine learning techniques used in NLP

UNIT I (8 Hrs)

Sound : Biology of Speech Processing; Place and Manner of Articulation; Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

Words and Word Forms : Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based

Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

UNIT 2 (8 Hrs)

Structures : Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution

UNIT 3 (8 Hrs)

Meaning : Lexical Knowledge Networks, Wordnet Theory; Indian Language, Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

UNIT 4 (6 Hrs)

Web 2.0 Applications: Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

References:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Deep Learning Foundations & Applications

Teaching Scheme					Evaluation Scheme				
Th.	Tu.	Pr.	Total Hours	Credit	Theory			Practical	
					TA	CA	EE	Int.	Ext.
2	0	-	2	2	10	15	25	-	-
					50				

Mode of exam: offline

Course Objective:

1. To provide students with foundational concepts required for deep learning across various applications ranging across speech and natural language processing to machine vision to medical imaging.
2. To introduce the fundamental principles of deep neural networks and the important paradigms of deep learning.
3. To build analytics solutions to problems in signal, image and text paradigm using deep neural networks.
4. To understand the concepts of deep neural networks and will be able to develop solutions using deep neural networks

Course outcome

5. Introduce the fundamental principles of deep neural networks and the important paradigms of deep learning.
6. To build analytics solutions to problems in signal, image and text paradigm using deep neural networks.
7. To understand the concepts of deep neural networks
8. To develop solutions using deep neural networks.

UNIT 1 (8 Hrs)

Foundation Concepts

Linear Algebra for Deep Learning: Scalars, vectors, matrices, tensors. Multiplication on matrices and tensors, trace operator and determinant.

Deep Neural Network Design and Learning: Simple exercises with Deep Neural Network Libraries viz. PyTorch/TensorFlow. Acceleration with CUDA on GPUs and MKL/Open MPI on CPUs.

Optimization for Training a Deep Neural Network Gradient descent, Stochastic gradient descent, Adaptive momentum.

UNIT 2 (8 Hrs)

Deep Learning for Speech and Natural Language Processing

Sequence Modeling with Recurrent Networks: Long Short-term Memory (LSTM) and Gated Recurrent Units (GRU), Backpropagation through time (BPTT)

Machine Translation and Text Summarization: Word Vectors, RNN Language Model, attention mechanism for sequence generation with applications to machine translation and text summarization.

UNIT 3 (7 Hrs)

Deep Learning for Machine Vision

Vector Convolutional Networks: Vector Convolution for rotation and scale invariance/equivariance, Learnable Deconvolution.

Digit, Handwriting and Hieroglyph Classification: LeNet-5 for MNIST, Fashion MNIST, NIST SD-19, Egyptian Hieroglyph, Rotation equivariant and scale invariant LeNet-5.

Object Recognition and Classification: AlexNet, VGG, ResNet, DenseNet on CIFAR-10.

Object Localization: Single shot multi-box detection and classification. Regional Proposal CNN (rCNN), Fast rCNN and Faster rCNN, YOLO-9000

UNIT 4 (7 Hrs)

Deep Learning for Healthcare and Medical Imaging

ECG Signal Classification: ECG signal filtering, segmentation and classification using 1D CNN

Digital Pathology: Blood pathology classification on ALL-IDB using transfer learning of Image Net pre-trained models, Multiple Instance Learning of CNN for Histopathology Whole Slide Classification

Digital Radiology: Chest X-ray Classification, Brain Lesion Classification and Segmentation in MRI.

Text Books:

1. "Deep Learning", I. Goodfellow, Y. Bengio, A. Courville, MIT Press, 2016.
2. "Neural Networks and Learning Machines", S. Haykin, 3rd Edition, Pearson, 2008.

Reference Books:

1. "Neural Networks for Pattern Recognition", C. M. Bishop, Oxford University Press, 1995.
2. "Pattern Classification", R. O. Duda, P. E. Hart, D. G. Stork, 2nd Edition, Wiley, 2001.
3. "A Sampler of Useful Computational Tools for Applied Geometry, Computer Graphics and Image Processing", D. Cohen-Or, C. Greif, T.

Ju, N. J. Mitra, A. Shamir, O. Sorkine-Hornung, H. Zhang, CRC Press, 2015.

4. "Machine Learning", T. M. Mitchell, Mc. Graw Hill Education, 1997.

5. "Pattern Recognition and Machine Learning", C.M. Bishop, 2nd Edition, Springer, 2011

Track 3

System Programming for Embedded Devices (Elective Track)

Teaching Scheme					Evaluation Scheme				
Th.	Tu	Pr.	Total	Credit	Theory			Practical	Total Marks
					TAE	CAE	ESE	Int. Ext.	
4	-	-	4	3	20	20	60	-	100

Course Objectives:

5. To gain knowledge about the Embedded system & its architecture
6. To able to use-Interface hardware, software tools.
7. To able to understand concept Programming & Tools.
8. To able to understand Perform programming & application design.

Course Outcomes:

5. Analyze different embedded system & its architecture.
6. Interpret functioning of microcontroller & Processor using new architecture.
7. Design the system programming using embedded tool.
8. Interpret embedded advance programming & simulation.

CO Mapping with PO and PSO:

Contents:**Unit-I: (CO1) Introduction of Microcontroller and architecture:****(8Hrs)**

Microcontrollers : Microprocessors and Micro-controllers, Types of Micro-controllers, External memory, Processor Architecture – Harvard v/s Van Neumann; CISC v/s RISC, Micro-controller, Memory types, Software development tools like assembler, cross- compiler, emulator, and simulator, 8051 controller, Block Diagram & Architecture.

Unit-II (CO2) Embedded system and languages**(6hrs)**

8051 Instruction Set, Addressing modes & programming. 8051 Timers, Serial I/O, Embedded C programming, AVR addressing modes, RISC, CISC Programming set of instruction.

Unit-III (CO3) Embedded internal programming**(8hrs)**

Simulator vs Emulator, Memory Addressing Program Memory, ROM, Data Memory, RAM, Internal RAM, Registers, Bit addressable memory, Special Function Register, Classic and Extended 8051 Devices, ARM7 and ARM9 based Microcontrollers, Cortex-Mx based Microcontrollers, Code Comparison, Software Development Cycle, µVision IDE, µVision Device Database, µVision Debugger, Assembler, C/C++ Compiler, Object-HEX Converter.

Unit-IV (CO4) Embedded software Tools & Advance application**(8hrs)**

Programming & debugging, Hex code creation, Logic analyzer, Serial I/O interface, UART interface, Programming Flash Devices, Configuring External Tools, ISIS AND PCB DESIGN, ISIS AND SIMULATION, Bitmap Generation Interfacing in Proteus, Classic and Extended 8051 Devices, ARM7 and ARM9 based Microcontrollers, Cortex-Mx based Microcontrollers, Code Comparison, Software Development Cycle, µVision IDE, µVision Device Database, µVision Debugger, Assembler, C/C++ Compiler, Object-HEX Converter.

Text Books:

4. Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	P S O 1	P S O 2	P S O 3
CO1	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2
CO2	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2
CO3	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2
CO4	2	1	1	1	3	1	1	1	1	1	1	1	1	1	2

assembly & C Pearson Education second edition 2008

5. Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
6. Maneesh Rao, Internet of Things with Raspberry Pi 3, Packt Publisher, Second edition 2018

Reference Books:

3. Ajay V. Deshmukh Micro-controllers - Theory and Applications, Tata McGraw Hill
4. The Arduini Project Book, Designed, printed and bound in Torino, Italy, September 2012

Mechatronics (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total Mark
					TAE	CA	EESE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

5. To gain knowledge about the electromechanical system & its automation
6. To able to use-Interface hardware, software tools.
7. To able to understand concept Programming & Tools.

8. To able to understand Perform programming & application design.

Course Outcomes:

- Analyze different embedded system & its architecture.
- Interpret functioning of microcontroller & sensor interfacing
- Illustrate the system design for stepper motor & transfer function mechanisms.
- Illustrate & develop embedded application using Hydraulic systems.

CO Mapping with PO and PSO:

Course Outcomes ▼	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Content

Unit-I (CO1) Introduction: Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach.

Unit-II (CO2): Review of fundamentals of electronics. Data conversion devices, sensors, micro sensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

Unit-III (CO3) Module III: Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Unit-IV (CO4): Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic circuits. Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. Description, Description of PID controllers. CNC machines and part programming. Industrial Robotics.

Text Book:

- Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
- Groover, M. P., Automation, Production System & Computer Integrated Manufacturing, Pearson Education Asia (2009).
- Nakra, B. C., Theory and Applications of Automatic Controls, Revised 2nd Edition, New Age International Publishers (2014).

Reference Books:

- Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using assembly & C Pearson Education second edition 2008
- Morriss, S. B., Automated Manufacturing Systems, McGraw Hill (2006).
- Auslander, D. M. and Kempf, C. J., Mechatronics: Mechanical System Interfacing, Prentice Hall., New Jersey (1996). John W. Webb & Ronald A. Reis,
- Programmable Logic Controllers – Principles and Applications, Fifth Edition, Pearson Education (2008).
- John R. Hackworth & Frederick D. Hackworth Jr, Programmable Logic Controllers – Programming Methods and Applications, Pearson (2011).

Mechatronics (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	T o t al	Credits	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

- To gain knowledge about the electromechanical system & its automation
- To able to use-Interface hardware, software tools.
- To able to understand concept Programming & Tools.
- To able to understand Perform programming & application design.

Course Outcomes:

- Analyze different embedded system & its architecture.
- Interpret functioning of microcontroller & sensor interfacing
- Illustrate the system design for stepper motor & transfer function mechanisms.
- Illustrate & develop embedded application using Hydraulic systems.

CO Mapping with PO and PSO:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Content**Unit-I : Introduction: (7 Hours)**

Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach.

Unit-II: (7 Hours)

Review of fundamentals of electronics. Data conversion devices, sensors, micro sensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

Unit-III: (7 Hours)

Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Unit-IV: (9 Hours)

Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic circuits. Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. Description, Description of PID controllers. CNC machines and part programming. Industrial Robotics.

Text Book:

- Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
- Groover, M. P., Automation, Production System & Computer Integrated Manufacturing, Pearson Education Asia (2009).
- Nakra, B. C., Theory and Applications of Automatic Controls, Revised 2nd Edition, New Age International Publishers (2014).

Reference Books:

- Muhammad Ali Mazidi, The 8051 Micro-controller & Embedded System using assembly & C Pearson Education second edition 2008
- Morriss, S. B., Automated Manufacturing Systems, McGraw Hill (2006).
- Auslander, D. M. and Kempf, C. J., Mechatronics: Mechanical System Interfacing, Prentice Hall., New Jersey (1996). John W. Webb & Ronald A. Reis,
- Programmable Logic Controllers – Principles and Applications, Fifth Edition, Pearson Education (2008).
- John R. Hackworth & Frederick D. Hackworth Jr, Programmable Logic Controllers – Programming Methods and Applications, Pearson (2011).

Automotive Electronics (Elective

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total Marks
					TA	EC	AE	EE	Int. Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

- To understand the concepts of Automotive Electronics and its evolution and trends & Automotive systems & subsystems overview.
- To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
- To understand, design and model various automotive control systems using Model based development technique. & Microcontrollers in ECU design and choice of appropriate Hardware and Software.
- To describe various communication systems, wired and wireless protocols used in vehicle networking & Safety standards, advances in towards autonomous vehicles.

Course Outcomes:

- Obtain an overview of automotive components, subsystems, design cycles, communication protocols.
- Interface automotive sensors and actuators with microcontrollers.

- Develop, simulate and integrate control algorithms for ECUs with hardware.
- Safety systems employed in today's automotive industry.

CO Mapping with PO and PSO:

Content

Unit-I: Overview of Automotive Industry: (7 Hours)

Leading players, Automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes, Lead acid and alkaline batteries, battery rating, and battery charging characteristics, battery testing and maintenance, gel battery.

Unit-II: Systems Approach to Control and Instrumentation: (8 Hours)

Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Sensor modeling, Smart Nodes, Ignition system, magneto coil ignition system, spark plug types, electronic ignition system-transistor ignition system, and capacitor discharge ignition system, distributor less ignition system and solid state ignition system.

Unit-III : STARTING AND CHARGING SYSTEM: (7 Hours)

Principle and construction of starter motor, working of different starter drive units. DC and AC Generators – principle, construction and working, regulation, automotive transmissions: Transmission fundamentals, Types MT, AT, CVT and DCT. Vehicle Braking Fundamentals: Vehicle dynamics during braking, Hydraulic brake system components, Introduction to antilock braking systems.

Unit-IV: SENSORS AND ACTUATORS: (8 Hours)

Classification of sensors, sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application.

Solenoids, stepper motors and relay. ELECTRONIC ENGINE CONTROLS: Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, engine mapping, and on-board diagnostics – engine control module and power train control module. Communication protocols: Overview of automotive communication protocols, CAN, LIN, Flex Ray, MOST, Ethernet, D2B and DSI, Communication interface with ECUs

Text Books:

1. Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes Publication, 2003.
2. Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.

Reference books:

1. Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
3. Terence Rybak & Mark Stefika: "Automotive Electromagnetic Compatibility (EMC)", Springer, 2004.
4. Allan Bonnick: "Automotive Computer Controlled Systems, Diagnostic Tools and Techniques", Elsevier Science, 2001.
5. Uwe Kiencke and Lars Nielsen: "Automotive Control Systems: Engine, Driveline and Vehicle", 2nd Edition, Springer Verlag, 2005.
6. David Alciatore & Michael Hstand: "Introduction to Mechatronics and Measurement Systems (SIE)", TMH, 2007.
7. Iqbal Husain: "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
8. Tom Denton: "Advanced Automotive Diagnosis", 2nd Edition, Elsevier, 2006.

9. G. Meyer, J. Valldorf and W. Gessner: "Advanced Microsystems for Automotive Applications", Springer, 2009.

10. Tracy Martin: "How to Diagnose and Repair Automotive Electrical Systems" Motor Books / MBI Publishing Company, 2005.

11. Mehrdad Ebsani, Ali Emadi & Yimin Gao: "Modern Electronic Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2nd Edition, CRC Press, 2009.

12. Marc E. Herniter and Zac Chambers: "Introduction to Model Based System Design", Rose-Hulman Institute of Technology.

Industrial Automation (Elective Track)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total Marks
					TA	EA	ESE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

5. To gain knowledge about the Industrial system & its automation
6. To able to use-Interface hardware, software tools.
7. To able to understand concept Programming & Tools.
8. To able to understand Perform programming & application design.

Course Outcomes:

5. Analyze different embedded system & its architecture.
6. Interpret functioning of microcontroller & Processor using new architecture.
7. Illustrate the system programming using embedded tool.
8. Illustrate & develop embedded application using advanced IDE tools for simulation.

Content**Unit-I: COMPUTER BASED CONTROL: (7 Hours)**

Implementing control system using computer or microprocessor; computer based controller: hardware configuration and software requirements. DISTRIBUTED CONTROL SYSTEM-Meaning and necessity of distributed control; hardware components of DCS; DCS software.

Unit-II: INTRODUCTION PROGRAMMABLE LOGIC CONTROLLER (PLC): (7 Hours)

What is PLC? PLC versus microprocessor/microcontroller/computer, advantages and disadvantages of PLC, architecture and physical forms of PLC, BASIC PLC FUNCTIONS-Registers: holding, input and output registers; Timers and timer functions; counters and counter functions

Unit-III: INTERMEDIATE PLC FUNCTIONS: (9 Hours)

Arithmetic functions: addition, subtraction, multiplication, division and other arithmetic functions; Number comparison and conversion, DATA HANDLING FUNCTIONS OF PLC: Skip function and applications; master control relay function and applications; jump with non-return and return; data table, register and other move functions, BIT FUNCTIONS OF PLC: Digital bit functions and applications; sequencer functions and applications, ADVANCED FUNCTIONS OF PLC: Analog input and output functions, analog input and output modules, analog signal processing in PLC; PID control function, network communication function, PLC PROGRAMMING: PLC programming languages, ladder programming, mnemonic programming and high level language programming.

Unit-IV: SCADA: (7 Hours)

Supervisory control versus distributed control; Layout and parts of SCADA system, detailed block schematic of SCADA system; Functions of SCADA system: data acquisition, monitoring, control, data collection and storage, data processing and calculation, report generation; MTU: functions, single and dual computer configurations of MTU; RTU: functions, architecture / layout; MTU-RTU communication and RTU-field device communication.

BOOKS RECOMMENDED:

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO2	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO3	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2
CO4	1	1	2	1	3	1	1	1	2	1	1	1	1	1	2

Instrumentation Technology, Prentice Hall

- Webb JW and Reis RA, Programmable Logic Controllers, Prentice Hall
- Hackworth JR and Hackworth FD, "Programmable Logic Controllers," Pearson Edition
- Boyer SA, Supervisory Control and Data Acquisition (SCADA), International Society of Automation

IoT System Design

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total	Credit	Theory			Practical		Total Marks
					TA	EC	EE	Int.	Ext.	
4	-	-	4	3	20	20	60	-	-	100

Course Objectives:

- To gain knowledge about the Embedded system & its architecture
- To able to use-Interface hardware, software tools.
- To able to understand concept of IOT & its system architecture
- To able to understand sensory system analysis on Cloud using IoT platform

Course Outcomes:

- Analyze different embedded system & its architecture.
- Interpret functioning of microcontroller & Processor using new architecture.
- Design the embedded system software & Hardware interfacing.
- Analyze IOT concept & architecture.

11. Interpret IOT DATA LINK LAYER & IOT Hardware.
12. Design & develop IoT based application using advanced technology

CO Mapping with PO and PSO:

Contents:

Unit-I: (CO1) INTRODUCTION TO EMBEDDED CONCEPTS (6hrs)

Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software

Unit-II : Embedded system architecture

(8hrs)

Classifications of embedded systems, challenges and design issues in embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC, fundamentals of Vonneuman/Harvard architectures, and types of microcontrollers, MP vs MC 8051, MC-8051 & 89s52 architecture–pin diagram, Simulator vs Emulator, Memory Addressing Program Memory, ROM, Data Memory, RAM, Internal RAM, Registers, Bit addressable memory, Special Function Register, Motor driver – Manual robot Interfacing.

Unit-III : IOT Architecture

(8hrs)

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management UNIT Unit-IV (CO4) IOT DATA LINK LAYER & IOT Hardware

(8hrs)

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy,

DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP, Arduino, Raspberry Pi, Sensors Interfacing, and Wi-Fi ESP8266 interfacing ,WSN node, Power supply, Antenna concept, Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud

Course Outcomes ↓	Programme Outcomes												Programme Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	1	1	3	1	1	1	1	1	1	2	1	1	3
CO2	2	2	1	1	3	1	1	1	1	1	1	2	1	1	3
CO3	2	2	1	1	3	1	1	1	1	1	1	2	1	1	3
CO4	2	2	1	1	3	1	1	1	1	1	1	2	1	1	3

Standards – Cloud Providers and Systems, Mobile Cloud Computing, Think speak, carrot, Amazon Web Services for IoT, Skynet IoT Messaging Platform. Case Studies: Home Intrusion Detection, Weather Monitoring System, Air Pollution Monitoring, Smart Irrigation, Alexa services.

Text Books:

6. Muhammad Ali Mazidi, The 8051 Microcontroller & Embedded System using assembly & C Pearson Education second edition 2008
7. Kenneth J. Ayala, The 8051 Microcontroller – Architecture, Programming & Applications, Penram International & Thomson Asia, Second edition 1996
8. Maneesh Rao, Internet of Things with Raspberry Pi 3, Packt Publisher, Second edition 2018
9. Peter Waher, Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3, Packt Publisher, First edition 2018
10. Internet of Things A to Z: Technologies and Applications June 2018 with 6,388

Reads Publisher: 978-1-119-45674-2,
Publisher: Wiley-IEEE Press.

7. Design, synthesize, evaluate, and analyze biomaterials.
8. Make use of their learning for clinical trials, and manufacturing.

Reference Books:

4. John C. Shovic, Raspberry Pi IoT Projects: Prototyping Experiments for Makers, Apress Publisher, First edition 2018
5. Ajay V. Deshmukh Micro-controllers - Theory and Applications, Tata McGraw Hill
6. Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Series in Signal, Image and Speech Processing John Soldatos Athens Information Technology Greece, River Publishers Alsbjergvej 10 9260 Gistrup Denmark.

TRACK 4:

Department Elective –I:

Biomaterials- Materials in Medicine

(Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TA	EC	EESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

4. Description of classes of biomaterials used in medicine and specific requirements.
5. Understanding of the concept of biocompatibility and the methods for biomaterials testing.
6. Learn how to design, synthesize, evaluate and analyze biomaterials.

Course outcomes:

5. Demonstrate the fundamental of biomaterials.
6. Interpret the bioinformatics.

Contents:

UNIT-I: (7 Hours)

Fundamentals of biomaterial science, concept of biocompatibility, classes of biomaterials used in medicine, basic properties, medical requirements and clinical significance, disinfection and sterilization of biomaterials.

UNIT-II: (8 Hours)

Physico-chemical properties of biomaterials: mechanical (elasticity, yield stress, ductility, toughness, strength, fatigue, hardness, wear resistance), tribological (friction, wear, lubricity), morphology and texture, physical (electrical, optical, magnetic, thermal), chemical and biological properties.

UNIT-III: (7 Hours)

Elements in contact with the surface of a biomaterial: blood composition, plasma proteins, cells, tissues. Phenomena at the bio-interfaces. molecular and cellular processes with living environment, blood-materials interaction, short and long term reactions to the body.

UNIT-IV: (8 Hours)

FDA requirements, standards on the biological evaluation of medical devices (ISO-10993) and implications to applications in human. Practical aspects of biomedical devices: manufacturing, storage quality, regulatory and ethical issues, price of implants and allocation of resources.

Text Books:

1. H.Boenig, Fundamentals of Plasma Chemistry and Tehnology, Technomic Publishing Co.Inc. Lancaster Basel, 1990.
2. Practical Surface Analysis, 2- edition, Edited by D.Briggs, M.P.Seah, J.Wiley & Sons Ltd, 1990.
3. Biomaterials Science, An Intoduction to Materials in medicine, Eds. B. D. Ratner and A. S. Hoffman, Academic Press, New York, 1996.
4. Plasma-surface modification of biomaterials, P.K.Chua, J.Y.Chena, L.P.Wanga, N.Huang, Elsevier Science B.V, 2002.

5. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2004, USA.

Department Elective -2:
Biochemistry & Cell Biology
(Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TA	EC	AE	EE	SE	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

The course should give awareness about the basic molecular mechanisms in a living cell and its main components.

Course outcomes:

- Interpret the general structures of the macromolecules of the cell (protein, nucleic acid, carbohydrate and lipid).
- Describe the different parts of the eukaryotic cell, their cellular functions and the basic energy metabolism.
- Demonstrate the renewal of glucose, fatty acids, amino acids and nucleotides.
- Explain the flow of genetic information in the cell; including replication, transcription and translation and their regulation.

Contents:

UNIT-I: (8 Hours)

Biochemistry Protein structure, enzymology, cellular renewal of glucose, fatty acids, amino acids and nucleotides, basic cell energy metabolism, biological membranes, reactive oxygen forms, methods for isolation and analysis of proteins (lectures). The structure and function of haemoglobin (seminar).

UNIT-II: (7 Hours)

The structure of nucleic acids, function and synthesis. The cell biology central dogma about the information flow in the cell. The

structure of the genome. The gene concept and gene structure.

UNIT -III: (7 Hours)

DNA replication and DNA repair. Genetic recombination. Transcription and its regulation. Translation and its regulation. Basic recombinant DNA techniques.

UNIT -IV: (8 Hours)

The structure and ultrastructure of the cell. Organelles and membrane systems and their structure and function. Cell division: mitosis and meiosis. Intracellular protein sorting and secretion and endocytosis. Cell skeletons and cell motility.

Text Books:

- Champe, Pamela C.; Harvey, Richard A.; Ferrier, Densise R, Biochemistry 4. Ed.: Baltimore, MD: Lippincott Williams & Wilkins, cop. 2008
- Lodish, Harvey F., Molecular cell biology, 7th ed., International ed.: New York: W.H. Freeman, 2012

Department Elective -3:

Bioinformatics: Algorithms and Applications

(Total Hours: 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TA	EC	AE	EE	SE	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

To give students an introduction to the basic practical techniques of bioinformatics.

Course outcomes:

- Illustrate the basic concepts of bioinformatics
- Analyse protein structures and protein sequence
- Explain Finite Volume Method
- Develop algorithms by using machine learning techniques and programming.

Contents:

UNIT -I: (7 Hours)

Introduction, DNA sequence analysis, DNA Databases, Protein structure and function, protein sequence databases, sequence

alignment, PAM matrix, Global and local alignment, BLAST: features and scores.

UNIT –II: (8 Hours)

Multiple sequence alignment, Conservation score, phylogenetic trees. Protein sequence analysis, hydrophobicity profiles, non-redundant datasets. Protein secondary structures, Ramachandran plot, propensity, secondary structure prediction.

UNIT –III: (7 Hours)

Protein tertiary structure, Protein Data Bank, visualization tools, structural classification, contact maps. Protein structural analysis, protein structure prediction, Finite Volume Method (FVM) – I

UNIT-IV: (8 Hours)

Protein stability, energetic contributions, database, stabilizing residues, stability upon mutations, Computer aided drug design, docking, screening, QSAR, Development of algorithms, AWK programming, machine learning techniques, applications using WEKA.

Text Books:

1. M. Michael Gromiha, Protein Bioinformatics: From Sequence to Function, Academic Press, 2010
2. D.E. Krane and M.L. Raymer, Fundamental concepts of bioinformatics, Pearson Education Inc. 2006

Department Elective -4:

Brain Machine Interface

(Total Hours 30)

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credi	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

4. To introduce the basic concepts of brain computer interface.
5. To study the various signal acquisition methods.
6. To study the signal processing methods used in BCI.

Course outcomes:

5. Demonstrate the basics concept in the field of brain sensing for human-computer interaction research.

6. Make use of the various tools used in brain sensing.
7. Illustrate the steps required to use real-time brain sensing data as input to an interactive system.
8. Make use of the required features and classify the signal for applications.

Contents:

Unit I: Introduction to Brain Machine Interface (8 Hours)

Fundamentals, structure and classification of brain machine interface system, Non-invasive and Partially Invasive Brain signal acquisition, Signal Pre-processing, artefacts removal.

Unit –II: Electrophysiological Sources (8 Hours)

Sensorimotor, Neuronal activity in motor cortex and related areas, Electric and magnetic fields produced by the brain, signals reflecting brain metabolic activity, Mu rhythm, Movement Related Potentials, Slow Cortical Potentials, P300 Event related potential, Visual Evoked Potential, Activity of Neural Cells, Multiple Neuro-mechanisms

Unit –III: Feature Extraction Methods (7 Hours)

Time/Space Methods – Fourier Transform, Wavelets, Auto-regressive, Moving average, AR-MA models, Bandpass filtering, Template matching, Kalman filter, PCA, Laplacian filter – Linear and Non-Linear Features

Unit –IV: Feature Translation Methods (7 Hours)

Linear Discriminant Analysis – Nearest neighbours, Support Vector Machines, Regression, Learning Vector Quantization, Gaussian Mixture Modeling, Hidden Markov Modeling, Neural Networks.

Text Books:

4. Jonathan Wolpaw, Elizabeth Winter Wolpaw, 'Brain Computer Interfaces: Principles and practice', Edition 1, Oxford University Press, USA, January 2012.
5. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010
6. Wolpaw J.R, N.Birbaumer et al, "Brain control interface for

Communication and control”, Clinical Neurophysiology, 113, 2002.

**Department Elective -5:
Physics and instrumentation in medical
imaging (Total Hours 30)**

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

Course Objectives:

3. To understand the physics behind different instruments in medical imaging
4. To learn how to design a simple review paper

Course Outcomes:

5. Demonstrate the basics concept and physics behind of X-ray technique
6. Illustrate the importance of nuclear magnetic resonance in MRI
7. Explain the concept of generation of ultrasound
8. Design a term paper on one of the given topics

Contents:

Unit -I: Planar X-rays (8 Hours)

Electromagnetic radiation, generation and characteristics of x-rays, x-ray tubes, interaction of x-rays with tissues.

Unit -II: Magnetic Resonance Imaging (MRI) (9 Hours)

Concept of spin and nuclear magnetic resonance, spin decay through interaction with tissues, use of different magnets in MRI systems, one or two simple imaging sequences.

UNIT –III: Ultrasound (9 Hours)

Characteristics of sound waves, piezoelectricity and generation of ultrasound, interaction of ultrasound with tissues, Doppler effect and its uses.

UNIT –IV: Term Paper (4 Hours)

Write a term paper on one of the given topics.

Text Books:

3. William R. Hendee and E. Russell Ritenour, Medical Imaging Physics, Wiley-Liss, 4th edition, 2002
4. Nadine Barrie Smith and Andrew Webb, Introduction to Medical Imaging: Physics, Engineering and Clinical Applications, Cambridge University Press, 1st edition, 2011

**Department Elective -6:
Neuromorphic Computing
(Total Hours: 30)**

Teaching Scheme					Evaluation Scheme					
Th.	Tu	Pr.	Total Hours	Credit	Theory			Practical		Total Marks
					TAE	CAE	ESE	Int.	Ext.	
2	-	-	2	2	10	15	25	-	-	50

Course objectives:

To introduce a number of mathematical and computational concepts and techniques that can be used for the mathematical modelling of the real world problem.

Course outcomes:

5. Demonstrate the basics concept in the field neuromorphic computing.
6. Illustrate the organization of nervous system and neuroanatomy.
7. Demonstrate the biophysical models of single neuron and simplified neural models.
8. Make use of the various models based on the neural networks to solve the real world problems.

Contents:

UNIT -1: (6 Hours)

Linear algebra – eigenvalues and eigenvectors for symmetric matrices. Quadratic forms, solving a system of linear equations, Dynamical systems - types of fixed pts, bifurcation map in terms of trace and determinant. Dynamical systems - types of fixed pts, bifurcation map in terms of trace and determinant.

UNIT -2: (8 Hours)

Neuron - axons, dendrites etc, the four components of Neural Signalling. Neurotransmission: neurotransmitter, receptor, ion channel, channel gating. Electrophysiology

- Nernst potential, resting potential, Goldman-Hodgkin-Katz voltage equation, outline of the Hodgkin-Huxley model. Modeling ion channel kinetics, activation and inactivation gates. Complete formulation of Hodgkin-Huxley model. Relation between output firing and constant input current. Discussion of regimes.

UNIT -3: (8 Hours)

Derivation of the cable equation - defining axial, radial resistance and membrane capacitance, defining quantities in terms of per unit length. Steady state Solution for Infinite cable and semi-infinite cable. Solution for Finite cable: sealed end, killed end and arbitrary boundary conditions. Time-dependent solution for impulse input. Propagation delay, pseudo-velocity. Relation between cable diameter and conduction velocity. Branched cables and Rall's condition. Modeling synaptic transmission.

UNIT -4: (7 Hours)

Fitzhugh-Nagumo neuron model - phase-plane analysis, showing excitability, bistability and oscillations. Integrate and fire neuron, resonate and fire neuron, Izhikevich models. Classical conditioning and instrumental condition. Sensitization, habituation and priming, Cellular correlates of learning. Hebbian learning, Long-term Potentiation (LTP) and Long-term Depression (LTD).

Text Books:

- Peter Dayan & LF Abbot, Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, MIT Press. ISBN 0-262-04199-5.
- Patricia Churcland & Terence Sejnowski, Computational Brain, MIT Press.
- Christof Koch, Biophysics of computation: information processing in single neurons, Oxford University Press, 2005
- Eric Kandel, James Thomas Schwartz, Jessel, Principles of Neural Science, 4th ed. McGraw-Hill, New York.

10. Computational neuroscience: a comprehensive approach, Edited by J. Feng, Chapman & Hall/CRC, 2004.

11. Randall C. O'Reilly, Yuko Munakata, Computational explorations in cognitive neuroscience: understanding the mind, MIT Press, 2000.

DEPARTMENTAL ELECTIVE 1: **OPERATING SYSTEMS:**

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I nt	E xt	
2	-	2	4	3	10	15	25	10	15	75

Mode of exam: Paper and pen-Offline

Course Objective:

- Introduces general idea, structure and functions of operating system
- Making students aware of basic mechanisms used to handle processes, memory, storage devices and files.

Course Outcome:

- Identify basic structure and purpose of operating system.
- Interpret the concepts of process and illustrate various CPU scheduling algorithms.
- Interpret the concepts of inter process communication.
- Schematize Deadlock & security mechanisms in operating systems.
- Analyze different memory management techniques with advantages and disadvantages.

CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	P02	P03	P04	P05	PSO1	PSO2
CO1	2	-	1	3	-	1
CO2	2	-	3	-	2	2
CO3	3	3	-	-	2	3
CO4	3	-	2	-	2	2

Contents

Unit-I

(8 hrs)

Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system

programs and system calls, system design and implementation.

Unit-II (8 hrs)

Process & Its Scheduling : Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms,

Unit-III (7 hrs)

Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems

Unit-IV (7 hrs)

Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation

TEXT BOOKS :

1. Operating System concepts – Silberchatz& Galvin, Addison Wesley, 6th Edn.
2. Modern Operating Systems – Tanenbaum, Pearson Edn. 2nd edn.

REFERENCE BOOKS :

1. Operating Systems – S R Sathe, Macmillan Publishers, India, 2008
2. Operating System – Milan Milenkovic, McGraw-Hill, 1987
3. Operating Systems - 3rd Edition by Gary Nutt, Pearson Education.

DEPARTMENTAL ELECTIVE 2: BIG DATA & HADOOP:

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I nt	E xt	
1	-	2	3	2	10	15	25	10	15	75

Mode of exam: Paper and pen-Offline

Course Objective:

4. Understand the various parts of Hadoop condition, for instance, Hadoop 2.7, Impala, Yarn, MapReduce, Pig, Hive, HBase, Sqoop, Flume, and Apache Spark
5. Learn Hadoop Distributed File System (HDFS) and YARN building, and make sense of how to function with them for limit and resource organization

6. understand MapReduce and its qualities and retain advanced MapReduce thoughts.

Course Outcome:

1. Interpret basic concepts and techniques of Hadoop ecosystem and Big data.
2. Design different component of Hadoop ecosystem.
3. Interpret the domain of data science and analysis of big data
4. Gain experience of doing independent study and research through case studies.

CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	PO 2	PO3	PO 4	PO 5	PSO 1	PSO 2
CO1	1	1	1	1	1	1
CO2	1	1	2	1	1	2
CO3	2	1	2	2	1	1
CO4	1	1	1	1	1	1

Contents

Unit-I: (Mapped CO1) (8 hrs)

Introduction to Hadoop and Big Data, Big data, challenges for processing big data, technologies support big data, History of Hadoop, Use cases of Hadoop, RDBMS vs Hadoop When to use and when not to use Hadoop.

Unit-II: (Mapped CO2) (8 hrs)

Hadoop Distributed File System, Significance of HDFS in Hadoop, Features of HDFS, Data Storage in HDFS :Introduction about Blocks, Data replication. Accessing HDFS:CLI (Command Line Interface) and admin commands, Java Based Approach, Fault tolerance. Download Hadoop, Installation and set-up of Hadoop, Start-up & Shut down process.

Unit-III: (Mapped CO3) (7 hrs)

Map Reduce: Map Reduce Story, Map Reduce Architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Different phases of Map

Reduce Algorithm, Different Data types in Map Reduce

Unit-IV: (Mapped CO4) (7 hrs)

PIG: Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Execution in Pig, Loading data, Exploring Pig Latin commands,

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 3rd edition, O'Reilly Media.
2. Big Data (Black Book), Wiley
3. V. Prajapati, "Big Data Analytics with R and Hadoop", PacktPub.

Reference Books:

1. V. Ankam, Big Data Analytics, Packt Pub Ltd.
2. N. Dasgupta, Practical Big Data Analytics, Packt Pub Ltd.

DEPARTMENTAL ELECTIVE 3: DATA STRUCTURE & ALGORITHMS:

Teaching Scheme				Credits		Continuous Evaluation Scheme					
					Theory				Practical		Total
Th.	Tu	Pr.	Total Hours		TA	CA	ES	Exam Mode	Int	Ext	
2	-	2	4	3	10	15	25	Online	10	15	75

Mode of exam: Paper and pen-Offline

Course Objective:

1. This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
2. It's also aimed at developing skill to implement methods to solve specific problems using basic data structures.
3. The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.

Course Outcome:

1. Describe data structures and understand when it is appropriate to use.
2. Infer algorithms for data searching and sorting.
3. Make use of linear and nonlinear data structures to solve various real world computing problems.
4. Inspecting to Relate use of Abstract data types & ways in which they can be stored, accessed and manipulated.

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	3	2	3	1	-
CO2	2	3	3	2	-
CO3	3	3	3	2	1
CO4	3	3	3	3	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Arrays & Pointers

Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Multidimensional Arrays, Pointers; Pointer Arrays, Dynamic Memory Management.

Unit-II: (Mapped CO2) (8 hrs)

Sorting and Searching

Introduction: Sorting; Bubble Sort, Insertion Sort, Selection Sort, Merging, Searching; Linear Search, Binary Search.

Unit-III: (Mapped CO3) (7 hrs)

Linked List

Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation and Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Circularly Linked Lists, Doubly Linked Lists.

Unit-IV: (Mapped CO4) (7 hrs)

Stacks, Queue and Recursion

Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Application of Stacks, Recursion, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques and Applications of Queues.

Text Books:

1. AVAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
2. THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.

Reference Books:

1. Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman, Person.

2. MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)

**DEPARTMENTAL ELECTIVE 4:
INFORMATION SECURITY & CRYPTO
CURRENCY:**

Teaching Scheme					Credits	Continuous Evaluation Scheme					
				Theory			Practical		Total		
Th	Tu	P	Total Hours	TA		CA	EE	Int		Ext	
2	-	2	4	3	10	15	25	10	15	75	

Mode of exam: Paper and pen-Offline

Course Objectives:

1. This course covers the fundamentals of computer systems security.
2. It introduces many different areas of security such as encryption, malicious code, authentication and access control, trusted computer systems, operating system and network security.
3. The objective of this course is to provide students with a comprehensive overview of the threats to computer security, technologies for security assurance, and engineering approaches to security solutions.
4. Create an ability to understand and use various open source security tools to improve personal information security & network security.

Course Outcomes:

1. Use the fundamentals of Cryptography and standard algorithms to provide confidentiality, integrity and authenticity.
2. Use symmetric and asymmetric key encryption systems
3. Analyze various message authentication codes and hash functions.
4. Analyze detection and prevention of various attacks

CO Mapping with PO and PSO

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	1	2	1	1	-

CO2	2	1	2	2	-
CO3	1	2	1	-	1
CO4	1	2	2	-	2

Contents:

Unit-I: (Mapped CO1) (8 hrs)

Introduction: Introduction to information and network security, Attacks, services, mechanisms, security attacks, security services, a model for internet work security, encryption model, steganography, classical encryption techniques, modern techniques - simplified DES, block cipher principles, data encryption standard, strength of DES, block cipher design principles, block cipher modes of operation.

(CO2) (7 hrs)

Confidentiality and Key Management: Confidentiality using conventional encryption: placement of encryption function, random number generation. Public key cryptography: principles, RSA algorithm, key management, diffie-hellman key exchange, elliptic curve cryptography, Chinese remainder theorem, Euclidean algorithm, extended Euclidean algorithm, discrete logarithms, primality testing, Chinese remainder theorem, finite fields.

Unit-III: (Mapped CO3) (8 hrs)

Authentication requirements, functions, codes, security of hash function & MACs. Hash & Mac algorithms. Messages digest, Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions. Digital signatures & authentication protocols, Elgamal digital signature algorithm, digital signature standard.

Unit-III: (Mapped CO4) (8 hrs)

Network Security: Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec. Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.

Books:

1. Cryptography and networks security principles & practice by William Stallings (Pearson Education prentice Hall).
2. Networks security Essentials Applications & standards by William Stallings (Pearson Education, LPP).
3. Cryptography in C and C++ by Michael Welschenbach (A press IDG Books India).

4. Introduction to Data Compression by Khalid Sayood (Morgan kaufmann/Harcourt India).

Reference Books

1. Information Security: The Complete Reference, Second Edition 2nd Edition by Mark Rhodes-Ousley ISBN-13:978-0071784351 ,ISBN-10:0071784357
2. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
3. Cryptography and Network Security : Forouzan Mukhopadhyay, McGraw Hill, 3rd Edition

DEPARTMENTAL ELECTIVE 5: ADVANCED NETWORKS

Teaching Scheme				Credits	Continuous Evaluation Scheme					
Th.	Tu	Pr.	Total Hours		Theory			Practical		Total
					TA	CA	EE	Int	Ext	
1	-	4	5	3	10	15		10	15	50

Mode of exam: Paper and pen: Offline

CO mapping with PO and PSO

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	1	1	-
CO2	2	1	2	2	-
CO3	1	3	1	2	1
CO4	1	2	2	1	2

Course Objectives:

4. To learn about Software Defined Networking.
5. To understand an emerging Internet architectural framework, including the main concepts, architectures, algorithms, protocols and applications
6. To be able to implement Network virtualization framework.

Course Outcomes:

7. Design a network with appropriate protocols selected according to requirement.

8. Analyze different routing protocols and traffic engineering methods deployed in networking.
9. Interpret the concept of SDN (i.e. abstracting and centralizing the control plane).
10. Analyze the implications of shifting from traditional network architectures to software defined networks.
11. Apply and analyze network functions virtualization.
12. Implement a network service using the knowledge acquired throughout the lectures.

Contents

Unit-I: (Mapped CO1) (8 hrs)

Routing in Packet Networks

Circuit Switching and Packet Switching, Types of Routing Protocols: Interior and Exterior Gateway protocols, Adaptive and Non-adaptive Routing Algorithms, Traffic Management at packet level, Traffic management at flow level.

Unit-II: (Mapped CO2) (8 hrs)

Introduction to Software Defined Networking (SDN)

Evolution of Switches and Control Planes, Centralized and Distributed Control and Data Planes Concepts, Advantages and Disadvantages, Open Flow protocol. SDN Controller: General Concepts, Layer 3 Centric, PLEXI, Cisco OnePK, Network Programmability

Unit-III: (Mapped CO3) (6 hrs)

Data Center Concepts and Constructs

Technologies for the Data Center, The Multitenant Data Center, The Virtualized Multitenant Data Center, SDN Solutions for the Data Center Network, VLANs, EVPN, VxLan, NVGRE Network Topology and Topological Information Abstraction: Introduction, Network Topology, Traditional Methods, LLDP, BGP-TE/LS, ALTO, I2RS Topology

Unit-IV: (Mapped CO3) (8 hrs)

Building an SDN Framework: Introduction

The Juniper SDN Framework IETF SDN Framework(s) Open Daylight Controller/Framework Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring, Use Cases for Input Traffic Monitoring, Classification, and Triggered Actions, Firewalls as a Service, Network Access Control Replacement, Extending the Use Case with a Virtual Firewall, Feedback

and Optimization ,Intrusion Detection/Threat Mitigation

Textbooks

- SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.
- Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844

References Books:

- SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.
- Network Innovation through Open Flow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
- Open Networking Foundation (ONF) Documents, <https://www.opennetworking.org>, 2015.
- Open Flow standards, <http://www.openflow.org>, 2015.
- Online Reading Lists, including: <http://www.nec-labs.com/~lume/sdn-reading-list.html>, 2015.

DEPARTMENTAL ELECTIVE 6: BLOCKCHAIN TECHNOLOGY

(Total hours – 30)

Teaching Scheme				Credits		Continuous Evaluation Scheme					
					Theory			Practical		Total	
Th.	Tu	Pr.	Total Hours		TA	CA	SE	Exam Mode	Int		Ext
2	-	2	4	3	10	15	25	Online	10	15	75

Mode of exam: Offline

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	1	1	1
CO2	2	2	3	1	1
CO3	1	1	1	2	1
CO4	1	1	2	3	2

Course Objective:

- To understand the concept of blockchain.
- To be able to implement blockchain in security and other applications

Course Outcomes:

- Demonstrate Basic Cryptographic primitives used in Blockchain
- Illustrate hyperledger fabric in blockchain
- Experiment with different applications of blockchain
- Apply blockchain for research in AI, Big Data

Contents

UNIT –I: (8 Hours)

Introduction to Blockchain, Crypto Primitives and Bitcoin, Consensus algorithms and their scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

UNIT –II: (8 Hours)

Permissioned Blockchain, Hyperledger Fabric, Fabric Demo, Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

UNIT –III: (7 Hours)

Blockchain Use Cases – Finance, Blockchain Use Cases – Industry, Blockchain in Government and Blockchain Security

UNIT –IV: (7 Hours)

Security and Research Aspects, Research Aspects in Blockchain, AI and Blockchain and Big Data

Text Books:

- Draft version of “S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, ‘Blockchain Technology: Cryptocurrency and Applications’, Oxford University Press, 2019.
- Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.



G H RAISONI COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Institute Vision

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and create technical manpower of global standards with capabilities of accepting new challenges.

Institute Mission

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stakeholders. Our strength is directed to create competent professionals. Our endeavor is to provide all possible support to promote research and development activities.

Programme:

UG in Computer Science & Engineering

Vision and Mission:

DEPARTMENT VISION

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards in Computer Science Engineering with capabilities of accepting new challenges

DEPARTMENT MISSION

- To develop professionals who are competent in the design, analysis and implementation of computational systems.
- To impart quality and value based education and contribute towards the advancement of computing, science and technology to raise satisfaction level of all stakeholders.
- Our endeavor is to apply new developments in computational hardware and software.

Program Education Objectives:

The program Educational Objectives of the Computer Science & Engineering programme are designed to produce competent engineers who are ready to contribute effectively to the advancement of Computer Science & Engineering causes and to accommodate the needs of the profession. The graduates shall:

1. Apply analysis, design, optimization and implementation skills in order to formulate and solve Computer Science and Engineering and multidisciplinary problems
2. Take up higher studies, research & development and other creative efforts in science & technology.
3. Use their skills in ethical & professional manner to raise the satisfaction level of stakeholders.

Program Outcomes:

The programme is targeted at developing the following competencies, skills and abilities amongst students. They shall be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO 1:

Apply the skills in the areas of Networks & Cyber Security ,Cloud Computing , Smart Systems & in the multi disciplinary area of Computer Science Engineering .

PSO 2:

Demonstrate engineering practice learned through industry internship to solve live problems in various domains. software applications for problem solving .

B.TECH. COMPUTER SCIENCE AND ENGINEERING

B.TECH. FIRST YEAR SCHEME (COMPUTER SCIENCE & ENGINEERING) SEMESTER- I

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.	
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	--	50
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25
BECL101 BECP101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25
TOTAL		9	4	16	29	21	90	135	175	200	600

SEMESTER- II

BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75
BECL102 BECP102	Analog Circuits	1	1	2	4	3	10	15	25	25	75
BECP103	Embedded Programming	-	-	2	2	1	--	--	--	25	25
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100
BHUP102	Ethics & Professional Competencies	-	-	2	2	1	--	--	--	25	25
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25
TOTAL		4	5	26	35	22	50	75	125	350	600

SEMESTER III													
Course Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Continuous Evaluation Scheme					
								Theory			Practical		Total
			Th.	Tu	Pr.	Total Hour		TAE	CAE	ESE	Int	Ext	
BFYL141	Mathematics-V (Discrete Mathematics)	Offline	1	1	-	2	2	10	15	25	-	-	50
BCSL203/ BCSP203	Data Structures and Algorithms	Online Moodle	2	-	2	4	3	10	15	25	10	15	75
BECL320/ BECP320	Hardware Description Language	Offline	1	-	2	3	2	10	15	25	10	15	75
BCSP205	Object Oriented Programming	Online Moodle	-	-	4	4	2	-	-	-	25	25	50
BCSL207	Problem Identification & Design Thinking	Activity Based	1	-	-	1	1	10	15	-	-	-	25
BCSL208/ BCSP208	Database Management Systems	Online Moodle	2	-	2	4	3	10	15	25	10	15	75
BCSL209	Software Engineering & Project Management	Activity Based	1	1	-	2	2	10	15	25	-	-	50
BAIP201	Foundation Course In Machine Learning	Practical Based	-	-	2	2	1	-	-	-	25	25	50
BAIP202	Skill Development-1 (Linear Algebra)	Practical Based	0	-	2	2	1	-	-	-	25	-	25
BHUP202	Reasoning	Online	-	-	1	1	0.5	-	-	-	25	-	25
BHUP203	Quant		-	-	1	1	0.5	-	-	-	25	-	25
BHUP204	Liberal arts	Offline	-	-	1	1	0.5	-	-	-	25	-	25
BHUP205	Business English Certification	Online	-	-	4	4	2	-	-	-	50	-	50
BHUP206	Aptitude 1	Online	-	-	1	1	0.5	-	-	-	25	-	25
Total			8	2	22	32	21	60	90	125	255	95	625

SEMESTER IV													
BFYL142	Mathematics-VI (Graph Theory and Number System)	Online	1	1	-	2	2	10	15	25	-	-	50
BCSL211/ BCSP211	Operating Systems	Activity Based	2	-	2	4	3	10	15	25	10	15	75
BCSL212	Formal languages and Automata	Offline	2	1	-	3	3	10	15	50		-	75
BCSP213	Java Programming	Online Moodle	-	-	4	4	2	-	-	-	25	25	50
BCSP214	Principles in Programming Languages	Online Moodle	-	-	2	2	1	-	-	-	25	25	50
BCSL215/ BCSP215	Big Data	Online	1	-	2	3	2	10	15	25	10	15	75
BCSL216	Software Architecture and Web Services	Activity Based	2	-	-	2	1	10	15	25	-	-	50
BAIL203	Machine Learning Algorithms	Activity Based	2	-	-	2	2	10	15	25			50
BCSLXXX	Open elective-1		2	-	-	2	2	10	15	25			50
BCSP219	Mini Project & Technical Report Writing	Online	-	-	2	2	2	-	-	-	50	-	50
BMBP102	Entrepreneurship Development	Offline	-	-	2	2	1	-	-	-	25	-	25
BHUP207	Soft Employability Skills	Viva-Voce	-	-	1	1	0.5	-	-	-	25	-	25
Total			12	2	15	29	21.5	70	105	200	170	80	625

SEMESTER V

Course Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Continuous Evaluation Scheme					
			Th.	Tu	Pr.	Total Hour		Theory			Practical		Total
								TAE	CAE	ESE	Int	Ext	
BFYL143	Mathematics-VII (Integral Transforms)	Online	1	-	-	1	1	10	15	25	-	-	50
BCSL316/BCSP316	Design & Analysis of Algorithms	Online	2	-	2	4	3	10	15	25	10	15	75
BCSL309/BCSP309	Compiler Design	Offline	2	-	2	4	3	10	15	25	10	15	75
BCSL317/BCSP317	Data Communication and Networks	Offline	2	-	2	4	3	10	15	25	10	15	75
BCSL315/BCSP315	Cloud Computing	Activity Based	1	-	2	3	2	10	15	25	10	15	75
MBL104	Advanced Communication Skills	Activity based	-	-	4	4	2	-	-	-	50	-	50
BCSP318	Skill Development-3	Online	-	-	2	2	1	-	-	-	25	-	25
BHUP302	Aptitude 2	online	-	-	1	1	0.5				25	-	25
BCSP319	Internship & Technical Report Writing	Activity based	-	-	2	2	1	-	-	-	25	50	75
MBP301	Financial Management for Engineers	Activity based	-	-	1	1	0.5		-	-	25	-	25
XXXX	Elective 1(Humanities)	Activity based	2	-		2	2	10	15	25	-	-	50
XXXX	Elective 2(Science)	offline	2	-		2	2	10	15	25	-	-	50
Total			12	0	18	30	21	70	105	175	190	110	650

SEMESTER VI

BFYL144	Mathematics-VIII (Probability & Statistics)	Online/ Moodle	1	-	-	1	1	10	15	25	-	-	50
BECL218/ BEC218	Embedded Systems Design	Online Activity based	2	-	2	4	3	10	15	25	25	25	100
BCSL320/ BCSP320	Information Security & Cryptography	Offline Moodle	2	-	2	4	3	10	15	25	10	15	75
BCSL321/ BCSP321	Advanced Networks	Offline	1	-	4	5	3	10	15		10	15	50
MBP319	Product Development & IPR		-	-	2	2	1	-	-	-	25	-	25
BHUP303	Aptitude 3	Online	-	-	1	1	0.5	-	-	-	25	-	25
BCSLXXX	Open Elective 2		2	-	-	2	2	10	15	25	-	-	50
BCSP322	Skill Development-4	Online	-	-	2	2	1	-	-	-	25	-	25
BHUP304	Career Development Practice	Activity Based	-	-	2	2	1	-	-	-	25	-	25
BCSLXXX	Elective 3		2	-	-	2	2	10	15	25	-	-	50
BCSLXXX	Elective 4		2	-	-	2	2	10	15	25	-	-	50
Total			12	0	15	27	19.5	70	105	150	145	55	525

SEMESTER VII												
Course Code	Name of the Course	Teaching Scheme				Cr edi ts	Continuous Evaluation Scheme					
		Th.	Tu	Pr .	Total Hours		Theory			Practical		Total
							TAE	CAE	ESE	Int	Ext	
XXXLXXX	Elective 5	2	-	-	2	2	10	15	25			50
XXXLXXX	Elective 6	2	-	-	2	2	10	15	25			50
XXXLXXX	Elective 7	2	-	-	2	2	10	15	25	-	-	50
XXXLXXX	Elective 8	2	-	-	2	2	10	15	25	-	-	50
XXXLXXX	Elective 9	2	-	-	2	2	10	15	25	-	-	50
BCSP428	Project Phase I	-	-	4	4	4	-	-	-	75	50	125
BCSP432	MOOCs-1	-	-	2	2	2	-	-	-	50	-	50
Total		10	0	6	16	16	50	75	125	125	50	425
SEMESTER VIII												
BCSP430	6 Month Internship	-	-	12	12	12	-	-	-	150	150	300
BCSP433	Project Phase 2	-	-	4	4	4	-	-	-	50	50	100
BCSL432	MOOCs-2	2	-		2	2	-	-	-	50	-	50
	Total	2	-	16	18	18	10	15	25	250	200	450
		First Year Credits				43	First Year Marks					1200
		Total Credits SE-BE				117	Total Marks SE-BE					3300
		Grand Total Credits				160	Grand Total Marks					4500

ELECTIVE : I BCSL312- COMPUTER GRAPHICS AND VISUALISATION BCSL414- DATA MINING AND WAREHOUSING BITL301- JAVA PROGRAMMING BITL408- DISTRIBUTED DATABASES AND OBJECT ORIENTED DATABASES
ELECTIVE II : BCSL403- AI AND EXPERT SYSTEMS BCSL407- ADVANCED COMPUTER ARCHITECTURE BCSL419- Digital Marketing BCSL427- Data Analytics BECL405- DIGITAL SIGNAL PROCESSING BECL413 - WIRELESS COMMUNICATION BECL423 - PATTERN RECOGNITION BCSL432 – Automation with AI BSCL434 –Artificial Natural Network BCSL436 – AI in Speech Processing
ELECTIVE III : BCSL410 - SOFT COMPUTING BCSL412 – SOFTWARE ARCHITECTURE BCSL416 - MACHINE LEARNING BCSL420 – Entrepreneurship BCSL421 - Blockchain Technology BECL428 - WIRELESS SENSOR NETWORK BITL307 - SCRIPTING LANGUAGES BCSL438 – Applications of AI in Bio Medical BCSL439 –Applications of AI in Civil Engineering
ELECTIVE IV : BECL425 - REAL TIME OPERATING SYSTEM BECL409 - DIGITAL IMAGE PROCESSING BITL407 - ADVANCED WEB TECHNOLOGIES BITL410 - SOFTWARE TESTING BCSL310- MOBILE COMPUTING BCSL415 -CLOUD COMPUTING BCSL422 - Big Data and Hadoop BCSL435 - AI in Video Processing BCSL440 – Applications of AI in Industry 4.0
ELECTIVE-V BITL309 - CYBER LAWS BCSL311 - E-COMMERCE BITL411 - ENTERPRISE RESOURCE PLANNING BCSL417 - BIO INFORMATICS BCSL423 - Artificial Intelligence and Machine Learning BCSL433 – AI in AgriTech BCSL437 – Applications of AI Financial Sector BCSL441 – Applications of AI Embedded System

SEMESTER-III

BFYL141 MATHEMATICS-V (DISCRETE MATHEMATICS) (Offline)

Teaching Scheme				Credits			Evaluation Scheme						
					Theory						Practical		Total
Th.	Tu	Pr.	Total		TAE	CAE	ESE	Exam Mode	Int.		Ext.		
1	1	0	2	2	10	15	25				50		

Course Objectives :

1. This course introduces size and kind of objects.
2. It also skills to analyze objects meeting the criteria, finding "largest", "smallest", or "optimal" objects.
3. It also introduces combinatorial structures and apply algebraic techniques to combinatorial problems.

Course Outcomes :

Upon successful completion of the course, students will be able to:

1. Apply concept of Set theory.
2. Understand and use concepts of Groups and Rings
3. Apply the concepts of Lattices and Boolean algebra in computer science engg.

Unit –I: Set Theory (10 hrs)

Operations on sets, Laws of algebra of sets, Representation of sets on computer in terms of 0's & 1's. Partition & covering of a set, ordered pair, Product set, Relation–Different types of relations, Graph of relation, Matrix of relation, Transitive closure of relation, Properties of relations, Compatible relation. Functions, Partial ordering & partially ordered set, Hasse diagram of Poset, Totally ordered set, Peano axioms & Mathematical Induction.

Unit –II: Group and Rings (12 hrs)

Algebra or Algebraic systems like semigroup, monoid, and examples. Homomorphism, Isomorphism of semigroup & monoid. Groups, properties of algebraic groups. Permutations groups, Subgroups, Cosets, Lagrange's theorem, properties of cyclic groups, generator of group, Homomorphism, quotient group. Rings, Fields and Integral domain

Unit -III: Lattices and Boolean algebra (8 hrs)

Lattice as Poset & as algebraic system, Types of lattices, Hasse diagrams, Sublattice, direct product of Lattices Lattice Homomorphism, complement of elements of lattices, Various lattices, composition tables, Lattice B_n . Boolean algebra; Boolean Expressions, Equivalence of Boolean Expression by tables, Simplification of circuit & equivalent circuit by truth tables.

Recommended Reference Books:

1. Discrete mathematical structure with application to computer science; Trembley & Manohar; Mc. Graw Hill, 2011
2. Discrete Mathematical Structure ; Busby & Ross ; PHI, 2009
3. Discrete Mathematics ; John Truss ; Addison Wesley

BECL207/BECP201 HARDWARE DESCRIPTION LANGUAGE(Offline)

Scheme of the Course:										
Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Theory	Tutorial	Practical	Total Hours		TA E	CA E	ES E	Int .	Ext.	
1	-	2	3	2	10	15	25	10	15	75

Course Objectives:

1. Apply Boolean algebra and other techniques to express and simplify logic expressions.
2. Analyze and design combinational and sequential digital systems.
3. Use different techniques among them a hardware description language and a programming language, to design digital systems.

Course Outcomes

- CO1. Student shall be able to Conceptualize of digital systems and the use of Boolean algebra in logic analysis and design
- CO2. Understanding of RTL design and verification techniques and methodologies
- CO3. Understand the principles and methodology of digital logic design at the gate and switch level, including both combinational and sequential logic elements.
- CO4. introduce basic tools of logic design and provide hands-on experience designing digital circuits
- CO5. appreciate the uses and capabilities of a modern FPGA platform

Course Contents:

Unit 1. Introduction to Hardware Description Languages:

Combinational Logic, Structural Modeling, Sequential Logic, More Combinational Logic, Parameterized Modules, Test benches

Unit 2.

Sequential circuit Sequential circuit: Latches and flip-flops, counters, shift register, Finite state machine; representation and synthesis.

Unit 3.

FPGA architecture and synthesis Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation

Unit 4.

Semiconductor memories, PALs, PLAs and FPGAs; Pipelining and timing issues, PROMs (DRAMs, Flash memory etc.)

Text Books :

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog	Douglas Smith	Doone publications	1998	1st
2	Verilog HDL, A guide to Digital Design and Synthesis	Samir Palnitkar	Prentice Hall		1st

Reference Books:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	FPGA based Prototyping Methodology Manual	Doug Amos, Austin Lesea, Rene Richter	Synopsis Press		
2	Introduction to Reconfigurable Computing, Architectures, Algorithms	Christophe Bobda	Springer Netherlands.		
3	Writing Testbenches: Functional Verification of HDL Model	Janick Bergeron	Springer	2003	2nd

BCSP210 ELECTIVE V-ARTIFICIAL INTELLIGENCE (Online)

Teaching Scheme				Credit S	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th .	T u	Pr .	Total Hour s		TA E	CA E	ES E	In t	Ex t	
-	-	2	2	1	-	-	-	25	25	50

Course Objectives:

- Be able to formulate machine learning problems corresponding to different applications.
- Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes: Upon completion of the course students shall be able to:

- 1. Recall the basic concepts and techniques of artificial Intelligence
- 2. Classify machine learning algorithms to solve real time problems of moderate complexity.
- 3. Gain experience of doing independent study and research through case studies.

Unit I: Artificial Neural Networks

Introduction to Artificial Intelligence, Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing, The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptron, Backpropagation Algorithm

Unit II: Probability & Statistical Analysis

Introduction to Bayesian Function, Mean, Median & Mode, Linear Regression, Multiple Regression, Logistic Regression, Normal Distribution, Binomial Distribution, Poisson Regression, Analysis of Covariance, Time Series Analysis, Nonlinear Least Square, Decision Tree, Random Forest, Survival Analysis, Chi Square Tests

UNIT III: Case Study of Artificial Intelligence using Nvidia.

Text Books:

1. *Introduction to machine learning*, Ethem Alpaydin. — 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
2. *Introduction to artificial neural systems*, J. Zurada, St. Paul: West.
3. *R in a Nutshell*, 2nd Edition - O'Reilly Media.

Reference Books:

1. *Machine Learning*, Tom M Mitchell.
2. *The Elements of Statistical Learning*, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

Resource Persons

Mr. Vivek Patole,
Head Product Engineering & Development at Iknowlation, Research Labs Pvt. Ltd, Pune

Prof. Sudeshna Sarkar
Head of the Centre
Contact (Head)
Phone: +91-3222-282256
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Anupam Basu

Professor

PhD (IIT Kharagpur)
Joined Institute in 1984
Phone: 283462(o), 283463(r)
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Free Courses:

Sr. No.	Artificial Intelligence course name	Offered by
1	Artificial Intelligence	EDX
2	Intro to Artificial Intelligence	Udacity's
3	Artificial Intelligence: Principles and Techniques	Stanford university
4	Artificial Intelligence for Robotics by	Georgia Tech Udacity

BCSL208/BCSP208 Database Management System (Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme						
					Theory			Exam Mode	Practical		Total
Th.	Tu	Pr.	Total Hours		TA	CA	EE		Int	Ext	
2	-	2	4	3	10	15	25	Online	10	15	75

Course Objective:

- This course introduces general idea of database management system.
- It is aimed at developing skills to design databases using data modeling and design techniques.
- It is also aimed to developing skills to implement real life applications which involve database handling.
- This course also provide carrier opportunities in subject areas of designing, storage techniques and data handling and managing techniques

Course Outcome: Upon successful completion of the course, students shall be able to-

- CO1: Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms and design appropriate data model for it.
- CO2: Demonstrate an understanding of various normalization forms and apply knowledge of normalization for creation of database.

- CO3: Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database and perform inferential analysis of data model
- CO4: Demonstrate query processing and able to design optimized query execution plan.
- CO5: Perform basic transaction processing and management and ensure database security, integrity and concurrency control
- CO6: Demonstrate the management of structured and unstructured data management with recent tools and technologies

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes				Programme Specific Outcomes	
	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	3	-	2	-	3
CO2	-	3	2	2	2	3
CO3	-	2	-	3	2	2
CO4	3	3	2	2	3	3
CO5	3	3	1	2	2	3
CO6	1	3	-	3	3	3

Syllabus

Unit I - Introduction to DBMS, DBMS Architecture, Data Models, UML

Unit II - Relational Database design: Functional Dependency (FD) – Basic concepts, closure of set of FD, closure of attribute set, Decomposition, Normalization – 1NF, 2NF, 3NF, BCNF, 4NF.

Unit III - SQL Concepts : Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, Save point. Cursors, Stored Procedures, Stored Function, Database Triggers

Unit IV - Query Processing & Query Optimization: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views

Unit V - Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, Two- Phase Commit protocol, Deadlock, two-phase locking protocol

Unit VI -NoSQL Databases - Introduction, CRUD Operations, Data Mining, XML

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2002.
2. Jeff Ullman, and Jennifer Widom, A First Course in Database systems, 2nd Ed.

Reference Books:

1. G. K. Gupta : "Database Management Systems", McGraw – Hill.
2. Regina Obe, Leo Hsu, PostgreSQL: Up and Running, 3rd Ed, O'Reilly Media 2017.
3. Kristina Chodorow, Shannon Bradshaw, MongoDB: The Definitive Guide, 3rd Ed, O'Reilly Media 2018.
4. Ramez Elmasri and Shamkant Navathe, Fundamentals of Database Systems 2nd Ed, Benjamin Cummings, 1994.

Certification Courses available:

1. <http://infolab.stanford.edu/~ullman/fcdb.html>
2. <https://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir/>

Free Courses available:

1. Database Systems Concepts & Design - [Udacity, edx] - Free Course (<https://in.udacity.com/course/database-systems-concepts-design--ud150>)
2. <https://www.edx.org/course/database-systems-concepts-and-design>
3. Database Management System - Swayam (<https://swayam.gov.in/course/220-database-management-system>)
4. Database Management System - NPTEL (https://onlinecourses.nptel.ac.in/noc18_cs15/preview)

Expert Faculty:

1. P. Sreenivasa Kumar, IIT Madras
2. S. Sudarshan, IIT Bombay
(Email: sudarsha@cse.iitb.ac.in URL: <http://www.cse.iitb.ac.in/~sudarsha> Tel: +91.22 2576 7714 (Dept. Office: 2576 7700))
3. David G. Sullivan PhD, Senior Lecturer on Computer Science, Boston University Location: Maxwell-Dworkin G125

BCSL207 PROBLEM IDENTIFICATION & DESIGN THINKING (Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours	TA	CA	ESE	Int	Ext		
1	-	-	1	1	10	15	-	-	-	25

Course Objective:

1. Introduce students to a discipline—design thinking—that enhances innovation activities in terms of value creation, speed, and sustainability. Be exposed to architectural styles and views
2. Strengthen students' individual and collaborative capabilities to identify problems/issues/needs, develop sound hypotheses, collect and analyze appropriate data, and develop ways to collect meaningful feedback in a real-world environment
3. Teach students to translate broadly defined opportunities into actionable innovation possibilities and recommendations for stakeholders and their organizations

Course Outcome: Upon successful completion of the course, students shall be able to:

1. Have an awareness of how design thinking can be applied in a wide range of contexts, from the personal to the global
2. Initiate an attitude of playfulness to aid design thinking
3. Use computing tools and online environments to aid design thinking.

Syllabus

UNIT I: Why Design Thinking and The Design Process provides context and an introduction to key concepts, terminology, and structure for the course. Scoping, The Design Brief and Visualization introduces ways to clarify the scope of a project and its intent, questions to explore, target stakeholders, and establishes the importance of pictures and storytelling in the overall process

UNIT II: Fundamentals of Ethnography and Identifying Insights reviews how to observe users in their natural habitat and efficiently extract useful patterns from collected data. Establishing Design Criteria and Brainstorming shows how to develop a succinct expression of the ideal end state of a project, and deliberately generate many fresh alternatives to the status quo

UNIT III: Concept Development and The Napkin Pitch details how to choose the best ideas, assemble them into detailed solutions, and rationally evaluate them, as well as introduce a simple, consistent format for summarizing and communicating new concepts. Assumptions Testing and Prototyping introduces a tool for surfacing key assumptions underlying the attractiveness of a new concept and using data to assess the likelihood that they are true, as well as ways to create visual manifestations of concepts..

Text Books:

1. Jeanne Liedtka and Tim Ogilvie Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia University Press, 2011)

Reference Books:

2. Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm (Profile Books, 2002)
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
4. Roger Martin, *The Design of Business: Why Design Thinking Is The Next Competitive Advantage* (Harvard Business Review Press, 2009)
5. Alexander Osterwalder and Yves Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (John Wiley and Sons, 2010)
6. Nigel Cross, *Design Thinking: Understanding How Designers Think and Work* (Bloomsbury Academic, 2011)

Certification Courses available:

1. <https://www.coursera.org/learn/uva-darden-design-thinking-innovation>
2. <https://www.edx.org/course/introduction-to-design-thinking-1/>
3. <https://in.udacity.com/course/intro-to-the-design-of-everyday-things--design101>

Expert Faculty:

1. Tim Zak, Associate Teaching Professor, Heinz College, Director—Institute for Social Innovation
2. Dr Deepak John Mathew of IIT Hyderabad

BCSL 203/BCSP203 Data Structure and Algorithms (Online)

BCSL203/ BCSP203

Teaching Scheme				Credits		Continuous Evaluation Scheme					
					Theory				Practical		Total
Th.	Tu	Pr.	Total Hours		TA	CA	ES	Exam Mode	Int	Ext	
2	-	2	4	3	10	15	25	Online	10	15	75

Course Objective:

1. This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
2. It's also aimed at developing skill to implement methods to solve specific problems using basic data structures.
3. The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.

Course Outcome: Upon successful completion of the course, students shall be able to-

CO1: Describe data structures and understand when it is appropriate to use. **(Remembering)**

CO2: Understand algorithms for data searching and sorting. **(Understanding)**

CO3: Apply linear and nonlinear data structures to solve various real world computing problems.

(Applying)

CO4: Structuring to Relate use of Abstract data types & ways in which they can be stored, accessed and manipulated. **(Analyzing)**

CO5: Evaluate critical, independent and quantitative problems using various data structures. **(Evaluating)**

CO6: Design the hierarchical data structure with minimum complexity for real world problem. **(Creating)**

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	3	2	3	1	
CO2	2	3	3	2	
CO3	3	3	3	2	1
CO4	3	3	3	3	2
CO5	3	3	3	2	3
CO6	2	3	3	3	3

Syllabus

Unit I: Arrays & Pointers

Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Multidimensional Arrays, Pointers; Pointer Arrays, Dynamic Memory Management.

Unit II: Sorting and Searching

Introduction: Sorting; Bubble Sort, Insertion Sort, Selection Sort, Merging, Searching; Linear Search, Binary Search.

Unit III: Linked List

Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation and Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Circularly Linked Lists, Doubly Linked Lists.

Unit IV: Stacks, Queue and Recursion

Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Application of Stacks, Recursion, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques and Applications of Queues.

Unit V: Trees and Graphs

Introduction: Binary Trees, Representing Binary Tree in Memory, Traversing Binary Trees, Binary Search Trees, Searching, Inserting and Deletion in a Binary Search Tree, Introduction & Graph Theory Terminology, Sequential Representation of Graphs, Operations on Graphs, Traversing a Graph.

Unit VI:

Project based Learning ,Splay Tree, AVL Tree, Red and Black Tree, Floyd and WarshellTechnique, Height Balance Tree.

Text Books:

- 1.AVAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
- 2.THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.

Reference Books:

1. Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
2. MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)

Certification Courses available:

Sr.N o.	Name of the course	MOOC's/ SWAYAM/NPTEL	Link	Duration of Course	Name of Expert	Affiliation
1	Programing Data Structure and Algorithm	SWAYAM	https://swayam.gov.in/course/4422-programming-data-structure-s-and-algorithms	8 weeks (certification Course)	Sudarshanlyengar	IIT Madras

Free Courses available:

Sr.N o.	Name of the course	MOOC's/ SWAYAM/NPTEL	Link	Duration of Course	Name of Expert	Affiliation
1	Programing, Data Structures and Algorithms using Python	NPTEL	https://nptel.ac.in/courses/106106145/ https://onlinecourses.nptel.ac.in/noc18_cs34	8 weeks(from 28 January 2019 to 22 March 2019)	Prof. MadhavanMukund	Chennai Mathematical Institute
2	Data Structure and Algorithm	NPTEL	https://nptel.ac.in/courses/106102064/	8 weeks(Video Lectures)	Dr. Naveen Garg	IIT DELHI
3	Programing Data Structure and Algorithm	NPTEL	https://nptel.ac.in/courses/106106133/	8 weeks(Video)	Dr. N S. Narayanaswamy Prof. Shankar Balachandran Prof.	IIT Madras

Sr.N o.	Name of the course	MOOC's/ SWAYAM/NPTEL	Link	Duration of Course	Name of Expert	Affiliation
					Hema A Murthy ,IIT Madras	

Expert Faculty:

1. Dr. Naveen Garg,Department of Computer Science and Engineering Indian Institute of Technology, Delhi.
- 2.YogeshSimmhan, Assistant Professor,Department of Computational and Data Sciences (CDS), Indian Institute of Science (IISc), Bangalore.

BCSP205 OBJECT ORIENTED PROGRAMMING (Online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
Th.	Tu	Pr.	Total Hours		Theory			Practical		Total
					TA E	CAE	ES E	Int	Ext	
-	-	4	4	2	-	-	-	25	25	50

Course Objective:

1. This course introduced features of object oriented programming.
2. The course provide carrier opportunities in implementation of various applications as object oriented concepts plays dominant role in software development.

Course Outcome: Upon successful completion of the course, students shall be able to–

- CO 1:** Articulate the principles of object oriented programming using C++
- CO 2:** Understand function overloading, constructor overloading, operator overloading, polymorphism & its uses in programming.
- CO3:** Implement inheritance concepts and its use for application development
- CO4:** Analyze of dynamic memory allocation and its use for software development
- CO5:** Implement concept of file handling in real life problems
- CO6:** Implement a project for real world problems

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 11	PSO1	PSO2
CO1	1	2	2	3		-	-	-
CO2	-	3	3	2	-	2	1	2
CO3	-	3	3	2	1	2	2	3
CO4	-	3	1	3	3	2	3	3
CO5	-	3	3	2	2	2	1	3

CO6	-	3	3	3	3	3	3	3

Syllabus

Unit-I: Principles of Object Oriented Programming -

Introduction to OOPS: Differences between C and C++. A look at procedure Oriented programming, object oriented programming paradigm, basic concepts of OOP, Headers & Name Spaces

Unit-II: Functions & Polymorphism -

Functions, Types of Functions, Constructor, Destructor, Function overloading & Ambiguity, Operator Overloading, Function Overriding, Friend Function

Unit-III: Inheritance & Virtual Functions -

Inheritance and the access specifiers, Types of Inheritance, Pointers and references to derived types, Virtual Functions

Unit-IV: Pointers & Dynamic allocations -

Static & Dynamic allocation using new and delete,* and ->* operators, Creating conversion functions, this pointer.

Text Books:

1. Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications
2. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH

Reference Books:

1. Let's C++ by Y. Kanetkar, BPB publications
2. Object oriented programming with C++, E Balagurusamy, 4th edition, TMH
3. Object-Oriented Programming with C++, SouravSahay, Oxford University Press

Certification Courses Available:

Name of Course: Programming In C++ (NPTEL)
Link: <https://nptel.ac.in/courses/106105151/>
https://onlinecourses.nptel.ac.in/noc18_cs32

Duration of Course: 8 Weeks (from 28 January 2019 to 22 March 2019)

Name of Expert: Prof. ParthaPratim Das
Affiliation: IITKharagpur

Expert Faculty:

Name of Expert: Prof. ParthaPratim Das
Affiliation: IITKharagpur

BCSL209 SOFTWARE ENGINEERING AND PROJECT MANAGEMENT(Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA E	CA E	ES E	In t	Ex t	
1	1	-	2	2	10	15	25	-	-	50

Course Objectives:

The student should be made to:

- Understand the phases in a software project
- Understand fundamental concepts of requirements engineering and Analysis Modelling.
- Understand the major considerations for enterprise integration and deployment.
- Learn various testing and maintenance measures

Course Outcomes: At the end of the course, the student should be able to

- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes	
	PO1	PO2	PO3	PO5	PO8	PO11	PSO1	PSO2
CO1	3	2	3	-	-	3	-	-
CO2	3	2	3	-	-	3	-	-
CO3	2	3	3	2	1	3	3	2
CO4	2	3	3	-	-	3	3	3
CO5	3	-	3	1	-	3	-	3
CO6	3	2	3	3	-	3	3	3

Syllabus

UNIT I: SOFTWAREPROCESS

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis – Risk Management.

UNIT II: REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management- Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III: SOFTWARE DESIGN

Design process – Design Concepts-Design Model–
Design Heuristic – Architectural Design –
Architectural styles, Architectural Design,
Architectural Mapping using Data Flow- User
Interface Design: Interface analysis, Interface
Design –Component level Design: Designing Class
based components, traditional Components.

UNIT IV: TESTING AND IMPLEMENTATION

Software testing fundamentals-Internal and external
views of Testing-white box testing – basis path
testing-control structure testing-black box testing-
Regression Testing – Unit Testing – Integration
Testing – Validation Testing – System Testing And
Debugging – Software Implementation Techniques:
Coding practices-Refactoring.

UNIT V: PROJECT MANAGEMENT

Estimation – FP Based, LOC Based, Make/Buy
Decision, COCOMO II – Planning – Project Plan,
Planning Process, RFP Risk Management –
Identification, Projection, RMMM – Scheduling and
Tracking –Relationship between people and effort,
Task Set & Network, Scheduling, EVA – Process
and Project Metrics.

Text Books:

- Roger S. Pressman, "Software Engineering – A
Practitioner's Approach", Seventh Edition, McGraw-
Hill International Edition, 2010.

Reference Books:

- Ian Sommerville, "Software Engineering", 9th
Edition, Pearson Education Asia, 2011.
- Rajib Mall, "Fundamentals of Software Engineering",
Third Edition, PHI Learning Private Limited, 2009.
- Pankaj Jalote, "Software Engineering, A Precise
Approach", Wiley India, 2010.
- Kelkar S.A., "Software Engineering", Prentice Hall of
India Pvt Ltd, 2007.
- Stephen R. Schach, "Software Engineering", Tata
McGraw-Hill Publishing Company Limited, 2007.
- <http://nptel.ac.in/>.

Certification Courses available:

<https://nptel.ac.in/downloads/106105087/>

Free Courses available:

[https://swayam.gov.in/course/236-software-
engineering](https://swayam.gov.in/course/236-software-engineering)

Expert Faculty:

Dr. Madhuri Bhavsar

Nirma University

Total Experience 25 Year

Educational
Qualification Ph.D.

Research Area High Performance Computing,
Software

General information

Designation	Professor and Head of Department
Office Phone	07930642213
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SEMSTER-IV

**BFYL142 COURSE NAME: MATHEMATICS-VI(GRAPH THEORY AND NUMBER SYSTEM)
(Online)**

Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper
					Theory			Practical		Total	
Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.		
1	1	0	2	2	10	15	25			50	2

Course Objectives :

- 1.This course introduces size and kind of objects.
- 2.It also skills to analyze objects meeting the criteria, finding "largest", "smallest", or "optimal" objects.
- 3.It also introduces combinatorial structures and apply algebraic techniques to combinatorial problems.

Course Outcomes :

Upon successful completion of the course, students will be able to:

1. Know data structure used to represent different kinds of objects viz Graph, Trees
2. Know the basics of combinatorial structure and develop algebraic technique to solve combinatorial problems.
3. Programming application of group, ring and number theory.

Unit -I: Graph Theory

Graphs and its types, subgraph, Quotient graph, Euler path, Complete path, indegreeoutdegree, reachability, cycle, matrix representation of graph. Transitive closure of graph, Adjacency matrix, Trees, Venn diagram, Representation of trees, binary trees, spanning trees, Prims algorithm.

Unit –II: Combinatorics

Definition of generating functions and examples, proof of simple combinatorial identities,

$$\text{Probab.G.F. } p(t) = \sum p_n t^n, \quad E(x) = p'(t),$$

examples. Recursive relations: definitions & examples, explicitly formula for sequence, back tracking to find explicit formula of sequence, solving recurrence relations. Counting Theorem Principle of counting, Permutation & Combination with examples. Pigeon hole principle.

Unit -III: Number Theory:

The study of continued fractions .alpha has Infinite continued fraction if alpha is irrational. Alpha has periodic continued fractions if alpha is quadratic irrational. Application to approximation of irrationals by rationals. Hurwitz's theorem, Advanced topic on Combinatorial Theory

Recommended Reference Books:

1. Discrete mathematical structure with application to computer science; Trembley&Manohar; Mc. Graw Hill,2011
2. Discrete Mathematical Structure ; Busby & Ross ; PHI, 2009
3. Discrete Mathematics ; John Truss ; Addison Wesley

BCSL211/BCSP211 OPERATING SYSTEM (Online)

Teaching Scheme					Theory			Practical		Total
Th .	T u	Pr .	Total Hour s	Credit s	T A E	C A E	E S E	In t	Ex t	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. Introduces general idea, structure and functions of operating system
2. Making students aware of basic mechanisms used to handle processes, memory, storage devices and files.

Course Outcome: Upon successful completion of the course, students shall be able to-

- 1.Identify basic structure and purpose of operating system.
 2. Interpret the concepts of process and illustrate various CPU scheduling algorithms.
 3. Interpret the concepts of inter process communication.
 4. Schematize Deadlock & security mechanisms in operating systems.
 5. Analyze different memory management techniques with advantages and disadvantages.
- CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	P02	P03	P04	P05	PSO1	PSO2
CO1	2	-	1	3	-	1
CO2	2	-	3	-	2	2
CO3	3	3	-	-	2	3
CO4	3	-	2	-	2	2
CO5	3	-	3	2	3	2
CO6	-	-	2	3	2	2

Syllabus

Unit-I

Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation.

Unit-II

Process & Its Scheduling

Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms,

Unit-III

Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems

Unit-IV

Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation

Unit-V

File systems: File concept, Access methods space allocation strategies, disk arm scheduling strategies. Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging, Virtual Memory Concepts, page faults and instruction restart, page replacement algorithms, working sets, Locality of reference, Thrashing, Garbage Collection.

TEXT BOOKS :

1. Operating System concepts – Silberchatz& Galvin, Addison Wesley, 6 thEdn.
2. Modern Operating Systems – Tanenbaum, Pearson Edn. 2 ndedn.

REFERENCE BOOKS :

1. Operating Systems – S R Sathe, Macmillan Publishers, India, 2008
2. Operating System –Milan Milenkovik, McGraw-Hill, 1987
3. Operating Systems - 3 rd Edition by Gary Nutt, Pearson Education.

Certification Courses available:

By Edureka

1. Linux Administration
2. UNIX Shell Scripting
3. Linux Fundamentals

Free Courses available:

UDACITY: Introduction to Operating Systems by Georgia Institute of Technology

Expert Faculty:

1. Debadatta Mishra

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2. MythiliVutukuru

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3. SoravBansal

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BCSL212 FORMAL LANGUAGE AND AUTOMATA(Offline)

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I nt	E xt	
2	1	-	3	3	10	15	50		-	75

Course Objectives:

1. To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
2. To introduce the fundamental concepts of formal languages, grammars and automata theory.
3. Classify machines by their power to recognize languages.
4. Employ finite state machines to solve problems in computing.
5. To understand deterministic and non-deterministic machines.
6. To understand the differences between decidability and un-decidability.

Course Outcomes:

1. Able to understand the concept of abstract machines and their power to recognize the languages.
2. Able to employ finite state machines for modeling and solving computing problems.
3. Able to design context free grammars for formal languages.
4. Able to distinguish between decidability and un-decidability.
5. Able to gain proficiency with mathematical tools and formal methods.

Syllabus

Unit-I: Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with ϵ - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without ϵ -moves – Equivalence of finite Automaton.

UNIT-II: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

UNIT-III: Context-Free Grammars: Chomsky hierarchy of languages. Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tree, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

UNIT-IV: Definitions of Turing machines – Models – Computable languages and functions – Techniques for Turing machine construction – Multi head and Multi tape Turing Machines – The Halting problem – Partial Solvability – Problems about Turing machine

UNIT-V: Un-decidability: A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines, Post's Correspondence Problem, Other Undecidable Problems, Intractable Problems: The Classes P and NP, An NP-Complete Problem.

TEXT BOOKS:

- Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
- Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.

REFERENCE BOOKS:

- Introduction to Languages and The Theory of

Course Outcomes	Program Outcomes					Program Specific Outcomes	
	PO2	PO3	PO5	PO8	PO1	PSO1	PSO2
CO1	2	3	-	-	2	-	2
CO2	2	3	-	-	3	-	3
CO3	2	3	-	-	3	3	3
CO4	2	3	2	-	3	-	3
CO5	2	3	2	2	3	3	3
CO6	2	3	2	-	3	3	3

Computation, John C Martin, TMH.

- Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
- A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
- Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.

- Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekar, 2nd edition, PHI.
Certification Courses available:
<https://nptel.ac.in/courses/111103016/>

Free Courses available:

Expert Faculty:

Prof. Diganta Goswami
Department of Computer Science and Engineering
Indian Institute of Technology, Guwahati

Prof. Kamala Krithivasan
Department of Computer Science and Engineering
Indian Institute of Technology, Madras

BCSP213 JAVA PROGRAMMING (Online)

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I n t	E x t	
-	-	4	4	2	-	-	-	25	25	50

Course Objective:

1. This course introduces fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
2. It is aimed at building software development skills using java programming for creating real world applications.
3. Use a development environment to design, code, test, and debug simple programs, including multi-file source projects, in an object-oriented programming language

Course Outcome: Upon successful completion of the course, students shall be able to–

- **CO 1:** Explain the basic data types and control flow constructs using J2SE.
- **CO 2:** Make use of Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper for program development.
- **CO3:** Design object oriented class structures with parameters, constructors, and utility.
- **CO4:** Implement a final project selected from an approved project chosen by the student.

CO Mapping with PO and PSO

Syllabus

Unit I: Introduction to JAVA, Class and Object

Introduction to data types, operators and control statements, Classes: fundamentals of classes, declaring objects, Assigning objects, reference variables, methods, constructor, variable handling.

Methods and classes: Overloading methods, understanding static and final.

Unit II: Array, Packages, Interface Introduction to Array, Vectors, Wrapper class & Inheritance, Packages and interface: Packages, access protection, importing packages, interfaces.

Unit III: Exception Handling & Multithreaded Programming

Exception handling: Fundamentals exception types, uncaught exception, try-catch, displaying description of an exception, multiple catch clauses, nested try statements, throw, finally, built in exceptions, creating own exception subclasses, JAVA thread model, creating thread, creating multiple thread.

Unit IV: Applet, Graphics Programming and Database Connectivity

Introduction to applet, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling.

Database Connectivity: JDBC (Java Data Base Connection), Introduction to JDBC, Databases and Drivers, Types of Driver, Loading a driver class file, establishing the Connection to Database with different Driver. Executing SQL queries by result Set using Statements

Text Books:

1. The Complete Reference by Herbert Schild, TMH Publication
2. Programming with Java- A Primer by E. Balagurusamy, 3rd Edition, TMH Publication

Reference Books:

7. The Complete Reference- JAVA 2- 3rd Edition By Patrick Naughton, TMH Publication.
8. Java 6 Programming Black Book by Kogent Solution Inc., Dreamtech Press Publication.
9. Java 2 Black Book by Steve Holzner, Paraglyph Press, 2nd Ed.

Certification Courses available:

Name of Course: Java Programming (NPTEL)

Link: <https://nptel.ac.in/courses/106106147/5>

Duration of Course: 2 Weeks

Name of Expert: Prof. Pushpedra Singh

Affiliation: Indraprasth Institute of Information Technology Delhi

Name of Course: Java Programming (SWAYAM)

Link: <https://swayam.gov.in/courses/4104-spoken-tutorial-java-oriya>

Duration of Course: 16 Weeks

Name of Expert: Prof. KannanMoudgalya

Affiliation: IIT Bombay

Expert Faculty:

Expert 1:

Name of Expert: Prof. Pushpedra Singh

Affiliation: Indraprasth Institute of Information Technology Delhi

Expert 2:

Name of Expert: Prof. KannanMoudgalya

Affiliation: IIT Bombay

BCSP214PRINCIPLES OF PROGRAMMING LANGUAGE(Online)

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	Int	Ext	
-	-	2	2	1	-	-	-	25	25	50

Course Objective:

1. This course introduces the general ideas of programming concepts.
2. Making students aware of basic programming paradigms, the principles and techniques involved in design and implementation of it.
3. It is aimed at developing skills to provide frameworks specifying and reasoning about programming languages.

Course Outcome: Upon successful completion of the course, students shall be able to-

1. Recognize programming paradigm and design principles.
2. Demonstrate different data types and their specification.
3. Illustrate the generic subprograms and its structure.

CO Mapping with PO and PSO

Course Outcomes	Program Outcomes			Program Specific Outcomes	
	PO2	PO3	PO5	PSO1	PSO2
CO1	3	3		2	3
CO2	3	2		2	2
CO3	3	2		3	2

Syllabus

Unit I: Introduction to Programming language

Definition of Programming language, Implementation of high-level languages, Data elements, binding time. Concept of r-value and l-value and their implementation. Language paradigms.

Unit II: Data Types and Object

Data type, Type checking and type conversion, elements of specification and implementation of data type. arrays Files and i/o, Generic functions, Objects. Inheritance and Encapsulation
Abstract data type, Inheritance and type of Inheritance, encapsulation, Implementation of new data types,

Unit III: Exception Handling and sequence control
Exception Handling in Various Languages, Programming Events, Handling Large Databases, Special Languages, Sequence control, Implicit and explicit sequence control, implementation of case statement, recursive and non-recursive subprogram.

Text Books:

1. Programming Languages, 1st edition by T.W. Pratt and M. V. Zelkowitz & T. V. Gopal by Pearson Education, 2008
2. Programming Languages, Ravi Sethi, Addison Wesley.
3. Programming Languages: Paradigm and Practices by Doris Appleby and J. J. Vandekopple, McGraw Hill.
4. Concepts of Programming Languages by Robert W. Sebesta, Pearson Education.

Reference Books:

1. Principles of programming languages by Gilles Dowe, Springer-verlag, London Limited 2009
2. Concepts in programming languages by John C. Mitchell copyright, Cambridge University press 2003
3. Principles of Programming Languages: Design, Evaluation, and Implementation by Bruce J. MacLennan third Edition, 1999 by oxford university press Inc.
4. Programming Languages: Application and Interpretation, 2003-07, Shriram Krishnamurthi, United States License

Certification Courses available:

1. <https://www.udemy.com/fundamentals-of-programming/>

Free Courses available:

1. <https://nptel.ac.in/courses/106106145/26>
2. <https://nptel.ac.in/courses/106106145/28>
3. <https://nptel.ac.in/courses/106106145/37>
4. <https://nptel.ac.in/courses/106106145/38>
5. <https://nptel.ac.in/courses/106106145/35>

Expert Faculty:

1. Prof. Madhavan Mukund, Department of Computer Science and Engineering, Indian Institute of Technology, Madras.
2. Prof. S. Arun Kumar, Department of Computer Science and Engineering, Indian Institute of Technology, Delhi.
3. Prof. S. Arun Kumar, Department of Computer Science and Engineering, Indian Institute of Technology, Delhi

BCSL215/BCSP215 BIG DATA(Online)

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I n t	E x t	
1	-	2	3	2	10	15	25	10	15	75

Course Outcome:

Upon successful completion of the course, students shall be able to-

CO1: Understand basic concepts and techniques of Hadoop ecosystem and Big data.

CO2: Design different component of Hadoop ecosystem.

CO3: Understand the domain of data science and analysis of big data.

Syllabus

UNIT 01: Big data, challenges for processing big data, technologies support big data, History of Hadoop, Use cases of Hadoop, The Data Scientist, Big Data Analytics in Industry Verticals, Data Analytics Lifecycle, Hadoop Distributed File System, Significance of HDFS in Hadoop, Features of HDFS, Data Storage in HDFS **(07Hrs.)**

UNIT 02: Map Reduce: Map Reduce Story, Map Reduce Architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Data Flow Engines and other memory databases. **(06Hrs.)**

UNIT 03: Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Execution in Pig, Loading data, Exploring Pig Latin commands, Hive introduction, Hive architecture. Data types and schemas, Partitions and buckets, Spark Shell, Spark Application, Flume, SQOOP introduction and application. **(06Hrs.)**

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 3rd edition, O'Reilly Media.
2. Big Data (Black Book), Wiley
3. V. Prajapati, "Big Data Analytics with R and Hadoop", PacktPub.

Reference Books:

1. V. Ankam, Big Data Analytics, Packt Pub Ltd.
2. N. Dasgupta, Practical Big Data Analytics, Packt Pub Ltd.

Certification Courses available:

1. <https://www.udemy.com/big-data-hadoop-the-complete-course/>

2. <https://www.cloudera.com/more/training/certification.html>

3. <https://www.edureka.co/big-data-and-hadoop>
<https://www.simplilearn.com/big-data-and-analytics/big-data-and-hadoop-training>

Free Courses available:

1. <https://nptel.ac.in/courses/106106142/> ----- Algorithm for Big data
2. <https://nptel.ac.in/courses/106104135/48> ---- Big data
3. <https://nptel.ac.in/courses/106106168/22> ----- HDFS

Expert Faculty:

1. Dr. R.B.V. Subramaanyam, National Institute of Technology, Warangal.
2. Animesh Mukherjee, Indian Institute of Technology, Kharagpur.
3. Mr. ValaAfshar, Boston, MA, USA. Area of interest: Digital Marketing, Social Business, Link: <https://www.cmswire.com/author/vala-afshar/>

BCSL216SOFTWARE ARCHITECTURE & WEB SERVICES(Online)

Teaching Scheme					Theory			Practical		Total
Th	T	Pr	Total Hour	Credit	TA	CA	ES	In	Ex	
2	-	-	2	1	10	15	25	-	-	50

Course Objective:

1. Understand software architectural requirements
2. Be exposed to architectural styles and views
3. Be familiar with architectures for emerging technologies

Course Outcome: Upon successful completion of the course, students shall be able to:

1. Design software architecture for large scale software systems.
2. Describe a software architecture using various documentation approaches and architectural description languages.
3. Use well-understood paradigms for designing new systems.

Syllabus

UNIT I: Introduction to Software Architecture

Introduction: What is software architecture?, Standard Definitions, Architectural structures, Influence of software architecture on organization both business and technical, Architecture Business Cycle: Introduction, Functional requirements, Technical constraints, Quality Attributes: Quality Attribute Workshop,

Documenting Quality attributes, Six part scenarios.

UNIT II: UML Modelling

UML diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns, documenting software architecture, reconstructing software architecture, Issues in Software Architecture: Scalability and interoperability issues, web application architectures.

UNIT III: Introduction to Web Services & XML

Web Service Architecture, Web Services VS other Technologies, Web Services Benefits, DTD VS XSD, What is XML Parsing?, Various other XML Binding API's, JAX-P API based XML parsing using (SAX, DOM), Validating XML Documents using JAX-Vp, XML Binding using JAX-B (Marshalling, Un-Marshalling and In-Memory Validation)

Text Books:

1. Len Bass, Paul Clements, and Rick Kazman, "Software Architectures Principles and Practices", 2nd Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, "Architecting Software Intensive System. A Practitioner's Guide", Auerbach Publications, 2010.

Reference Books:

1. Mary Shaw, David Garlan, Software architecture: perspectives on an emerging discipline. Prentice-Hall, 1996.
2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Pattern-oriented software architecture, Volume 1: A system of patterns, Wiley, 1996.
3. Douglas Schmidt, Michael Stal, Hans Rohnert, Frank Buschmann, Pattern-Oriented Software Architecture, Volume 2; Patterns for Concurrent and Networked Objects, Wiley, 2000.
4. Martin Fowler, Patterns of Enterprise Application Architecture, Addison-Wesley, 2000.
5. Selected research papers, and Articles related to state-of-the-art technologies and standards.

Certification Courses available:

1. <https://www.coursera.org/learn/software-architecture>
2. <https://www.udemy.com/basics-of-software-architecture-design-in-java/>
3. <https://in.udacity.com/course/software-architecture-design--ud821>

Free Courses available:

1. <https://www.coursera.org/learn/software-architecture>
2. <https://www.udemy.com/basics-of-software-architecture-design-in-java/>
3. <https://in.udacity.com/course/software-architecture-design--ud821>

Expert Faculty:

1. Prof. Rajib Mall is Professor, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, West Bengal.
2. Prof. N.L. Sardais Professor, Department of Computer Science and Engineering, Indian Institute of Technology Bombay.

BCSP217MACHINE LEARNING(Online)

Teaching Scheme					Theory			Practical		Total
Th	Tu	Pr	Total Hours	Credits	TA	CA	ES	Int	Ext	
-	-	2	2	1	-	-	-	25	25	50

Course Objectives:

- Be able to formulate machine learning problems corresponding to different applications.
- Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes: Upon completion of the course students shall be able to:

- CO1. Recall the basic concepts and techniques of Machine Learning.
- CO2. Summarize and compare a range of machine learning algorithms along with their strengths and weaknesses
- CO3. Develop skills of using recent machine learning software for solving practical problems.

Unit I: Understanding Machine Learning

Introduction, What Is Machine Learning? , Examples of Machine Learning Applications, Learning Associations, Supervised&Unsupervised Learning, Reinforcement Learning, Classification, Regression

Unit II: Applying R-Programming

R - Basic Syntax, Data Types, Variables, Operators, Decision Making, Loops, Functions, Strings, Vectors, Lists, Matrices, Arrays, Factors, Data Frames, Packages-chart & graphs

UNIT III: Clustering & Application of ML

Introduction to clustering, k-Means Clustering, Hierarchical clustering, Introduction to Chat Bot, creation of Chat Bot

Text Books:

1. *Introduction to machine learning*, Ethem Alpaydin. — 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
2. *Introduction to artificial neural systems*, J. Zurada, St. Paul: West.
1. *R in a Nutshell*, 2nd Edition - O'Reilly Media.

Reference Books:

11. *Machine Learning*, Tom M Mitchell.
12. *The Elements of Statistical Learning*, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

Resource Persons

Mr. Vivek Patole,
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Anupam Basu**Professor**

PhD (IIT Kharagpur)
Joined Institute in 1984
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Free Courses:

Sr. No.	Machine Learning course name	Offered by
1	Machine Learning by Andrew Ng	Stanford COURSERA
2	Intro to Machine Learning	Udacity's
3	Learning from Data (Introductory Machine Learning)	EDX
4	Statistical Machine Learning	CARNEGIE MELON UNIVERSITY
5	Neural Networks for Machine Learning	Coursera
6	Google's Deep Learning	Udacity's
7	R Tutorial on Machine Learning	Kaggle
8	Principles of Machine Learning	EDX
9	Machine Learning Specialization	Coursera

SEMSTER-V

BFYL143 Mathematics-VII (Integral Transforms)
(online)

Teaching Scheme				Credits	Evaluation Scheme					
Th.	Tu	Pr.	Total		Theory			Practical		Total
					TAE	CAE	ESE	Int.	Ext.	
1	0	0	1	1	10	15	25			50

1. Analyze problems, recognize appropriate methods of solution, solve the problems and find the solutions.

2. Apply principles from mathematics to solve applied problems in engineering.

Course Outcomes

Upon successful completion of the course, students will be able to:

1. Understand and use Laplace- transform to solve engineering problems.
2. Apply the concept of z-Transform to solve difference equations
3. Apply the concepts of Numerical methods to solve engineering problems

Unit -I: Laplace Transforms: (10 hrs)

Laplace transform: definition and their simple properties, transform of derivatives and integrals, evaluation of integrals by L.T. ,inverse L.T. &its properties , convolution theorem, Laplace transforms of periodic function & unit step function,

Unit -II: Z-Transforms:

The Z transform- definition & properties, inverse & relation with Laplace Transform.Application to z-transform to solve difference equations with constant coefficients.

Unit-III:Application :

applications of Laplace and Z-Transform transforms
Recommended Reference Books:

1. Kreyszig, E.: Advanced Engineering Mathematics (Eighth Edition); John Wiley & Sons; 2000.
Jain, R.K. and Iyengar, S.R.K.; Advanced Engineering Mathematics; Narosa Publishers; 2003.

BCSL316/BCSP316DESIGN AND ANALYSIS OF ALGORITHMS(online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA	CA	EE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. This course introduces students the general idea of analysis and design of algorithms while making them aware of basic methods of algorithm analysis and design.
2. It is also aimed at developing skills to solve real life applications which involve algorithm development.
3. The course also provides career opportunities in analysis, design and optimization technique in algorithms.

Course Outcome: Upon successful completion of the course, students shall be able to-

Upon successful completion of the course, students will be able to

1. Apply basic concepts of algorithm in analysis and Design of algorithms.
2. Identify and apply methods used for analysis and Design of Algorithm
3. Develop an appropriate mathematical formulations in designing algorithm
4. Use advanced techniques and tools available for algorithm analysis and development

CO Mapping with PO and PSO

Course Outcomes	Program Outcomes					Program Specific Outcomes	
	PO1 :	PO 2	PO 3	PO4 :	PO 5	PSO 1	PSO 2
CO1	2	3	3	-	-	2	3
CO2	-	3	3	3	-	2	3
CO3	-	-	3	3	-	3	2
CO4	-	-	2	2	-	2	3

Syllabus

Unit – I: Mathematical foundations

summation of arithmetic and geometric series, n , n^2 , bounding summations using integration, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, Complexity calculation of various standard functions, Principles of designing algorithms

Unit – II: Asymptotic notations

Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, application of amortized analysis, Sorting networks, comparison networks, biotonic sorting network.

Unit – III :Advanced data structures

Advanced data structures like Fibonacci heap, Binomial heap, disjoint set representation, red and black trees and their applications. Divide and conquer basic strategy, matrix operation, binary search, quick sort, merge sort, fast fourier transform.

Unit – IV :Greedy Method & Dynamic Programming

Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc. Dynamic Programming basic strategy, multistage graphs, all pairs shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem, Maximum flow networks.

Unit V: Traversal And Search Techniques

Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, graph coloring, Hamiltonian cycles etc

Unit VI: Completeness Problems And Applications

NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, decision and optimization problems, Computational Geometry, Approximation algorithm and concepts based on approximation algorithms. Recent trends in Design and analysis of algorithms, advanced topics & its Application.

Text Books:

1. Thomas H. Cormen et al. "Introduction to Algorithms", Prentice Hall of India.
2. Design & Analysis of Computer Algorithms by Aho, Horowitz, Sahani, Rajsekharam, Pearson education

Reference Books:

1. "Computer Algorithms", Galgotia Publications Pvt. Ltd. Brassard, Bratley, "Fundamentals of Algorithms", Prentice Hall
2. Computer Algorithms: Introduction to Design and analysis, 3rd Edition, By Sara Baase & A. V. Gelder Pearson Education.

Certification Courses available:

- 1) Design and Analysis of Algorithms CS161, Stanford School of Engineering
<https://online.stanford.edu/courses/cs161-design-and-analysis-algorithms>
- 2) EdX course on Algorithm Design and Analysis, University of Pennsylvania
<https://www.edx.org/course/algorithm-design-analysis-pennx-sd3x>

Free Courses available:

- 1) MOOCs Free Online Courses in Algorithm Design:
<https://www.class-central.com/tag/algorithm-design>
- 2) NPTEL course on Design and Analysis of Algorithms:
<https://www.class-central.com/course/nptel-design-and-analysis-of-algorithms-3984>

Expert Faculty:

- 1) Prof. Abhiram Ranade, Department of Computer Science Engineering, IIT Bombay
- 2) Prof. Madhavan Mukund, Chennai Mathematical Institute
- 3) Prof. Madhavan Mukund, Chennai Mathematical Institute

BCSL309/BCSP309 COMPILER DESIGN

(offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
					TA	CA	SE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. This course introduces student general ideas of compiler.
2. This course introduces to use regular languages to describe the lexical elements of a programming language and understand syntax analysis.
3. Aimed to develop skills to understand optimization technique

Course Outcome: Upon successful completion of the course, students shall be able to-

1. Understand basic concepts of compiler and different phases of compiler.
2. Explain the role of a semantic analyzer and describe the purpose of a syntax tree.
3. Apply context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables.
4. Demonstrate lexical analysis using a finite automata along with error recovery.
5. Apply optimization techniques to intermediate code and generate machine code for high level language program.
6. Implement the knowledge and skills necessary to develop a language translator or compiler covering a broad range of engineering and scientific applications.

CO Mapping with PO and PSO

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO 2	PO 3	PO 4	PO 5	PO 6	PO 11	PO 12	PS O1	PS O2
CO1	3	-	-	3	-	1	2	3	1
CO2	3	3	-	3	1	1	2	3	1
CO3	3	2	-	2	-	-	1	3	-
CO4	2	-	3	2	-	-	-	2	-
CO5	3	3	1	2	-	-	-	2	-
CO6	2	-	3	2	-	-	-	2	-

Syllabus

UNIT I INTRODUCTION TO COMPILERS

Overview of compiler and translator, types of Compiler, Analysis of the Source Program, The Phases of a compiler, grouping of phases, Cousins of the Compiler, design of lexical Analysis. compiler writing tools – bootstrapping

UNIT II SYNTAX ANALYSIS

Review of Context-Free Grammars – Derivation trees and Parse Trees, Ambiguity. Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL(1) Grammars. Bottom-Up Parsing: Shift Reduce parsing – Operator precedence parsing (Concepts only) LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables.

UNIT III Semantic Analysis

Need of semantic analysis, Abstract Parse trees for Expressions, variables, statements, functions and class declarations, Syntax directed definitions, Syntax directed translation schemes for declaration processing, type analysis, scope analysis, Symbol Tables (ST), Organization of ST for block structure and non block structured languages, Symbol Table management.

UNIT IV Intermediate code generation and error recovery

Intermediate code generation: Intermediate languages, Design issues, Translation of different language features, different types of intermediate forms. Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

UNIT V CODE OPTIMIZATION

Principal Sources of Optimization-DAG-Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

UNIT VI Recent Trends

Recent trends and Compiler tools, advanced topics & its Application. Virtual Machines and Interpretation Techniques, Just-In-Time (JIT) and Adaptive Compilation, Runtime System Architectures and Automatic Memory Management Techniques.

Text Books:

1. Alfred V. Aho, Monica S. Lam, R. Sethi and J.D. Ullman "Compilers: principles, techniques and tools" Pearson Education.
2. "Modern Compiler Implementation in ML" by Andrew W. Appel, Cambridge University Press, 1998.

Reference Books:

- Kenneth C Loudon, "Compiler Construction Principle and Practice", PWS publishing Company, 1997
- Dhamdhare D.M., "Compiler Construction Principle and Practice", Mac. Millan India, New Delhi, 1983
- Holub, A.J., "Compiler design in C" –Prentice Hall, 1982
- John Levine, Tony Mason & Doug Brown, "Lex and Yacc", O'Reilly. 1995

Certification Courses available:

1. <https://nptel.ac.in/courses/106108052/9>
2. <https://nptel.ac.in/courses/106104123/10>

Free Courses available:

1. The lex and Yacc page <http://dinosaur.compilertools.net/>
2. <http://www.personal.kent.edu/~rmuhamma/Compilers/compiler.html>
3. <http://www.cs.sjsu.edu/~louden/cmptext/>
4. <http://www.gtoal.com/software/CompilersOneOhOne/>
5. <http://lambda.uta.edu/cse5317/notes/node4.html>

Expert Faculty:

1. Prof. Y. N. Srikant, Department of Computer Science and Automation, Indian Institute of Science, Bangalore.
2. Prof. S. K. Aggarwal, Dept. of Computer Science and Engineering. Indian institute of Technology, Kanpur

BCL317/BCSP317 DATA COMMUNICATION AND NETWORKS (Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA E	CA E	ES E	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. This course introduces student's basics of data communication and networking while making them aware of functions of each layer in architecture.
2. The course provide career opportunities in design, implement, operate & manage enterprise work.
3. Understand advanced technique such as Data encoding and Compression.

Course Outcomes:

- Upon successful completion of the course, students will be able to
1. Understand Basics of data communications and Computer Networks
 2. Identify the techniques involved in the data transfer process

3. Understand advanced technique such as Data encoding and Compression
4. Recognize the need for OSI reference Model in computer networking
5. Use different elementary protocols for communication and identify IEEE standards employed in Computer networking
6. Design techniques involved in developing transport and application layer of Computer Networking

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes	
	PO 1	PO 2	PO 4	PO 5	PO1 1	PSO 1	PSO 2
CO1	1	3	3	-	-	3	2
CO2	-	3	2	-	-	2	-
CO3	-	-	3	-	2	3	2
CO4	1	3	2	2	2	3	2
CO5	1	3	3	-	-	2	-
CO6	-	-	2	2	2	3	2

SYLLABUS

Course Content:

UNIT I: Introduction

Introduction: Data Communications, Networks, The Internet, Protocols and Standards, Network Models, Layered Tasks, The OSI Model, Layers in the OSI Model, TCP/IP Protocol Suite, Addressing, Physical Layer and Media, Data and Signals, Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance, Digital Transmission, Digital-to-Digital Conversion, Analog-to-Digital Conversion, Analog Transmission, Digital-to-analog Conversion, Analog-to-analog Conversion

UNIT II: II Physical Layer

Bandwidth utilization: Multiplexing and Spreading, Multiplexing, Spread Spectrum, Transmission Media, Guided Media, Unguided Media: Wireless, Switching, Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of a Switch, Using Telephone and Cable Networks for Data Transmission, Telephone Networks, Dial-up Modems, Digital Subscriber Line, Cable TV Networks, Cable TV for Data Transfer

UNIT III: Data Link Layer

Error Detection and Correction, Introduction, Block Coding, Linear Block Codes, Cyclic Codes, Checksum, Data Link Control, Framing, Flow and Error Control, Protocols, Noiseless Channels, HDLC, Point-to-Point Protocol, Multiple Access, Random Access, Aloha, Controlled Access, Channelization, IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet,

Gigabit Ethernet, IEEE 802.11, Bluetooth, Backbone Networks, and Virtual LANs, Connecting Devices, Backbone Networks, Virtual LANs, Cellular Telephony, Satellite Networks, Sonet/SDH, Architecture, Sonet Layers, Sonet Frames, STS Multiplexing, Sonet Networks, Virtual Tributaries, Virtual-Circuit Networks: Frame Relay and ATM, Frame Relay, ATM, ATM LANs

UNIT IV: Network layer

Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Network Layer: Internet Protocol, Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Network Layer: Address Mapping, Error Reporting and Multicasting, Address Mapping, ICMP, IGMP, ICMPv6, Network Layer: Delivery, Forwarding and Routing, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols

UNIT V: Transport Layer

Transport Layer: Process-Process Delivery: UDP, TCP and SCTP, Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, SCTP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control, Two Examples, Quality Service, Techniques to improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks

UNIT VI: Application Layer

Application Layer: Domain Name System, Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS Messages, Types of Records, Registrars, Dynamic Domain Name System (DDNS), Encapsulation, Remote Logging, Electronic Mail and File Transfer, Remote Logging, Telnet, Electronic Mail, File Transfer, WWW and HTTP: Architecture, Web Documents, HTTP, Network Management: SNMP, Network Management System, Simple Network Management Protocol (SNMP), Multimedia, Digitizing Audio and Video, Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice over IP

TEXT BOOKS:

1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan, TMH.
2. Computer Networks, A.S.Tanenbaum, 4th Edition, Pearson education.

REFERENCE BOOKS:

1. Introduction to Data communications and Networking, W.Tomasi, Pearson education.
2. Data and Computer Communications, G.S.Hura and M.Singhal, CRC Press, Taylor and Francis Group.
3. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson

Education.

4. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.

Free Certification Courses available:

Coursera – “Data communication Network Services” by Cisco
NPTEL – “Data Communication” by IIT Kharagpur
Swayam – “Computer Networks” by Anand More, Devi Ahilya Vishwavidyalaya, Indore

Expert Faculty:

Dr. Versha Apte, IIT Bombay
Dr. S. Selvakumar, NIT Tiruchirappalli
Dr. T. Kishore Kumar, NIT Warangal
Mr. Jack Lange, University of Pittsburgh, Pennsylvania

BCSL315/BCSP315 CLOUD COMPUTING (online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA	CA	EE	Int	Ext	
1	-	2	3	2	10	15	25	10	15	75

Course Objective:

1. Understand the new technologies for resources sharing
2. Explain classification of Cloud deployment
3. Discuss capacity planning for cloud configuration
4. Understand Cloud service model
5. Cloud Security and privacy issue
6. Cloud business model for cost effectiveness

Course Outcome: Upon successful completion of the course, students shall be able to-

- CO1: State the basics of distributed computing and cloud computing.
CO2: Summarize the technical capabilities and business benefits cloud technology.
CO3: Develop cloud-based application demonstrating its implications
CO4: Develop cost effective solution using cloud technology
CO5 : Develop solution for Society with minimized resources
CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes					Program Specific Outcomes
	PO1	PO2	PO3	PO4	PO5	PSO1
CO1	1	3	3	3	3	-
CO2	-	3	3	3	3	2
CO3	2	3	3	3	3	3
CO4	1	3	2	3	3	3
CO5	1	2	3	2	3	3
CO6	1	3	2	3	3	3

Syllabus

Unit- I: Introduction to Cloud Computing

Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy. Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Hardware-as-a-service: (HaaS), Oriented Architecture (SOA)

Unit – II: Cloud Computing Architectural Framework

Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment.

Unit – III: Cloud Application Development

Role of business analyst, Technical architecture considerations, Service creation environments to develop cloud based applications, Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages, Cloud Economics,

Unit – IV: Cloud Security and Risk Management

Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.

Text Books:

9. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012
10. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
11. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg,

Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference Books:

- 1 Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
- 2 GautamShroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN:978-0521137355]
3. Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]
4. Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010
5. Tim Mather, SubraKumaraswamy, and ShahedLatif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

Certification Courses available:

Sr No	Name	Affiliation	Expertise	Courses
1	Prof Soumya KantiGhosh	IIT Kaharagpur	Cloud Computing	SWAYAM
2	Dr. Rajiv Mishra	IIT Patna	Cloud Computing and Distributed Systems	NPTL
3		https://www.udemy.com/topic/Cloud-Computing(66onlinecoursesofcloud)	Cloud Computing	Udemy

Free Courses available: on UDEMY, NPTEL, CourseEra, MOOC

<https://pages.awscloud.com/TC-Global-Campaign-2019>
<https://www.coursera.org/courses?query=cloud%20computing>
<https://www.udemy.com/introduction-to-cloud-computing/>

Expert Faculty:

S r. N o.	Name	Affiliation	Expertise	Conta ct Detail s

S r. N o.	Name	Affiliation	Expertise	Conta ct Detail s
1	Prof C. L. Wang	BS Nat. Taiwan; MS, PhD S. Calif BEng(CE) Programme Coordinator; Professor University of Hong Kong	Cloud Computing and Virtualization	Tel: (+852) 2857 8458 Fax: (+852) 2559 8447 Email: clwang@cs.hku.hk Home page: http://www.cs.hku.hk/~clwang
2	Prof Debadatta Mishra https://www.cse.iitk.ac.in/users/deba/	Professor, Department of CSE, IIT Kanpur	Cloud Computing	+91(512)259/333/679-2004 deba@cse.iitk.ac.in
3	Prof PurushottamKulkarni	Associate Professor IIT Bombay	Virtualization and Cloud Computing	puru@cse.iitb.ac.in
4	Prof D. JanaKiram	Professor IIT Madras	Cloud, Cluster and Grid Computing	djram@cse.iitm.ac.in

SEMSTER-VI

BFYL144 Mathematics-VIII (Probability & Statistics)(online)

Teaching Scheme				Credits	Evaluation Scheme				
					Theory			Practical	
Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Int	Ext
2	0	0	2		10	15	25		50

Course Objectives :

1. This course introduces a general mathematical concepts and objects.
2. It skill the students to understand important mathematical models used in computer science branch

Course Outcomes :

Upon successful completion of the course, students will be able to:

- 1.Understand the concepts of Random variables.
2. Understand and use special probability distributions

Unit -I Random Variables :

Random Variables, Distribution functions of continuous & discrete random variables, Joint distributions, mathematical expectations, moment, Moment generating function & characteristic function

Unit –II : Special probability distribution:

Binomial, Poisson's, Geometric, Uniform, Exponential, Normal.

Unit-III : Hypothesis testing.

Recommended Reference Books:

1. Kreyszig, E.: Advanced Engineering Mathematics (Eighth Edition); John Wiley & Sons; 2000.
2. Jain, R.K. and Iyengar, S.R.K.; Advanced Engineering Mathematics; Narosa Publishers; 2003.

BCSL321/BCSP321 ADVANCED NETWORKS(offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					Total
					Theory			Practical		
Th.	Tu	Pr	Total Hours		TA	CA	EE	Int	Ext	
1	-	4	5	3	10	15		10	15	50

Course Objectives:

7. To learn about Software Defined Networking.
8. To understand an emerging Internet architectural framework, including the main concepts, architectures, algorithms, protocols and applications
9. To be able to implement Network virtualization framework.

Course Outcomes:

Upon completion of course students will be able to:

13. Design a network with appropriate protocols selected according to requirement.
14. Analyze different routing protocols and traffic engineering methods deployed in networking.
15. Understand the concept of SDN (i.e. abstracting and centralizing the control plane).
16. Analyze the implications of shifting from traditional network architectures to software defined networks.
17. Apply and analyze network functions virtualization.
18. Implement a network service using the knowledge acquired throughout the lectures.

Syllabus

UNIT 1: Routing in Packet Networks

Circuit Switching and Packet Switching, Types of Routing Protocols: Interior and Exterior Gateway protocols, Adaptive and Non-adaptive Routing

Algorithms, Traffic Management at packet level, Traffic management at flow level.

UNIT2: Introduction to Software Defined Networking (SDN)

Evolution of Switches and Control Planes, Centralized and Distributed Control and Data Planes Concepts, Advantages and Disadvantages, OpenFlow protocol. SDN Controller:

General Concepts, Layer 3 Centric, Plexxi, Cisco OnePK, Network Programmability

UNIT 3: Data Center Concepts and Constructs

Technologies for the Data Center, The Multitenant Data Center, The Virtualized Multitenant Data Center, SDN Solutions for the Data Center Network, VLANs, EVPN, VxLan, NVGRE Network Topology and Topological Information Abstraction: Introduction, Network Topology, Traditional Methods, LLDP, BGP-TE/LS, ALTO, I2RS Topology

UNIT 4: Building an SDN Framework

Introduction The Juniper SDN Framework IETF SDN Framework(s) Open Daylight Controller/Framework Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring, Use Cases for Input Traffic Monitoring, Classification, and Triggered Actions, Firewalls as a Service, Network Access Control Replacement, Extending the Use Case with a Virtual Firewall, Feedback and Optimization, Intrusion Detection/Threat Mitigation

UNIT 5: Network Function Virtualization

Introduction, Existing Network Virtualization Framework (VMWare and others), Virtualization and Data Plane I/O, Services Engineered Path, Service Locations and Chaining, NFV at ETSI, Non-ETSI NFV Work

Textbook(s):

5. SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.
6. Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844

References:

1. SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.
2. Network Innovation through Open Flow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
3. Open Networking Foundation (ONF) Documents, <https://www.opennetworking.org>, 2015.
4. Open Flow standards, <http://www.openflow.org>, 2015.
5. Online Reading Lists, including: <http://www.nec-labs.com/~lume/sdn-reading-list.html>, 2015.

Certification Courses available:

1. CompTIA A+ Technician

This entry-level certification is a starting point for a career in IT. Certified A+ techs handle PC maintenance, operating systems, printers, mobile devices and laptops. The CompTIA A+ validates skills hiring managers need from entry-level technicians and often provides entry-level employment opportunities for aspiring IT practitioners without work-related experience.

2. CompTIA Network+

Interested in a networking career? CompTIA Network+ verifies the ability to design, manage and troubleshoot wired and wireless networks. This is another in-demand certification ideal for beginning a career in IT, and serves as a recommended prerequisite for more advanced network training.

3. Cisco Certified Network Associate (CCNA)

Routing and Switching

The CCNA: Routing and Switching is an associate-level certification and assures employers that you're able to install, operate and configure enterprise-level networks. CCNA-certified pros can also detect and solve common network problems. This is a fantastic certification for anyone building a career in networking. With this certification, you also have the options of specializing in security, voice or wireless networking.

4. Microsoft Certified Solutions Expert (MCSE)

Cloud Platform and Infrastructure

The MCSE: Cloud Platform and Infrastructure is an ideal certification for advanced-level practitioners responsible for managing modern data centers. MCSE certification is offered in specializations that include server infrastructure, desktop infrastructure, private cloud, enterprise devices and apps, data platform, business intelligence, messaging, communications and SharePoint.

5. Certified Information Systems Auditor (CISA)

The CISA validates a high-level of audit skills and knowledge, and certifies the ability to identify vulnerabilities, report on compliance and institute controls within an enterprise system. Earn this certification and enjoy an amazing career in IT auditing.

6. Certified Information Systems Security Professional (CISSP)

The CISSP validates skills required to protect large enterprise systems from a host of modern cyber threats. With less than 112,000 practitioners in existence, those with this in-demand certification find lucrative employment opportunities all over the world.

7. AWS Certified Solutions Architect – Associate

The AWS Certified Solutions Architect – Associate validates skills for designing distributed applications and systems on the AWS platform.

This is an ideal certification for anyone wanting to ride the bleeding edge of the IT industry. Get certified in cloud computing and meet the business demands of today and tomorrow.

8. Certified Information Security Manager (CISM)

The CISM is another in-demand certification from ISACA, and validates skills required to design, build and manage enterprise-level security programs. Candidates for this certification will have many years of experience in managing enterprise systems and will fully understand the many enterprise-level risks and vulnerabilities that are involved. Achieve this expert-level certification and become the defender of your enterprise system.

9. Certified in Risk and Information Systems Control (CRISC)

This ISACA certification validates skills required to provide enterprise-level risk management and is arguably the top IT certification in the world. With less than 21,000 current practitioners, job security is essentially guaranteed for those willing to achieve this expert-level credential. Achieve this world-class certification and enjoy all that comes with a rewarding career in risk management.

Free Courses available:

- **Massachusetts Institute of Technology (MIT)**

- MIT offers a free online course in network optimization. The course addresses problems in network flow, like minimum cost and maximum flow.

- Network Optimization

- **Open University**

- Open University offers students an intro to network security course which is designed for advanced-level students. The course takes 25 hours to complete.
- The protocols in multi-service networks course explores communication protocols. Class topics include packet-switched and circuit-switched networks, the OSI (Open Systems Interconnection) reference model, TCP/IP (Transmission Control Protocol/Internet Protocol) architecture and protocol software. This networking course takes 30 hours to complete.

- Network Security

- Protocols in Multi-Service Networks

Expert Faculty:

- **Brad Hedlund**

<https://www.linkedin.com/in/bradhedlund/@BradHedlund>

Brad is the Technical Account Manager for AWS and before that an engineering Architect for VMWare. Brad has extensive hands-on experience and specializes in Cloud networking, data center infrastructure, and network security. Check out an interview with Brad on VMWorld TV.

- **Greg Ferro**

<https://www.linkedin.com/in/etherealmind/@etherealmind>

Greg is one of the co-founders of Packet Pushers

which is a weekly podcast about data networking by networking architects. Greg is a veteran of networking and a prolific writer. Sign up for his [networking newsletter](#) which gives the latest news on networking infrastructure and great hands-on advice too. Greg stated recently on Twitter: "Gonna talk about SD-WAN in 2018. It will be kind of ranty. Ok, maybe a lot ranty."

- **Prof. C P Katti,**
Dean
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Jawaharlal Nehru University, New Delhi
(www.jnu.ac.in/SCSS/default.html)
**BCSL320/BCSP320 INFORMATION SECURITY
AND CRYPTOGRAPHY**
(offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA	CA	EE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objectives:

- This course covers the fundamentals of computer systems security.
- It introduces many different areas of security such as encryption, malicious code, authentication and access control, trusted computer systems, operating system and network security.
- The objective of this course is to provide students with a comprehensive overview of the threats to computer security, technologies for security assurance, and engineering approaches to security solutions.
- Create an ability to understand and use various open source security tools to improve personal information security & network security.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Use the fundamentals of Cryptography and standard algorithms to provide confidentiality, integrity and authenticity.

CO2: Use symmetric and asymmetric key encryption systems

CO3: Analyze various message authentication codes and hash functions.

CO4: Analyze detection and prevention of various attacks

CO5: Use open source tools like wireshark, keylogger etc to protect important data.

CO6: Design secure applications

Course Contents:

Unit-I: Introduction

Introduction to information and network security, Attacks, services, mechanisms, security attacks, security services, a model for internet work security, encryption model, steganography, classical encryption techniques, modern techniques - simplified DES, block cipher principles, data encryption standard, strength of DES, block cipher design principles, block cipher modes of operation.

Unit-II: Confidentiality and Key Management

Confidentiality using conventional encryption: placement of encryption function, random number generation. Public key cryptography: principles, RSA algorithm, key management, diffie-hellman key exchange, elliptic curve cryptography, Chinese remainder theorem, Euclidean algorithm, extended Euclidean algorithm, discrete logarithms, primality testing, Chinese remainder theorem, finite fields.

Unit-III: Message Authentication and Hash Functions

Authentication requirements, functions, codes, security of hash function & MACs. Hash & Mac algorithms. Messages digest, Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions. Digital signatures & authentication protocols, Elgamal digital signature algorithm, digital signature standard.

Unit-IV: Network Security

Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec. Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.

Unit-V: Open Source Tools

Hands-on sessions on open source network & information security tools such as Wireshark, Nmap & Zenmap, CryptoForge, VeraCrypt, Quick Checksum Verifier, KeePass, CrypTool, Metasploit.

Unit-VI: Trends and Applications of Network Security

Recent trends in Computer System & Security, Advanced topics & its Application

Books:

- Cryptography and networks security principles & practice by William Stallings (Pearson Education prentice Hall).
- Networks security Essentials Applications & standards by William Stallings (Pearson Education, LPF).
- Cryptography in C and C++ by Michael Welschenbach (A press IDG Books India).
- Introduction to Data Compression by Khalid Sayood (Morgan kaufmann/Harcourt India).

Reference Book

- Information Security: The Complete Reference, Second Edition 2nd Edition by Mark Rhodes-Ousley ISBN-13:978-0071784351 ,ISBN-10:0071784357
- Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
- Cryptography and Network Security : ForouzanMukhopadhyay, McGraw Hill, 3rd Edition
- Information Security, Principles, and Practice: Mark Stamp, Wiley India.
- Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
- Introduction to Network Security: Neal Krawetz, CENGAGE Learning
- Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

MOOCS Courses:

- NPTEL LINKS:
 - nptel.ac.in/courses/106105031 (IIT K)
 - <https://nptel.ac.in/courses/106105031/39>
 - <https://nptel.ac.in/courses/106106129>
 - https://onlinecourses.nptel.ac.in/noc18_cs24
- MIT Courseware
 - <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/exams/>
- Swayam Courses:
 - <https://swayam.gov.in/course/1303-introduction-to-information-security-i>
 - <https://swayam.gov.in/courses/4957-information-security>
- MOOCS Link
 - <https://www.khanacademy.org/computing/computer-science/cryptography/modarithmetic/a/the-euclidean-algorithm>
 - <https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/intro-to-cryptography>

Open Source Tools:

- Nmap
- OpenVAS
- OSSEC
- Security Onion
- Metasploit Framework
- OpenSSH
- Wireshark
- Kali Linux.
- Snort
- SalesForce
- CiscoPacketTracer
- OpenNMS

- Nikto.
- Truecrypt
- Moloch
- Bro IDS
- Snort
- OSQuery
- GRR - Google Rapid Response
- Omnet++
- Cacti
- NetDisco

Experts:

- Bhaskar Raman, IIT Bombay
- SachinDhedia - Professor - SGA EDUCATION INSTITUTE, Mumbai
- Dr. Abhijeet Das, IIT KGP, abhij@cse.iitkgp.ac.in, +91-3222-282350

BECL204/BECP204 MICROCONTROLLER AND EMBEDDED SYSTEMS(online)

Teaching Scheme				Credits	Continuous Evaluation Scheme				
Th.	Tu	P	Total Hours		Theory			Practical	
					TAE	CAE	ESE	Int	Ext
2	-	2	4	3	10	15	25	10	15
					75				

Course Objectives:

- To study and understand various microcontrollers and embedded systems.
- To understand the design parameters of embedded systems applications.
- To study and impart different tools for embedded system and IoT application design.

COURSE OUTCOMES:

On successful completion of the course, Students shall be able to:

- CO1: Understanding principle of embedded systems and Microcontroller
- CO2: Develop programming for applications develop real time applications
- CO3: Perform interfacing of devices and peripherals
- CO4: Make Use Of ARM7 Controller for Designing of Embedded Applications
- CO5: Understand different IoT platform for Embedded applications
- CO6: Design and Develop different embedded system and IoT applications.

SYLLABUS

Unit 1: Embedded Systems: Introduction to embedded Systems, Requirements /Components of Embedded Systems, Design Process in Embedded System

Microcontrollers: Introduction to microcontrollers, 8051 architecture, Addressing modes and instruction set, 8051 programming in Assembly language and Embedded C.

Unit 2: Programming: Timer, Interrupts and serial communications, Serial I/O, Programming Tools
Interfacing with 8051: ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display, Sensors interfacing (LDR, IR, PIR etc.)

Unit 3: Advanced devices and peripheral interfacing with ATmega16: GSM, GPS, GPRS, Bluetooth

Unit 4: Introduction of 32-bit

Microcontroller: ARM7 Processors, ARM Architecture, Register and Memory organization, Addressing modes, Arm Thumb and instruction sets, Basic Assembly Programming

Unit 5: Advance Microcontroller and

Programming: Introduction to Raspberry PI and Intel Galileo Board, Python Programming, OOP's and Modules in Python Programming.

Unit 6: Design and perform different embedded system and IoT Applications: Robotic, Industrial Automations,

REFERENCE BOOKS:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Shibu K. V.	Introduction to Embedded System,	The McGraw Hill,	2011	
2	Ajay V. Deshmukh	Micro-controllers - Theory and Applications,	Tata McGraw Hill		
3	Kenneth J. Ayala	The 8051 Micro-controller – Architecture, Programming & Applications,	Penram International & Thomson Asia,	1996	Second

TEXT BOOKS:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Muhammad Ali Mazidi	The 8051 Micro-controller & Embedded System using assembly & C	Pearson Education	2008	Second
2	Muhammad Ali Mazidi	ARM Assembly language programming and Architecture			Second
3	RajKamal	Microcontrollers: Architecture, Programming, Interfacing and System Design	Pearson Education India	2009	Second

ONLINE CERTIFICATION AVAILABLE:

Sr. No.	Course Name	Faculty Name	Institute Name	Link
1.	NPTEL video Course on Embedded Systems	Dr. Santanu Chaudhury	IIT-Delhi	https://nptel.ac.in/courses/108102045/#

ST FACULTY MEMBERS FROM IIT/CENTRALLY FUNDED INSTITUTES:

Sr No.	Faculty Name	Institute Name	Contact Details
1.	Dr. Santanu Chaudhury	IIT-Delhi	santanuc@ee.iitd.ernet.in



G H RAISONI COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

Accredited by NAAC with 'A+' Grade

CRPF Gate No.3, Hingna Road, Digdoh Hills, Nagpur – 440 016. (INDIA)

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E-mail: principal.ghrce@raisoni.net Web: ghrce.raisoni.net

DEPARTMENT OF INFORMATION TECHNOLOGY

Institute Vision and Mission

Programme: UG in Information Technology

Vision and Mission:

DEPARTMENT VISION

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies to create technical manpower of global standards with capabilities of accepting new challenges in Information Technology.

DEPARTMENT MISSION

- To equip our graduates with knowledge and expertise to contribute significantly to the knowledge and information industry and continue to grow professionally.
- Promoting collaborative research through special interest groups, research laboratories and Industry Institute Interactions.
- To nurture our graduates interpersonal and entrepreneurial skills to provide leadership in the information industries

Program Education Objectives:

The programme educational objectives of the Information Technology programme are designed to produce competent engineers who are ready to contribute effectively to the advancement of information technology causes and to accommodate the needs of the profession. The graduates shall:

1. Practice Information Technology in the general disciplines of design, development & deployment of software and integration of existing technologies for e-governance nationwide.
2. Apply fundamental technical knowledge and skills to provide workable solutions to problems in various areas of IT.
3. Pursue higher education, research and development and deploy creative efforts in the area of Information Technology.
4. Use the acquired knowledge in societal and environmental sensitive manner with professional ethics in a team

Program Outcomes:

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Programme Specific Outcomes:

Graduate shall be able to:

PSO1 -Ability to develop and apply Engineering conceptual knowledge and practices inprogramming Web based technologies and information management.

PSO 2 - Apply core concepts of information technology in android/iOSApplication& Product Development.

PSO3 -Utilize the hands on experience of industry internship leading to take up challenging jobs in IT industries

B.TECH. INFORMATION TECHNOLOGY

B.TECH. FIRST YEAR SCHEME (INFORMATION TECHNOLOGY) SEMESTER- I

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.	
BFYL101	Matrices	1	1	-	2	2	10	15	25	--	50
BFYL102	Differential & Vector Calculus	1	1	-	2	2	10	15	25	--	50
BEEL101 BEEP101	AC & DC Circuits	1	-	2	3	2	10	15	25	25	75
BEEL102	AC & DC Machine	2	-	-	2	2	10	15	25	--	50
BEEL103	Energy Sources & Audit	1		-	1	1	10	15	--	--	25
BITL101 BITP101	Programming for Problem Solving	1	-	4	5	3	10	15	25	50	100
BECL104	Bio-System in Engg.	1	1	-	2	2	10	15	25	--	50
BCSP101	Data Analytics	-	-	2	2	1	--	--	--	25	25
BECL101 BEC101	Introduction to Digital System	1	1	2	4	3	10	15	25	25	75
BHUP103	Foreign Language	-	-	2	2	1	--	--	--	25	25
BHUP104	Liberal/ Creative Arts	-	-	1	1	0.5	--	--	--	25	25
BFYP131	Waste Management	-	-	2	2	1	--	--	--	25	25
BFYP132	Environmental Science	-	-	1	1	0.5	--	--	--	25	25
TOTAL		9	4	16	29	21	90	135	175	200	600

SEMESTER- II

Subject Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme				
							Theory			Practical	Total Marks
		Th	Tu	Pr	Total Hours		TAE	CAE	ESE	Cont.	
BFYL103	Integral & Multiple Calculus	1	1	-	2	2	10	15	25	--	50
BFYL104	Ordinary & Partial Differential Equations	1	-	-	1	1	10	15	25	--	50
BCSP102	Data Structure	-	-	4	4	2	--	--	--	50	50
BFYP152	Internet of Things	-	-	2	2	1	--	--	--	25	25
BFYL121 BFYP121	Applied Physics	1	1	2	4	3	10	15	25	25	75
BECL102 BEC102	Analog Circuits	1	1	2	4	3	10	15	25	25	75
BEC103	Embedded Programming	-	-	2	2	1	--	--	--	25	25
BMEP102	Digital Fabrication	-	-	4	4	2	--	--	--	50	50
BFYP151	Mini Model through Innovation & Creativity	-	-	4	4	2	--	--	--	50	50
BHUL101 BHUP101	Communication Skills	-	2	2	4	3	10	15	25	50	100
BHUP102	Ethics & Professional Competencies	-	-	2	2	1	--	--	--	25	25
BMBP101	Entrepreneurship	-	-	2	2	1	--	--	--	25	25
TOTAL		4	5	26	35	22	50	75	125	350	600

SEMESTER III													
Course Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Continuous Evaluation Scheme					
								Theory			Practical		Total
			Th.	Tu	Pr.	Total Hour		TAE	CAE	ESE	Int	Ext	
BFYL141	Mathematics-V (Discrete Mathematics)	Offline	1	1	-	2	2	10	15	25	-	-	50
BCSL203/BCSP203	Data Structures and Algorithms	Online Moodle	2	-	2	4	3	10	15	25	10	15	75
BECL320/BECP320	Hardware Description Language	Offline	1	-	2	3	2	10	15	25	10	15	75
BCSP205	Object Oriented Programming	Online Moodle	-	-	4	4	2	-	-	-	25	25	50
BCSL207	Problem Identification & Design Thinking	Activity Based	1	-	-	1	1	10	15	-	-	-	25
BCSL208/BCSP208	Database Management Systems	Online Moodle	2	-	2	4	3	10	15	25	10	15	75
BCSL209	Software Engineering & Project Management	Activity Based	1	1	-	2	2	10	15	25	-	-	50
BAIP201	Foundation Course In Machine Learning	Practical Based	-	-	2	2	1	-	-	-	25	25	50
BAIP202	Skill Development-1(Linear Algebra)	Practical Based	-	-	2	2	1	-	-	-	25	-	25
BHUP202	Reasoning	Online	-	-	1	1	0.5	-	-	-	25	-	25
BHUP203	Quant		-	-	1	1	0.5	-	-	-	25	-	25
BHUP204	Liberal arts	Offline	-	-	1	1	0.5	-	-	-	25	-	25
BHUP205	Business English Certification	Online	-	-	4	4	2	-	-	-	50	-	50
BHUP206	Aptitude 1	Online	-	-	1	1	0.5	-	-	-	25	-	25
Total			8	2	22	32	21	60	90	125	255	95	625

SEMESTER IV													
BFYL142	Mathematics-VI (Graph Theory and Number System)	Online	1	1	-	2	2	10	15	25	-	-	50
BCSL211/ BCSP211	Operating Systems	Activity Based	2	-	2	4	3	10	15	25	10	15	75
BCSL212	Formal languages and Automata	Offline	2	1	-	3	3	10	15	50		-	75
BCSP213	Java Programming	Online Moodle	-	-	4	4	2	-	-	-	25	25	50
BCSP214	Principles in Programming Languages	Online Moodle	-	-	2	2	1	-	-	-	25	25	50
BCSL215/ BCSP215	Big Data	Online	1	-	2	3	2	10	15	25	10	15	75
BCSL216	Software Architecture and Web Services	Activity Based	2	-	-	2	1	10	15	25	-	-	50
BAIL203	Machine Learning Algorithms	Activity Based	2	-	-	2	2	10	15	25			50
BCSLXXX	Open elective-1		2	-	-	2	2	10	15	25			50
BCSP219	Mini Project & Technical Report Writing	Online	-	-	2	2	2	-	-	-	50	-	50
BMBP102	Entrepreneurship Development	Offline	-	-	2	2	1	-	-	-	25	-	25
BHUP207	Soft Employability Skills	Viva-Voce	-	-	1	1	0.5	-	-	-	25	-	25
Total			12	2	15	29	21.5	70	105	200	170	80	625

SEMESTER V

Course Code	Name of the Course	Exam Mode	Teaching Scheme				Credits	Continuous Evaluation Scheme					
								Theory			Practical		Total
			Th.	Tu	Pr.	Total Hour		TAE	CAE	ESE	Int	Ext	
BFYL143	Mathematics-VII (Integral Transforms)	Online	1	-	-	1	1	10	15	25	-	-	50
BCSL316/BCSP316	Design & Analysis of Algorithms	Online	2	-	2	4	3	10	15	25	10	15	75
BCSL309/BCSP309	Compiler Design	Offline	2	-	2	4	3	10	15	25	10	15	75
BCSL317/BCSP317	Data Communication and Networks	Offline	2	-	2	4	3	10	15	25	10	15	75
BCSL315/BCSP315	Cloud Computing	Activity Based	1	-	2	3	2	10	15	25	10	15	75
MBP107	Advanced Communication Skills	Activity based	-	-	4	4	2	-	-	-	50	-	50
BCSP318	Skill Development-3	Online	-	-	2	2	1	-	-	-	25	-	25
BHUP302	Aptitude 2	online	-	-	1	1	0.5				25	-	25
BCSP319	Internship & Technical Report Writing	Activity based	-	-	2	2	1	-	-	-	25	50	75
MBP301	Financial Management for Engineers	Activity based	-	-	1	1	0.5		-	-	25	-	25
XXXX	Elective 1(Humanities)	Activity based	2	-		2	2	10	15	25	-	-	50
XXXX	Elective 2(Science)	offline	2	-		2	2	10	15	25	-	-	50
Total			12	0	18	30	21	70	105	175	190	110	650

SEMESTER VI

BFYL144	Mathematics-VIII (Probability & Statistics)	Online/ Moodle	1	-	-	1	1	10	15	25	-	-	50
BECL218/BECP218	Embedded Systems Design	Online Activity based	2	-	2	4	3	10	15	25	25	25	100
BCSL320/BCSP320	Information Security & Cryptography	Offline Moodle	2	-	2	4	3	10	15	25	10	15	75
BCSL321/BCSP321	Advanced Networks	Offline	1	-	4	5	3	10	15		10	15	50
MBP108	Product Development & IPR		-	-	-	2	2	-	-	-	25	-	25
BHUP303	Aptitude 3	Online	-	-	1	1	0.5	-	-	-	25	-	25
BCSLXXX	Open Elective 2		2	-	-	2	2	10	15	25	-	-	50
BCSP322	Skill Development-4	Online	-	-	2	2	1	-	-	-	25	-	25
BHUP304	Career Development Practice	Activity Based	-	-	2	2	1	-	-	-	25	-	25
BCSLXXX	Elective 3		2	-	-	2	2	10	15	25	-	-	50
BCSLXXX	Elective 4		2	-	-	2	2	10	15	25	-		50
Total			12	0	15	27	19.5	70	105	150	145	55	525

SEMESTER VII												
Course Code	Name of the Course	Teaching Scheme				Cr edi ts	Continuous Evaluation Scheme					
							Theory			Practical		Total
		Th.	Tu	Pr .	Total Hours		TAE	CAE	ESE	Int	Ext	
XXXLXXX	Elective 5	2	-	-	2	2	10	15	25			50
XXXLXXX	Elective 6	2	-	-	2	2	10	15	25			50
XXXLXXX	Elective 7	2	-	-	2	2	10	15	25	-	-	50
XXXLXXX	Elective 8	2	-	-	2	2	10	15	25	-	-	50
XXXLXXX	Elective 9	2	-	-	2	2	10	15	25	-	-	50
BCSP428	Project Phase I	-	-	4	4	4	-	-	-	75	50	125
BCSP432	MOOCs-1	-	-	2	2	2	-	-	-	50	-	50
Total		10	0	6	16	16	50	75	125	125	50	425

SEMESTER VIII												
BCSP430	6 Month Internship	-	-	12	12	12	-	-	-	150	150	300
BCSP433	Project Phase 2	-	-	4	4	4	-	-	-	50	50	100
BCSL432	MOOCs-2	2	-		2	2	-	-	-	50	-	50
	Total	2	-	16	18	18	10	15	25	250	200	450
		First Year Credits				43	First Year Marks				1200	
		Total Credits SE-BE				117	Total Marks SE-BE				3300	
		Grand Total Credits				160	Grand Total Marks				4500	

ELECTIVE : I

BCSL312- COMPUTER GRAPHICS AND VISUALISATION

BCSL414- DATA MINING AND WAREHOUSING

BITL301- JAVA PROGRAMMING

BITL408- DISTRIBUTED DATABASES AND OBJECT ORIENTED DATABASES

ELECTIVE II :

BCSL403- AI AND EXPERT SYSTEMS

BCSL407- ADVANCED COMPUTER ARCHITECTURE

BCSL419- Digital Marketing

BCSL427- Data Analytics

BECL405- DIGITAL SIGNAL PROCESSING

BECL413 - WIRELESS COMMUNICATION

BECL423 - PATTERN RECOGNITION

BCSL432 – Automation with AI

BSCL434 –Artificial Natural Network

BCSL436 – AI in Speech Processing

ELECTIVE III :

BCSL410 - SOFT COMPUTING

BCSL412 – SOFTWARE ARCHITECTURE

BCSL416 - MACHINE LEARNING

BCSL420 – Entrepreneurship

BCSL421 - Blockchain Technology

BECL428 - WIRELESS SENSOR NETWORK

BITL307 - SCRIPTING LANGUAGES

BCSL438 – Applications of AI in Bio Medical

BCSL439 –Applications of AI in Civil Engineering

ELECTIVE IV :

BECL425 - REAL TIME OPERATING SYSTEM

BECL409 - DIGITAL IMAGE PROCESSING

BITL407 - ADVANCED WEB TECHNOLOGIES

BITL410 - SOFTWARE TESTING

BCSL310- MOBILE COMPUTING

BCSL415 -CLOUD COMPUTING

BCSL422 - Big Data and Hadoop

BCSL435 - AI in Video Processing

BCSL440 – Applications of AI in Industry 4.0

ELECTIVE-V

BITL309 - CYBER LAWS

BCSL311 - E-COMMERCE

BITL411 - ENTERPRISE RESOURCE PLANNING

BCSL417 - BIO INFORMATICS

BCSL423 - Artificial Intelligence and Machine Learning

BCSL433 – AI in AgriTech

BCSL437 – Applications of AI Financial Sector

BCSL441 – Applications of AI Embedded System

SEMESTER-III

BFYL141 MATHEMATICS-V (DISCRETE MATHEMATICS) (Offline)

Teaching Scheme				Credits			Evaluation Scheme						
					Theory						Practical		Total
Th.	Tu	Pr.	Total		TAE	CAE	ESE	Exam Mode	Int.		Ext.		
1	1	0	2	2	10	15	25					50	

Course Objectives :

- 1.This course introduces size and kind of objects.
- 2.It also skills to analyze objects meeting the criteria, finding "largest", "smallest", or "optimal" objects.
- 3.It also introduces combinatorial structures and apply algebraic techniques to combinatorial problems.

Course Outcomes :

Upon successful completion of the course, students will be able to:

1. Apply concept of Set theory.
2. Understand and use concepts of Groups and Rings
3. Apply the concepts of Lattices and Boolean algebra in computer science engg.

Unit -I: Set Theory (10 hrs)

Operations on sets, Laws of algebra of sets, Representation of sets on computer in terms of 0's & 1's. Partition & covering of a set, ordered pair, Product set, Relation–Different types of relations, Graph of relation, Matrix of relation, Transitive closure of relation, Properties of relations, Compatible relation. Functions, Partial ordering & partially ordered set, Hasse diagram of Poset, Totally ordered set, Peano axioms & Mathematical Induction.

Unit –II:Group and Rings (12 hrs)

Algebra or Algebraic systems like semigroup, monoid, and examples. Homomorphism, Isomorphism of semigroup&monoid.Groups, properties of algebraic groups. Permutations groups, Subgroups, Cosets, Lagranges theorem, properties of cyclic groups, generator of group, Homomorphism, quotient group. Rings , Fields and Integral domain

Unit -III: Lattices and Boolean algebra (8 hrs)

Lattice as Poset& as algebraic system, Types of lattices, Hasse diagrams, Sublattice, direct product of Lattices Lattice Homomorphism, complement of elements of lattices, Various lattices, composition tables, Lattice B_n . Boolean algebra; Boolean Expressions, Equivalence of Boolean Expression by tables, Simplification of circuit & equivalent circuit by truth tables.

Recommended Reference Books:

4. Discrete mathematical structure with application to computer science; Trembley&Manohar; Mc. Graw Hill,2011
5. Discrete Mathematical Structure ; Busby & Ross ; PHI, 2009
6. Discrete Mathematics ; John Truss ; Addison Wesley

BECL207/BECP201 HARDWARE DESCRIPTION LANGUAGE(Offline)

Scheme of the Course:										
Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total Marks
Theory	Tutorial	Practical	Total Hours		TA	CA	ESE	Int.	Ext.	
1	-	2	3	2	10	15	25	10	15	75

Course Objectives:

Apply Boolean algebra and other techniques to express and simplify logic expressions.
Analyze and design combinational and sequential digital systems.
Use different techniques among them a hardware description language and a programming language, to design digital systems.

Course Outcomes

- CO6. Student shall be able toConceptualize of digital systems and the use of Boolean algebra in logic analysis and design
- CO7. Understanding of RTL design and verification techniques and methodologies
- CO8. Understand the principles and methodology of digital logic design at the gate and switch level, including both combinational and sequential logic elements.
- CO9. introduce basic tools of logic design and provide hands-on experience designing digital circuits
- CO10. appreciate the uses and capabilities of a modern FPGA platform

Course Contents:

Unit 1. Introduction to Hardware Description Languages:

Combinational Logic, Structural Modeling, Sequential Logic, More Combinational Logic, Parameterized Modules, Test benches

Unit 2.

Sequential circuit Sequential circuit: Latches and flip-flops, counters, shift register, Finite state machine; representation and synthesis.

Unit 3.

FPGA architecture and synthesis Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation

Unit 4.

Semiconductor memories, PALs, PLAs and FPGAs; Pipelining and timing issues, PROMs (DRAMs, Flash memory etc.)

Text Books :

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog	Douglas Smith	Doone publications	1998	1st
2	Verilog HDL, A guide to Digital Design and Synthesis	Samir Palnitkar	Prentice Hall		1st

Reference Books:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	FPGA based Prototyping Methodology Manual	Doug Amos, Austin Lesea, Rene Richter	Synopsis Press		
2	Introduction to Reconfigurable Computing, Architectures, Algorithms	Christophe Bobda	Springer Netherlands.		
3	Writing Testbenches: Functional Verification of HDL Model	Janick Bergeron	Springer	2003	2nd

BCSP210 ELECTIVE V-ARTIFICIAL INTELLIGENCE (Online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
Th	Tu	Pr	Total Hours		Theory			Practical		Total
-	-	2	2	1	TA	CA	ES	In	Ex	
-	-	2	2	1	-	-	-	25	25	50

Course Objectives:

- Be able to formulate machine learning problems corresponding to different applications.
- Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes: Upon completion of the course students shall be able to:

- 1. Recall the basic concepts and techniques of artificial Intelligence
- 2. Classify machine learning algorithms to solve real time problems of moderate complexity.
- 3. Gain experience of doing independent study and research through case studies.

Unit I: Artificial Neural Networks

Introduction to Artificial Intelligence, Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing, The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptron, Backpropagation Algorithm

Unit II: Probability & Statistical Analysis

Introduction to Bayesian Function, Mean, Median & Mode, Linear Regression, Multiple Regression, Logistic Regression, Normal Distribution, Binomial Distribution, Poisson Regression, Analysis of Covariance, Time Series Analysis, Nonlinear Least Square, Decision Tree, Random Forest, Survival Analysis, Chi Square Tests

UNIT III: Case Study of Artificial Intelligence using Nvidia.

Text Books:

1. *Introduction to machine learning*, Ethem Alpaydin. — 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
2. Introduction to artificial neural systems, J. Zurada, St. Paul: West.
3. R in a Nutshell, 2nd Edition - O'Reilly Media.

Reference Books:

3. Machine Learning, Tom M Mitchell.
4. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

Resource Persons

Mr. Vivek Patole,
Head Product Engineering & Development at Iknowlation, Research Labs Pvt. Ltd, Pune

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Anupam Basu
Professor

PhD (IIT Kharagpur)
Joined Institute in 1984
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Free Courses:

Sr. No.	Artificial Intelligence course name	Offered by
1	Artificial Intelligence	EDX
2	Intro to Artificial Intelligence	Udacity's
3	Artificial Intelligence: Principles and Techniques	Stanford university
4	Artificial Intelligence for Robotics by	Georgia Tech Udacity

BCSL208/BCSP208 Database Management System (Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme						
					Theory			Exam Mode	Practical		Total
Th.	Tu	Pr.	Total Hours		TA	CA	EE		Int	Ext	
2	-	2	4	3	10	15	25	Online	10	15	75

Course Objective:

- This course introduces general idea of database management system.
- It is aimed at developing skills to design databases using data modeling and design techniques.
- It is also aimed at developing skills to implement real life applications which involve database handling.
- This course also provide carrier opportunities in subject areas of designing, storage techniques and data handling and managing techniques

Course Outcome: Upon successful completion of the course, students shall be able to-

- CO1: Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms and design appropriate data model for it.
- CO2: Demonstrate an understanding of various normalization forms and apply knowledge of normalization for creation of database.

- CO3: Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database and perform inferential analysis of data model
- CO4: Demonstrate query processing and able to design optimized query execution plan.
- CO5: Perform basic transaction processing and management and ensure database security, integrity and concurrency control
- CO6: Demonstrate the management of structured and unstructured data management with recent tools and technologies

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes				Programme Specific Outcomes	
	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	2	3	-	2	-	3
CO2	-	3	2	2	2	3
CO3	-	2	-	3	2	2
CO4	3	3	2	2	3	3
CO5	3	3	1	2	2	3
CO6	1	3	-	3	3	3

Syllabus

Unit I - Introduction to DBMS, DBMS Architecture, Data Models, UML

Unit II - Relational Database design: Functional Dependency (FD) – Basic concepts, closure of set of FD, closure of attribute set, Decomposition, Normalization – 1NF, 2NF, 3NF, BCNF, 4NF.

Unit III - SQL Concepts : Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, Save point. Cursors, Stored Procedures, Stored Function, Database Triggers

Unit IV - Query Processing & Query Optimization: Overview, measures of query cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views

Unit V - Transaction Management: Transaction concepts, properties of transactions, serializability

of transactions, Two- Phase Commit protocol, Deadlock, two-phase locking protocol

Unit VI -NoSQL Databases - Introduction, CRUD Operations, Data Mining, XML

Text Books:

3. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2002.
4. Jeff Ullman, and Jennifer Widom, A First Course in Database systems, 2nd Ed.

Reference Books:

5. G. K. Gupta : "Database Management Systems", McGraw – Hill.
6. Regina Obe, Leo Hsu, PostgreSQL: Up and Running, 3rd Ed, O'Reilly Media 2017.
7. Kristina Chodorow, Shannon Bradshaw, MongoDB: The Definitive Guide, 3rd Ed, O'Reilly Media 2018.
8. RamezElmasri and ShamkantNavathe, Fundamentals of Database Systems 2nd Ed, Benjamin Cummings, 1994.

Certification Courses available:

1. <http://infolab.stanford.edu/~ullman/fcdb.html>
2. <https://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir/>

Free Courses available:

1. Database Systems Concepts & Design - [Udacity, edx] - Free Course (<https://in.udacity.com/course/database-systems-concepts-design--ud150>)
2. <https://www.edx.org/course/database-systems-concepts-and-design>
- 3.Database Management System - Swayam (<https://swayam.gov.in/course/220-database-management-system>)
4. Database Management System - NPTEL (https://onlinecourses.nptel.ac.in/noc18_cs15/preview)

Expert Faculty:

1. P. Sreenivasa Kumar, IIT Madras
2. S. Sudarshan, IIT Bombay (Email: sudarsha@cse.iitb.ac.in URL: <http://www.cse.iitb.ac.in/~sudarsha> Tel: +91.22 2576 7714 (Dept. Office: 2576 7700))
3. David G. Sullivan PhD, Senior Lecturer on Computer Science, Boston University Location: Maxwell-Dworkin G125

BCSL207 PROBLEM IDENTIFICATION & DESIGN THINKING (Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
Th	Tu	Pr	Total Hours		Theory			Practical		Total
					TA	CA	ESE	Int	Ext	
1	-	-	1	1	10	15	-	-	-	25

Course Objective:

4. Introduce students to a discipline—design thinking—that enhances innovation activities in terms of value creation, speed, and sustainability. Be exposed to architectural styles and views
5. Strengthen students' individual and collaborative capabilities to identify problems/issues/needs, develop sound hypotheses, collect and analyze appropriate data, and develop ways to collect meaningful feedback in a real-world environment
6. Teach students to translate broadly defined opportunities into actionable innovation possibilities and recommendations for key stakeholders and their organizations

Course Outcome: Upon successful completion of the course, students shall be able to:

4. Have an awareness of how design thinking can be applied in a wide range of contexts, from the personal to the global
5. Initiate an attitude of playfulness to aid design thinking
6. Use computing tools and online environments to aid design thinking.

Syllabus

UNIT I: Why Design Thinking and The Design Process provides context and an introduction to key concepts, terminology, and structure for the course, Scoping, The Design Brief and Visualization introduces ways to clarify the scope of a project and its intent, questions to explore, target stakeholders, and establishes the importance of pictures and storytelling in the overall process

UNIT II: Fundamentals of Ethnography and Identifying Insights reviews how to observe users in their natural habitat and efficiently extract useful patterns from collected data Establishing Design Criteria and Brainstorming shows how to develop a succinct expression of the ideal end state of a project, and deliberately generate many fresh alternatives to the status quo

UNIT III: Concept Development and The Napkin Pitch details how to choose the best ideas, assemble them into detailed solutions, and rationally evaluate them, as well introduce a simple, consistent format for summarizing and communicating new concepts. Assumptions Testing and Prototyping introduces a tool for surfacing key assumptions underlying the attractiveness of a new concept and using data to assess the likelihood that they are true, as well as ways to create visual manifestations of concepts..

Text Books:

7. Jeanne Liedtka and Tim Ogilvie Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia University Press, 2011)

Reference Books:

8. Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm (Profile Books, 2002)
9. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
10. Roger Martin, *The Design of Business: Why Design Thinking Is The Next Competitive Advantage* (Harvard Business Review Press, 2009)
11. Alexander Osterwalder and Yves Pigneur, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (John Wiley and Sons, 2010)
12. Nigel Cross, *Design Thinking: Understanding How Designers Think and Work* (Bloomsbury Academic, 2011)

Certification Courses available:

4. <https://www.coursera.org/learn/uva-darden-design-thinking-innovation>
5. <https://www.edx.org/course/introduction-to-design-thinking-1/>
6. <https://in.udacity.com/course/intro-to-the-design-of-everyday-things--design101>

Expert Faculty:

3. Tim Zak, Associate Teaching Professor, Heinz College, Director—Institute for Social Innovation
4. Dr Deepak John Mathew of IIT Hyderabad

BCSL 203/BCSP203 Data Structure and Algorithms (Online)

BCSL203/ BCSP203

Teaching Scheme				Credits		Continuous Evaluation Scheme					
					Theory				Practical		Total
Th.	Tu	Pr.	Total Hours		TA	CA	ESE	Exam Mode	Int	Ext	
2	-	2	4	3	10	15	25	Online	10	15	75

Course Objective:

1. This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
2. It's also aimed at developing skill to implement methods to solve specific problems using basic data structures.
3. The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.

Course Outcome: Upon successful completion of the course, students shall be able to-

- CO1: Describe data structures and understand when it is appropriate to use. **(Remembering)**
 CO2: Understand algorithms for data searching and sorting. **(Understanding)**
 CO3: Apply linear and nonlinear data structures to solve various real world computing problems. **(Applying)**
 CO4: Structuring to Relate use of Abstract data types & ways in which they can be stored, accessed and manipulated. **(Analyzing)**
 CO5: Evaluate critical, independent and quantitative problems using various data structures. **(Evaluating)**
 CO6: Design the hierarchical data structure with minimum complexity for real world problem. **(Creating)**

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes			Programme Specific Outcomes	
	PO2	PO3	PO4	PSO1	PSO2
CO1	3	2	3	1	
CO2	2	3	3	2	
CO3	3	3	3	2	1
CO4	3	3	3	3	2
CO5	3	3	3	2	3
CO6	2	3	3	3	3

Syllabus

Unit I: Arrays & Pointers

Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Multidimensional Arrays, Pointers; Pointer Arrays, Dynamic Memory Management.

Unit II: Sorting and Searching

Introduction: Sorting; Bubble Sort, Insertion Sort, Selection Sort, Merging, Searching; Linear Search, Binary Search.

Unit III: Linked List

Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation and Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Circularly Linked Lists, Doubly Linked Lists.

Unit IV: Stacks, Queue and Recursion

Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Application of Stacks, Recursion, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques and Applications of Queues.

Unit V: Trees and Graphs

Introduction: Binary Trees, Representing Binary Tree in Memory, Traversing Binary Trees, Binary Search Trees, Searching, Inserting and Deletion in a Binary Search Tree, Introduction & Graph Theory

Terminology, Sequential Representation of Graphs, Operations on Graphs, Traversing a Graph.

Unit VI:

Project based Learning ,Splay Tree, AVL Tree, Red and Black Tree, Floyd and WarshellTechnique, Height Balance Tree.

Text Books:

- 1.AVAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
- 2.THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.

Reference Books:

1. Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
2. MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)

Certification Courses available:

Sr.N o.	Name of the course	MOOC's/ SWAYAM/NPTEL	Link	Duration of Course	Name of Expert	Affiliation
1	Programing Data Structure and Algorithm	SWAYAM	https://swayam.gov.in/course/4422-programming-data-structures-and-algorithms	8 weeks (certification Course)	Sudarshanlyengar	IIT Madras

Free Courses available:

Sr.N o.	Name of the course	MOOC's/ SWAYAM/NPTEL	Link	Duration of Course	Name of Expert	Affiliation
1	Programing, Data Structures and Algorithms using Python	NPTEL	https://nptel.ac.in/courses/106106145/ https://onlinecourses.nptel.ac.in/noc18_cs34	8 weeks (from 28 January 2019 to 22 March 2019)	Prof. MadhavanMukund	Chennai Mathematical Institute
2	Data Structure and Algorithm	NPTEL	https://nptel.ac.in/courses/106102064/	8 weeks (Video Lectures)	Dr. Naveen Garg	IIT DELHI
3	Programing Data Structure	NPTEL	https://nptel.ac.in/courses/106106133/	8 weeks (Video)	Dr. N S. Narayanaswamy Prof.	IIT Madras

Sr.N o.	Name of the course	MOOC's/ SWAYAM/NPTEL	Link	Duration of Course	Name of Expert	Affiliation
	and Algorithm				Shankar Balachandran Prof. Hema A Murthy ,IIT Madras	

Expert Faculty:

1. Dr. Naveen Garg, Department of Computer Science and Engineering Indian Institute of Technology, Delhi.
2. Yogesh Simmhan, Assistant Professor, Department of Computational and Data Sciences (CDS), Indian Institute of Science (IISc), Bangalore.

BCSP205 OBJECT ORIENTED PROGRAMMING (Online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th.	Tu	Pr.	Total Hours		TA E	CAE	ES E	Int	Ext	
-	-	4	4	2	-	-	-	25	25	50

Course Objective:

1. This course introduced features of object oriented programming.
2. The course provide carrier opportunities in implementation of various applications as object oriented concepts plays dominant role in software development.

Course Outcome: Upon successful completion of the course, students shall be able to–

CO 1: Articulate the principles of object oriented programming using C++

CO 2: Understand function overloading, constructor overloading, operator overloading, polymorphism & its uses in programming.

CO3: Implement inheritance concepts and its use for application development

CO4: Analyze of dynamic memory allocation and its use for software development

CO5: Implement concept of file handling in real life problems

CO6: Implement a project for real world problems

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes						Programme Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 11	PSO1	PSO2

CO1	1	2	2	3	-	-	-
CO2	-	3	3	2	-	2	2
CO3	-	3	3	2	1	2	3
CO4	-	3	1	3	3	2	3
CO5	-	3	3	2	2	2	3
CO6	-	3	3	3	3	3	3

Syllabus

Unit-I: Principles of Object Oriented Programming -

Introduction to OOPS: Differences between C and C++. A look at procedure Oriented programming, object oriented programming paradigm, basic concepts of OOP, Headers & Name Spaces

Unit-II: Functions & Polymorphism -

Functions, Types of Functions, Constructor, Destructor, Function overloading & Ambiguity, Operator Overloading, Function Overriding, Friend Function

Unit-III: Inheritance & Virtual Functions -

Inheritance and the access specifier, Types of Inheritance, Pointers and references to derived types, Virtual Functions

Unit-IV: Pointers & Dynamic allocations -

Static & Dynamic allocation using new and delete, * and ->* operators, Creating conversion functions, this pointer.

Text Books:

1. Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications
2. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH

Reference Books:

1. Let's C++ by Y. Kanetkar, BPB publications
2. Object oriented programming with C++, E Balagurusamy, 4th edition, TMH
3. Object-Oriented Programming with C++, SouravSahay, Oxford University Press

Certification Courses Available:

Name of Course: Programming In C++ (NPTEL)
Link: <https://nptel.ac.in/courses/106105151/>
https://onlinecourses.nptel.ac.in/noc18_cs32

Duration of Course: 8 Weeks (from 28 January 2019 to 22 March 2019)

Name of Expert: Prof. ParthaPratim Das
Affiliation: IITKharagpur

Expert Faculty:

Name of Expert: Prof. ParthaPratim Das

Affiliation: IITKharagpur

BCSL209 SOFTWARE ENGINEERING AND PROJECT MANAGEMENT(Offline)

Teaching Scheme				Credit s	Continuous Evaluation Scheme					
Th	T	Pr	Total Hour s		Theory			Practical		Total
.	.	.	.	.	TA E	CA E	ES E	In t	Ex t	I
1	1	-	2	2	10	15	25	-	-	50

Course Objectives:

The student should be made to:

- Understand the phases in a software project
 - Understand fundamental concepts of requirements engineering and Analysis Modelling.
 - Understand the major considerations for enterprise integration and deployment.
 - Learn various testing and maintenance measures
- Course Outcomes:** At the end of the course, the student should be able to
- Identify the key activities in managing a software project.
 - Compare different process models.
 - Concepts of requirements engineering and Analysis Modeling.
 - Apply systematic procedure for software design and deployment.
 - Compare and contrast the various testing and maintenance

CO Mapping with PO and PSO:

Course Outcom es	Programme Outcomes						Programme Specific Outcomes	
	PO 1	PO 2	PO 3	PO 5	PO 8	PO1 1	PSO 1	PSO 2
CO1	3	2	3	-	-	3	-	-
CO2	3	2	3	-	-	3	-	-
CO3	2	3	3	2	1	3	3	2
CO4	2	3	3	-	-	3	3	3
CO5	3	-	3	1	-	3	-	3
CO6	3	2	3	3	-	3	3	3

Syllabus

UNIT I: SOFTWAREPROCESS

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis – Risk Management.

UNIT II: REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System

requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III: SOFTWARE DESIGN

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV: TESTING AND IMPLEMENTATION

Software testing fundamentals-Internal and external views of Testing-white box testing – basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques: Coding practices-Refactoring.

UNIT V: PROJECT MANAGEMENT

Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II – Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM – Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics.

Text Books:

- Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2010.

Reference Books:

- Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
- Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
- PankajJalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
- Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
- Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.
- <http://nptel.ac.in/>.

Certification Courses available:

<https://nptel.ac.in/downloads/106105087/>

Free Courses available:

<https://swayam.gov.in/course/236-software-engineering>

Expert Faculty:

Dr. Madhuri Bhavsar Nirma University

Total Experience 25 Year

Educational Qualification Ph.D.

Research Area High Performance Computing, Software Engineering, Networking, Cloud Computing and Software Engineering

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SEMSTER-IV

BFYL142 COURSE NAME: MATHEMATICS-VI (GRAPH THEORY AND NUMBER SYSTEM) (Online)

Teaching Scheme				Credits	Evaluation Scheme						Duration of Paper
					Theory			Practical		Total	
Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.		
1	1	0	2	2	10	15	25			50	2

Course Objectives :

- 1.This course introduces size and kind of objects.
- 2.It also skills to analyze objects meeting the criteria, finding "largest", "smallest", or "optimal" objects.
- 3.It also introduces combinatorial structures and apply algebraic techniques to combinatorial problems.

Course Outcomes :

Upon successful completion of the course, students will be able to:

1. Know data structure used to represent different kinds of objects viz Graph, Trees
2. Know the basics of combinatorial structure and develop algebraic technique to solve combinatorial problems.
3. Programming application of group, ring and number theory.

Unit -I: Graph Theory

Graphs and its types, subgraph, Quotient graph, Euler path, Complete path, indegreeoutdegree, reachability, cycle, matrix representation of graph. Transitive closure of graph, Adjacency matrix, Trees, Venn diagram, Representation of trees, binary trees, spanning trees, Prims algorithm.

Unit -II: Combinatorics

Definition of generating functions and examples, proof of simple combinatorial identities, Probab. $G.F. p(t) = \sum p_n t^n$, $E(x) = p'(t)$, examples. Recursive relations: definitions & examples, explicitly formula for sequence, back tracking to find explicit formula of sequence, solving recurrence relations. Counting Theorem Principle of counting, Permutation & Combination with examples. Pigeon hole principle.

Unit -III: Number Theory:

The study of continued fractions .alpha has Infinite continued fraction if alpha is irrational. Alpha has periodic continued fractions if alpha is quadratic irrational. Application to approximation of irrationals by rationals. Hurwitz's theorem, Advanced topic on Combinatorial Theory

Recommended Reference Books:

- Discrete mathematical structure with application to computer science; Trembley&Manohar; Mc. Graw Hill,2011
- Discrete Mathematical Structure ; Busby & Ross ; PHI, 2009
- Discrete Mathematics ; John Truss ; Addison Wesley

BCSL211/BCSP211 OPERATING SYSTEM (Online)

Teaching Scheme					Theory			Practical		Total
Th	T	Pr	Total Hours	Credits	TA	CA	ES	In t	Ex t	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

- Introduces general idea, structure and functions of operating system
- Making students aware of basic mechanisms used to handle processes, memory, storage devices and files.

Course Outcome: Upon successful completion of the course, students shall be able to-

- Identify basic structure and purpose of operating system.
 - Interpret the concepts of process and illustrate various CPU scheduling algorithms.
 - Interpret the concepts of inter process communication.
 - Schematize Deadlock & security mechanisms in operating systems.
 - Analyze different memory management techniques with advantages and disadvantages.
- CO Mapping with PO and PSO:

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	P02	P03	P04	P05	PSO1	PSO2
CO1	2	-	1	3	-	1

CO2	2	-	3	-	2	2
CO3	3	3	-	-	2	3
CO4	3	-	2	-	2	2
CO5	3	-	3	2	3	2
CO6	-	-	2	3	2	2

Syllabus

Unit-I

Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation.

Unit-II

Process & Its Scheduling

Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms,

Unit-III

Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems

Unit-IV

Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation

Unit-V

File systems: File concept, Access methods space allocation strategies, disk arm scheduling strategies. Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging , Virtual Memory Concepts, page faults and instruction restart , page replacement algorithms , working sets , Locality of reference, Thrashing, Garbage Collection.

TEXT BOOKS :

- Operating System concepts – Silberchatz& Galvin, Addison Wesley, 6 thEdn.
- Modern Operating Systems – Tanenbaum, Pearson Edn. 2 ndedn.

REFERENCE BOOKS :

- Operating Systems – S R Sathe, Macmillan Publishers, India, 2008
- Operating System –Milan Milenkovik, McGraw-Hill, 1987
- Operating Systems - 3 rd Edition by Gary Nutt, Pearson Education.

Certification Courses available:

By Edureka

4. Linux Administration
5. UNIX Shell Scripting
6. Linux Fundamentals

Free Courses available:

UDACITY: Introduction to Operating Systems by Georgia Institute of Technology

Expert Faculty:**4. Debadatta Mishra**

Assistant Professor

Computer Science and Engineering
Indian Institute of Technology Kanpur
email: deba@cse.iitk.ac.in

5. MythiliVutukuru

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Indian Institute of Technology, Bombay
mythili@cse.iitb.ac.in

6. SoravBansal

Department of Computer Science and Engineering
Indian Institute of Technology, Delhi
sbansal@cse.iitd.ac.in

BCSL212 FORMAL LANGUAGE AND AUTOMATA(Offline)

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	I n t	E x t	
2	1	-	3	3	10	15	50		-	75

Course Objectives:

7. To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
8. To introduce the fundamental concepts of formal languages, grammars and automata theory.
9. Classify machines by their power to recognize languages.
10. Employ finite state machines to solve problems in computing.
11. To understand deterministic and non-deterministic machines.
12. To understand the differences between decidability and un-decidability.

Course Outcomes:

6. Able to understand the concept of abstract machines and their power to recognize the languages.

7. Able to employ finite state machines for modeling and solving computing problems.
8. Able to design context free grammars for formal languages.
9. Able to distinguish between decidability and undecidability.
10. Able to gain proficiency with mathematical tools and formal methods.

Syllabus

Unit-I: Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with ϵ - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without ϵ -moves – Equivalence of finite Automaton.

UNIT-II: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

UNIT-III: Context-Free Grammars: Chomsky hierarchy of languages. Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tree, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Push Down Automata; Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

UNIT-IV: Definitions of Turing machines – Models – Computable languages and functions – Techniques for Turing machine construction – Multi head and Multi tape Turing Machines – The Halting problem – Partial Solvability – Problems about Turing machine

UNIT-V: Un-decidability: A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines, Post's Correspondence Problem, Other Undecidable Problems, Intractable Problems: The Classes P and NP, An NP-Complete Problem.

TEXT BOOKS:

- Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
- Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.

REFERENCE BOOKS:

- Introduction to Languages and The Theory of Computation, John C Martin, TMH.

Course Outcomes	Program Outcomes					Program Specific Outcomes	
	PO2	PO3	PO5	PO8	PO1	PSO1	PSO2
CO1	2	3	-	-	2	-	2
CO2	2	3	-	-	3	-	3
CO3	2	3	-	-	3	3	3
CO4	2	3	2	-	3	-	3
CO5	2	3	2	2	3	3	3
CO6	2	3	2	-	3	3	3

- Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
- A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
- Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
- Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekar, 2nd edition, PHI.

Certification Courses available:

<https://nptel.ac.in/courses/111103016/>

Free Courses available:

Expert Faculty:

Prof. Diganta Goswami
Department of Computer Science and Engineering
Indian Institute of Technology, Guwahati

Prof. Kamala Krithivasan
Department of Computer Science and Engineering
Indian Institute of Technology, Madras

BCSP213 JAVA PROGRAMMING (Online)

Teaching Scheme					Theory			Practical		Total
Th.	Tu	P	Total Hours	Credits	TA	CA	ES	Int	Ext	
-	-	4	4	2	-	-	-	25	25	50

Course Objective:

1. This course introduces fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
2. It is aimed at building software development skills using java programming for creating real world applications.
3. Use a development environment to design, code, test, and debug simple programs, including multi-file source projects, in an object-oriented programming language

Course Outcome: Upon successful completion of the course, students shall be able to–

- **CO 1:** Explain the basic data types and control flow constructs using J2SE.

- **CO 2:** Make use of Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper for program development.
- **CO3:** Design object oriented class structures with parameters, constructors, and utility.
- **CO4:** Implement a final project selected from an approved project chosen by the student.

CO Mapping with PO and PSO

Syllabus

Unit I: Introduction to JAVA, Class and Object

Introduction to data types, operators and control statements, Classes: fundamentals of classes, declaring objects, Assigning objects, reference variables, methods, constructor, variable handling. Methods and classes: Overloading methods, understanding static and final.

Unit II: Array, Packages, Interface

Introduction to Array, Vectors, Wrapper class & Inheritance, Packages and interface: Packages, access protection, importing packages, interfaces.

Unit III: Exception Handling & Multithreaded Programming

Exception handling: Fundamentals exception types, uncaught exception, try-catch, displaying description of an exception, multiple catch clauses, nested try statements, throw, finally, built in exceptions, creating own exception subclasses, JAVA thread model, creating thread, creating multiple thread.

Unit IV: Applet, Graphics Programming and Database Connectivity

Introduction to applet, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling.

Database Connectivity: JDBC (Java Data Base Connection), Introduction to JDBC, Databases and Drivers, Types of Driver, Loading a driver class file, establishing the Connection to Database with different Driver. Executing SQL queries by result Set using Statements

Text Books:

1. The Complete Reference by Herbert Schild, TMH Publication
2. Programming with Java- A Primer by E. Balagurusamy, 3rd Edition, TMH Publication

Reference Books:

10. The Complete Reference- JAVA 2- 3rd Edition By Patrick Naughton, TMH Publication.
11. Java 6 Programming Black Book by Kogent Solution Inc., Dreamtech Press Publication.
12. Java 2 Black Book by Steve Holzner, Paraglyph Press, 2nd Ed.

Certification Courses available:**Name of Course:** Java Programming (NPTEL)**Link:**<https://nptel.ac.in/courses/106106147/5>**Duration of Course:** 2 Weeks**Name of Expert:** Prof. Pushpedra Singh**Affiliation:** Indraprasth Institute of Information Technology Delhi**Name of Course:** Java Programming (SWAYAM)**Link:**<https://swayam.gov.in/courses/4104-spoken-tutorial-java-oriya>**Duration of Course:** 16 Weeks**Name of Expert:** Prof. Kannan Moudgalya**Affiliation:** IIT Bombay**Expert Faculty:****Expert 1:****Name of Expert:** Prof. Pushpedra Singh**Affiliation:** Indraprasth Institute of Information Technology Delhi**Expert 2:****Name of Expert:** Prof. Kannan Moudgalya**Affiliation:** IIT Bombay**BCSP214 PRINCIPLES OF PROGRAMMING LANGUAGE(Online)**

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	Int	Ext	
-	-	2	2	1	-	-	-	25	25	50

Course Objective:

1. This course introduces the general ideas of programming concepts.
2. Making students aware of basic programming paradigms, the principles and techniques involved in design and implementation of it.
3. It is aimed at developing skills to provide frameworks specifying and reasoning about programming languages.

Course Outcome: Upon successful completion of the course, students shall be able to-

1. Recognize programming paradigm and design principles.
2. Demonstrate different data types and their specification.
3. Illustrate the generic subprograms and its structure.

CO Mapping with PO and PSO

Course Outcomes	Program Outcomes	Program Specific Outcomes

	PO2	PO3	PO5	PSO1	PSO2
CO1	3	3		2	3
CO2	3	2		2	2
CO3	3	2		3	2

Syllabus**Unit I:** Introduction to Programming language

Definition of Programming language, Implementation of high-level languages, Data elements, binding time. Concept of r-value and l-value and their implementation. Language paradigms.

Unit II: Data Types and Object

Data type, Type checking and type conversion, elements of specification and implementation of data type. arrays Files and i/o, Generic functions, Objects. Inheritance and Encapsulation Abstract data type, Inheritance and type of Inheritance, encapsulation, Implementation of new data types,

Unit III: Exception Handling and sequence control

Exception Handling in Various Languages, Programming Events, Handling Large Databases, Special Languages, Sequence control, Implicit and explicit sequence control, implementation of case statement, recursive and non-recursive subprogram.

Text Books:

1. Programming Languages, 1st edition by T.W. Pratt and M.V. Zelkowitz & T. V. Gopal by Pearson Education, 2008
2. Programming Languages, Ravi Sethi, Addison Wesley.
3. Programming Languages: Paradigm and Practices by Doris Appleby and J. J. Vandekopple, McGraw Hill.
4. Concepts of Programming Languages by Robert W. Sebesta, Pearson Education.

Reference Books:

1. Principles of programming languages by Gilles Dowe, Springer-verlag, London Limited 2009
2. Concepts in programming languages by John C. Mitchell copyright, Cambridge University press 2003
3. Principles of Programming Languages: Design, Evaluation, and Implementation by Bruce J. MacLennan third Edition, 1999 by oxford university press. Inc.
4. Programming Languages: Application and Interpretation, 2003-07, Shriram Krishnamurthi, United States License

Certification Courses available:

2. <https://www.udemy.com/fundamentals-of-programming/>

Free Courses available:

6. <https://nptel.ac.in/courses/106106145/26>
7. <https://nptel.ac.in/courses/106106145/28>

8. <https://nptel.ac.in/courses/106106145/37>
9. <https://nptel.ac.in/courses/106106145/38>
10. <https://nptel.ac.in/courses/106106145/35>

Expert Faculty:

1. Prof. MadhavanMukund, Department of Computer Science and Engineering, Indian Institute of Technology, Madras.
2. Prof: S. ArunKumar, Department of Computer Science and Engineering, Indian institute of Technology, Delhi.
3. Prof: S. Arun Kumar, Department of Computer Science and Engineering, Indian institute of Technology, Delhi

BCSL215/BCSP215 BIG DATA(Online)

Teaching Scheme					Theory			Practical		Total
T h.	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	Int	Ext	
1	-	2	3	2	10	15	25	10	15	75

Course Outcome:

Upon successful completion of the course, students shall be able to-

CO1: Understand basic concepts and techniques of Hadoop ecosystem and Big data.

CO2: Design different component of Hadoop ecosystem.

CO3: Understand the domain of data science and analysis of big data.

Syllabus

UNIT 01: Big data, challenges for processing big data, technologies support big data, History of Hadoop, Use cases of Hadoop, The Data Scientist, Big Data Analytics in Industry Verticals, Data Analytics Lifecycle, Hadoop Distributed File System, Significance of HDFS in Hadoop, Features of HDFS, Data Storage in HDFS.(07Hrs.)

UNIT 02: Map Reduce: Map Reduce Story, Map Reduce Architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Data Flow Engines and other memory databases.(06Hrs.)

UNIT 03: Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Execution in Pig, Loading data, Exploring Pig Latin commands, Hive introduction, Hive architecture. Data types and schemas, Partitions and buckets, Spark Shell, Spark Application, Flume, SQOOP introduction and application. (06Hrs.)

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 3rd edition, O'Reilly Media.
2. Big Data (Black Book), Wiley
3. V. Prajapati, "Big Data Analytics with R and Hadoop", PacktPub.

Reference Books:

1. V. Ankam, Big Data Analytics, Packt Pub Ltd.
2. N. Dasgupta, Practical Big Data Analytics, Packt Pub Ltd.

Certification Courses available:

1. <https://www.udemy.com/big-data-hadoop-the-complete-course/>
2. <https://www.cloudera.com/more/training/certification.html>
3. <https://www.edureka.co/big-data-and-hadoop>
<https://www.simplilearn.com/big-data-and-analytics/big-data-and-hadoop-training>

Free Courses available:

4. <https://nptel.ac.in/courses/106106142/> ----- Algorithm for Big data
5. <https://nptel.ac.in/courses/106104135/48> ---- Big data
6. <https://nptel.ac.in/courses/106106168/22> ----- HDFS

Expert Faculty:

4. Dr. R.B.V. Subramaanyam, National Institute of Technology, Warangal.
5. Animesh Mukherjee, Indian Institute of Technology, Kharagpur.
6. Mr. ValaAfshar, Boston, MA, USA. Area of interest: Digital Marketing, Social Business, Link: <https://www.cmswire.com/author/vala-afshar/>

BCSL216SOFTWARE ARCHITECTURE & WEB SERVICES(Online)

Teaching Scheme					Theory			Practical		Total
Th .	T u	P r.	Total Hours	Credits	TA E	CA E	ES E	Int	Ext	
2	-	-	2	1	10	15	25	-	-	50

Course Objective:

4. Understand software architectural requirements
5. Be exposed to architectural styles and views
6. Be familiar with architectures for emerging technologies

Course Outcome: Upon successful completion of the course, students shall be able to:

4. Design software architecture for large scale software systems.

- Describe a software architecture using various documentation approaches and architectural description languages.
- Use well-understood paradigms for designing new systems.

Syllabus

UNIT I: Introduction to Software Architecture

Introduction: What is software architecture?, Standard Definitions, Architectural structures, Influence of software architecture on organization both business and technical, Architecture Business Cycle: Introduction, Functional requirements, Technical constraints, Quality Attributes: Quality Attribute Workshop, Documenting Quality attributes, Six part scenarios.

UNIT II: UML Modelling

UML diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns, documenting software architecture, reconstructing software architecture, Issues in Software Architecture: Scalability and interoperability issues, web application architectures.

UNIT III: Introduction to Web Services & XML

Web Service Architecture, Web Services VS other Technologies, Web Services Benefits, DTD VS XSD, What is XML Parsing?, Various other XML Binding API's, JAX-P API based XML parsing using (SAX, DOM), Validating XML Documents using JAX-Vp, XML Binding using JAX-B (Marshalling, Un-Marshalling and In-Memory Validation)

Text Books:

- Len Bass, Paul Clements, and Rick Kazman, "Software Architectures Principles and Practices", 2nd Edition, Addison-Wesley, 2003.
- Anthony J Lattanze, "Architecting Software Intensive System. A Practitioner's Guide", Auerbach Publications, 2010.

Reference Books:

- Mary Shaw, David Garlan, Software architecture: perspectives on an emerging discipline. Prentice-Hall, 1996.
- Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Pattern-oriented software architecture, Volume 1: A system of patterns, Wiley, 1996.
- Douglas Schmidt, Michael Stal, Hans Rohnert, Frank Buschmann, Pattern-Oriented Software Architecture, Volume 2: Patterns for Concurrent and Networked Objects, Wiley, 2000.
- Martin Fowler, Patterns of Enterprise Application Architecture, Addison-Wesley, 2000.
- Selected research papers, and Articles related to state-of-the-art technologies and standards.

Certification Courses available:

- <https://www.coursera.org/learn/software-architecture>
- <https://www.udemy.com/basics-of-software-architecture-design-in-java/>
- <https://in.udacity.com/course/software-architecture-design--ud821>

Free Courses available:

- <https://www.coursera.org/learn/software-architecture>
- <https://www.udemy.com/basics-of-software-architecture-design-in-java/>
- <https://in.udacity.com/course/software-architecture-design--ud821>

Expert Faculty:

- Prof. Rajib Mall is Professor, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, West Bengal.
- Prof. N.L. Sardais Professor, Department of Computer Science and Engineering, Indian Institute of Technology Bombay.

BCSP217 MACHINE LEARNING(Online)

Teaching Scheme					Theory			Practical		Total
Th	T	Pr	Total	Credit	TA	CA	ES	In	Ex	
-	-	2	2	1	-	-	-	25	25	50

Course Objectives:

- Be able to formulate machine learning problems corresponding to different applications.
- Be able to apply machine learning algorithms to solve problems of moderate complexity.

Course Outcomes: Upon completion of the course students shall be able to:

- CO1. Recall the basic concepts and techniques of Machine Learning.
- CO2. Summarize and compare a range of machine learning algorithms along with their strengths and weaknesses
- CO3. Develop skills of using recent machine learning software for solving practical problems.

Unit I: Understanding Machine Learning

Introduction, What Is Machine Learning? , Examples of Machine Learning Applications, Learning Associations, Supervised&Unsupervised Learning, Reinforcement Learning, Classification, Regression

Unit II: Applying R-Programming

R - Basic Syntax, Data Types, Variables, Operators, Decision Making, Loops, Functions, Strings, Vectors, Lists, Matrices, Arrays, Factors, Data Frames, Packages-chart & graphs

UNIT III: Clustering & Application of ML

Introduction to clustering, k-Means Clustering, Hierarchical clustering, Introduction to Chat Bot, creation of Chat Bot

Text Books:

1. *Introduction to machine learning*, Ethem Alpaydin. — 2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.

2. *Introduction to artificial neural systems*, J. Zurada, St. Paul: West.

2. *R in a Nutshell*, 2nd Edition - O'Reilly Media.

Reference Books:

13. *Machine Learning*, Tom M Mitchell.

14. *The Elements of Statistical Learning*, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer

Resource Persons

Mr. Vivek Patole,
Head Product Engineering & Development at
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Anupam Basu

Professor

PhD (IIT Kharagpur)

Joined Institute in 1984

Phone: 283462(o), 283463(r)

Email: anupam[at]cse.iitkgp.ernet.in

Free Courses:

Sr. No.	Machine Learning course name	Offered by
1	Machine Learning by Andrew Ng	Stanford COURSERA
2	Intro to Machine Learning	Udacity's
3	Learning from Data (Introductory Machine Learning)	EDX
4	Statistical Machine Learning	CARNEGIE MELON UNIVERSITY
5	Neural Networks for Machine Learning	Coursera
6	Google's Deep Learning	Udacity's
7	R Tutorial on Machine Learning	Kaggle
8	Principles of Machine Learning	EDX
9	Machine Learning Specialization	Coursera

SEMSTER-V

BFYL143 Mathematics-VII (Integral Transforms)
(online)

Teaching Scheme				Credits	Evaluation Scheme					
					Theory			Practical		Total
Th.	Tu	Pr.	Total		TAE	CAE	ESE	Int.	Ext.	
1	0	0	1	1	10	15	25			50

1. Analyze problems, recognize appropriate methods of solution, solve the problems and find the solutions.

2. Apply principles from mathematics to solve applied problems in engineering.

Course Outcomes

Upon successful completion of the course, students will be able to:

- Understand and use Laplace- transform to solve engineering problems.
- Apply the concept of z-Transform to solve difference equations
- Apply the concepts of Numerical methods to solve engineering problems

Unit -I: Laplace Transforms: (10 hrs)

Laplace transform: definition and their simple properties, transform of derivatives and integrals, evaluation of integrals by L.T. ,inverse L.T. & its properties , convolution theorem, Laplace transforms of periodic function & unit step function,

Unit -II: Z-Transforms:

The Z transform- definition & properties, inverse & relation with Laplace Transform. Application to z-transform to solve difference equations with constant coefficients.

Unit-III: Application :

applications of Laplace and Z-Transform transforms
Recommended Reference Books:

- Kreyszig, E.: *Advanced Engineering Mathematics* (Eighth Edition); John Wiley & Sons; 2000.
- Jain, R.K. and Iyengar, S.R.K.; *Advanced Engineering Mathematics*; Narosa Publishers; 2003.

BCSL316/BCSP316 DESIGN AND ANALYSIS OF ALGORITHMS(online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th.	Tu	Pr.	Total Hours		TA E	CA E	ES E	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. This course introduces students the general idea of analysis and design of algorithms while making them aware of basic methods of algorithm analysis and design.
2. It is also aimed at developing skills to solve real life applications which involve algorithm development.
3. The course also provides career opportunities in analysis, design and optimization technique in algorithms.

Course Outcome: Upon successful completion of the course, students shall be able to-

Upon successful completion of the course, students will be able to

5. Apply basic concepts of algorithm in analysis and Design of algorithms.
6. Identify and apply methods used for analysis and Design of Algorithm
7. Develop an appropriate mathematical formulations in designing algorithm
8. Use advanced techniques and tools available for algorithm analysis and development

CO Mapping with PO and PSO

Course Outcomes	Program Outcomes					Program Specific Outcomes	
	PO1 :	PO 2	PO 3	PO4 :	PO 5	PSO 1	PSO 2
CO1	2	3	3	-	-	2	3
CO2	-	3	3	3	-	2	3
CO3	-	-	3	3	-	3	2
CO4	-	-	2	2	-	2	3

Syllabus**Unit – I: Mathematical foundations**

summation of arithmetic and geometric series, n , n^2 , bounding summations using integration, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, Complexity calculation of various standard functions, Principles of designing algorithms

Unit – II: Asymptotic notations

Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, application of amortized analysis, Sorting networks, comparison networks, biotonic sorting network.

Unit – III :Advanced data structures

Advanced data structures like Fibonacci heap, Binomial heap, disjoint set representation, red and black trees and their applications. Divide and conquer basic strategy, matrix operation, binary

search, quick sort, merge sort, fast fourier transform.

Unit – IV :Greedy Method & Dynamic Programming

Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc. Dynamic Programming basic strategy, multistage graphs, all pairs shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem, Maximum flow networks.

Unit V:Traversal And Search Techniques

Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, graph coloring, Hamiltonian cycles etc

UnitVI: Completeness Problems And Applications

NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, decision and optimization problems, Computational Geometry, Approximation algorithm and concepts based on approximation algorithms. Recent trends in Design and analysis of algorithms, advanced topics & its Application.

Text Books:

1. Thomas H. Cormen et. al. "Introduction to Algorithms", Prentice Hall of India.
2. Design & Analysis of Computer Algorithms by Aho., Horowitz, Sahani, Rajsekharam, Pearson education

Reference Books:

1. "Computer Algorithms", Galgotia Publications Pvt. Ltd. Brassard, Bratley, "Fundamentals of Algorithms", Prentice Hall
2. Computer Algorithms: Introduction to Design and analysis, 3rd Edition, By Sara Baase & A. V. Gelder Pearson Education.

Certification Courses available:

- 1) Design and Analysis of Algorithms CS161, Stanford School of Engineering
<https://online.stanford.edu/courses/cs161-design-and-analysis-algorithms>
- 2) EdX course on Algorithm Design and Analysis, University of Pennsylvania
<https://www.edx.org/course/algorithm-design-analysis-pennx-sd3x>

Free Courses available:

- 1) MOOCs Free Online Courses in Algorithm Design:
<https://www.class-central.com/tag/algorithm-design>

2) NPTEL course on Design and Analysis of Algorithms:
<https://www.class-central.com/course/npTEL-design-and-analysis-of-algorithms-3984>

Expert Faculty:

- 1) Prof. Abhiram Ranade, Department of Computer Science Engineering, IIT Bombay
- 2) Prof. Madhavan Mukund, Chennai Mathematical Institute
- 3) Prof. Madhavan Mukund, Chennai Mathematical Institute

BCSL309/BCSP309 COMPILER DESIGN

(offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr.	Total Hours		TA	CA	ESE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. This course introduces student general ideas of compiler.
2. This course introduces to use regular languages to describe the lexical elements of a programming language and understand syntax analysis.
3. Aimed to develop skills to understand optimization technique

Course Outcome: Upon successful completion of the course, students shall be able to-

7. Understand basic concepts of compiler and different phases of compiler.
8. Explain the role of a semantic analyzer and describe the purpose of a syntax tree.
9. Apply context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables.
10. Demonstrate lexical analysis using a finite automata along with error recovery.
11. Apply optimization techniques to intermediate code and generate machine code for high level language program.
12. Implement the knowledge and skills necessary to develop a language translator or compiler covering a broad range of engineering and scientific applications.

CO Mapping with PO and PSO

Course Outcomes	Program Outcomes							Program Specific Outcomes	
	PO 2	PO 3	PO 4	PO 5	PO 6	PO 11	PO 12	PS O1	PS O2
CO1	3	-	-	3	-	1	2	3	1
CO2	3	3	-	3	1	1	2	3	1

CO3	3	2	-	2	-	-	1	3	-
CO4	2	-	3	2	-	-	-	2	-
CO5	3	3	1	2	-	-	-	2	-
CO6	2	-	3	2	-	-	-	2	-

Syllabus

UNIT I INTRODUCTION TO COMPILERS

Overview of compiler and translator, types of Compiler, Analysis of the Source Program, The Phases of a compiler, grouping of phases, Cousins of the Compiler, design of lexical Analysis, compiler writing tools – bootstrapping

UNIT II SYNTAX ANALYSIS

Review of Context-Free Grammars – Derivation trees and Parse Trees, Ambiguity. Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL(1) Grammars. Bottom-Up Parsing: Shift Reduce parsing – Operator precedence parsing (Concepts only) LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables.

UNIT III Semantic Analysis

Need of semantic analysis, Abstract Parse trees for Expressions, variables, statements, functions and class declarations, Syntax directed definitions, Syntax directed translation schemes for declaration processing, type analysis, scope analysis, Symbol Tables (ST), Organization of ST for block structure and non block structured languages, Symbol Table management.

UNIT IV Intermediate code generation and error recovery

Intermediate code generation: Intermediate languages, Design issues, Translation of different language features, different types of intermediate forms. Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

UNIT V CODE OPTIMIZATION

Principal Sources of Optimization-DAG-Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

UNIT VI Recent Trends

Recent trends and Compiler tools, advanced topics & its Application. Virtual Machines and Interpretation Techniques, Just-In-Time (JIT) and Adaptive Compilation, Runtime System Architectures and Automatic Memory Management Techniques.

Text Books:

3. Alfred V. Aho, Monica S. Lam, R. Sethi and J.D. Ullman "Compilers: principles, techniques and tools" Pearson Education.

4. "Modern Compiler Implementation in ML" by Andrew W. Appel, Cambridge University Press, 1998.

Reference Books:

- Kenneth C Loudon, "Compiler Construction Principle and Practice", PWS publishing Company, 1997
- Dhamdhere D.M., "Compiler Construction Principle and Practice", Mac. Millan India, New Delhi, 1983
- Holub, A.J., "Compiler design in C" –Prentice Hall, 1982
- John Levine, Tony Mason & Doug Brown, "Lex and Yacc", O'Reilly, 1995

Certification Courses available:

3. <https://nptel.ac.in/courses/106108052/9>
4. <https://nptel.ac.in/courses/106104123/10>

Free Courses available:

1. The lex and Yacc page <http://dinosaur.compilertools.net/>
2. <http://www.personal.kent.edu/~rmuhamma/Compilers/compiler.html>
3. <http://www.cs.sjsu.edu/~louden/cmptext/>
4. <http://www.gtoal.com/software/CompilersOneOhOne/>
5. <http://lambda.uta.edu/cse5317/notes/node4.html>

Expert Faculty:

3. Prof. Y. N. Srikant, Department of Computer Science and Automation, Indian Institute of Science, Bangalore.
4. Prof. S. K. Aggarwal, Dept. of Computer Science and Engineering, Indian institute of Technology, Kanpur

BCL317/BCSP317 DATA COMMUNICATION AND NETWORKS (Offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA	CA	ESE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objective:

1. This course introduces student's basics of data communication and networking while making them aware of functions of each layer in architecture.
2. The course provide career opportunities in design, implement, operate & manage enterprise work.
3. Understand advanced technique such as Data encoding and Compression.

Course Outcomes:

Upon successful completion of the course, students will be able to

1. Understand Basics of data communications and Computer Networks
2. Identify the techniques involved in the data transfer process
3. Understand advanced technique such as Data encoding and Compression
4. Recognize the need for OSI reference Model in computer networking
5. Use different elementary protocols for communication and identify IEEE standards employed in Computer networking
6. Design techniques involved in developing transport and application layer of Computer Networking

CO Mapping with PO and PSO:

Course Outcomes	Programme Outcomes					Programme Specific Outcomes	
	PO 1	PO 2	PO 4	PO 5	PO1 1	PSO 1	PSO 2
CO1	1	3	3	-	-	3	2
CO2	-	3	2	-	-	2	-
CO3	-	-	3	-	2	3	2
CO4	1	3	2	2	2	3	2
CO5	1	3	3	-	-	2	-
CO6	-	-	2	2	2	3	2

SYLLABUS

Course

UNIT

I:

Content:

Introduction

Introduction: Data Communications, Networks, The Internet, Protocols and Standards, Network Models, Layered Tasks, The OSI Model, Layers in the OSI Model, TCP/IP Protocol Suite, Addressing, Physical Layer and Media, Data and Signals, Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance, Digital Transmission, Digital-to-Digital Conversion, Analog-to-Digital Conversion, Analog Transmission, Digital-to-analog Conversion, Analog-to-analog Conversion

UNIT

II:

II

Physical

Layer

Bandwidth utilization: Multiplexing and Spreading, Multiplexing, Spread Spectrum, Transmission Media, Guided Media, Unguided Media: Wireless, Switching, Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of a Switch, Using Telephone and Cable Networks for Data Transmission, Telephone Networks, Dial-up Modems, Digital Subscriber Line, Cable TV Networks, Cable TV for Data Transfer

UNIT

III:

Data

Link

Layer

Error Detection and Correction, Introduction, Block Coding, Linear Block Codes, Cyclic Codes, Checksum, Data Link Control, Framing, Flow and Error Control, Protocols, Noiseless Channels,

HDLC, Point-to-Point Protocol, Multiple Access, Random Access, Aloha, Controlled Access, Channelization, IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet, IEEE 802.11, Bluetooth, Backbone Networks, and Virtual LANs, Connecting Devices, Backbone Networks, Virtual LANs, Cellular Telephony, Satellite Networks, Sonet/SDH, Architecture, Sonet Layers, Sonet Frames, STS Multiplexing, Sonet Networks, Virtual Tributaries, Virtual-Circuit Networks: Frame Relay and ATM, Frame Relay, ATM, ATM LANs

UNIT IV: Network layer
 Network Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Network Layer: Internet Protocol, Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Network Layer: Address Mapping, Error Reporting and Multicasting, Address Mapping, ICMP, IGMP, ICMPv6, Network Layer: Delivery, Forwarding and Routing, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols

UNIT V: Transport Layer

Transport Layer: Process-to-Process Delivery: UDP, TCP and SCTP, Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, SCTP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control, Two Examples, Quality Service, Techniques to improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks

UNIT VI: Application Layer

Application Layer: Domain Name System, Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS Messages, Types of Records, Registrars, Dynamic Domain Name System (DDNS), Encapsulation, Remote Logging, Electronic Mail and File Transfer, Remote Logging, Telnet, Electronic Mail, File Transfer, WWW and HTTP: Architecture, Web Documents, HTTP, Network Management: SNMP, Network Management System, Simple Network Management Protocol (SNMP), Multimedia, Digitizing Audio and Video, Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice over IP

TEXT

1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan, TMH.
 2. Computer Networks, A.S.Tanenbaum, 4th Edition, Pearson education.

REFERENCE

1. Introduction to Data communications and Networking, W.Tomasi, Pearson education.
 2. Data and Computer Communications, G.S.Hura

and M.Singhal, CRC Press, Taylor and Francis Group.

3. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.

4. Understanding communications and Networks, 3rd Edition, W.A.Shay, Cengage Learning.

Free Certification Courses available:

Coursera – “Data communication Network Services” by Cisco

NPTEL – “Data Communication” by IIT Kharagpur
 Swayam – “Computer Networks” by Anand More, Devi Ahilya Vishwavidyalaya, Indore

Expert Faculty:

Dr. Versha Apte, IIT Bombay

Dr. S. Selvakumar, NIT Tiruchirappalli

Dr. T. Kishore Kumar, NIT Warangal

Mr. Jack Lange, University of Pittsburgh, Pennsylvania

BCSL315/BCSP315 CLOUD COMPUTING

(online)

Teaching Scheme				Credits	Continuous Evaluation				
					Theory			Practical	Total
					TA	CA	ESA	Int	
1	-	2	3	2	10	15	25	10	75

Course Objective:

1. Understand the new technologies for resources sharing
2. Explain classification of Cloud deployment
3. Discuss capacity planning for cloud configuration
4. Understand Cloud service model
5. Cloud Security and privacy issue
6. Cloud business model for cost effectiveness

Course Outcome: Upon successful completion of the course, students shall be able to-

CO1: State the basics of distributed computing and cloud computing.

CO2: Summarize the technical capabilities and business benefits cloud technology.

CO3: Develop cloud-based application demonstrating its implications

CO4: Develop cost effective solution using cloud technology

CO5 : Develop solution for Society with minimized resources

CO Mapping with PO and PSO:

Syllabus

Unit- I: Introduction to Cloud Computing

Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy. Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Hardware-as-a-service: (HaaS), Oriented Architecture (SOA)

Unit – II: Cloud Computing Architectural Framework

Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment.

Unit – III: Cloud Application Development

Role of business analyst, Technical architecture considerations, Service creation environments to develop cloud based applications, Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages, Cloud Economics,

Unit – IV: Cloud Security and Risk Management

Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management.

Text Books:

12. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012
13. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
14. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011

Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Reference Books:

- 1 Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Course Outcomes	Program Outcomes					Program Specific Outcomes
	PO1	PO2	PO3	PO4	PO5	PSO1
CO1	1	3	3	3	3	-
CO2	-	3	3	3	3	2
CO3	2	3	3	3	3	3
CO4	1	3	2	3	3	3
CO5	1	2	3	2	3	3
CO6	1	3	2	3	3	3

2. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN:978-0521137355]

3. Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]

4. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010

5. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

Certification Courses available:

Sr No	Name	Affiliation	Expertise	Courses
1	Prof Soumya Kanti Ghosh	IIT Kharagpur	Cloud Computing	SWAYAM
2	Dr. Rajiv Mishra	IIT Patna	Cloud Computing and Distributed Systems	NPTEL
3		https://www.udemy.com/topic/Cloud-Computing/ (66 online courses of cloud)	Cloud Computing	Udemy

Free Courses available: on UDEMY, NPTEL, CourseEra, MOOC

<https://pages.awscloud.com/TC-Global-Campaign-2019>

<https://www.coursera.org/courses?query=cloud%20computing>

<https://www.udemy.com/introduction-to-cloud-computing/>

Expert Faculty:

S r. N o.	Name	Affiliation	Expertise	Contact Details
1	Prof C. L. Wang	BS Nat. Taiwan; MS, PhD S. Calif BEng(CE) Program Coordinator; Professor University of Hong Kong	Cloud Computing and Virtualization	Tel: (+852) 2857 8458 Fax: (+852) 2559 8447 Email: clwang@cs.hku.hk Home page: http://www.cs.hku.hk/~clwang
2	Prof Debadatta Mishra https://www.cse.iitk.ac.in/users/deba/	Professor, Department of CSE, IIT Kanpur	Cloud Computing	+91(512)259/333/679-2004 deba@cse.iitk.ac.in
3	Prof Purushottam Kulkarni	Associate Professor IIT Bombay	Virtualization and Cloud Computing	puru@cse.iitb.ac.in
4	Prof D. JanaKiram	Professor IIT Madras	Cloud, Cluster and Grid Computing	djram@cse.iitm.ac.in

SEMESTER-VI

BFYL144 Mathematics-VIII (Probability & Statistics)(online)

Teaching Scheme				Credits	Evaluation Scheme					
Th	Tu	Pr	Total Hours		Theory			Practical		Total Marks
2	0	0	2		TAE	CAE	ESE	Int	Ext	50

Course Objectives :

1. This course introduces a general mathematical concepts and objects.
2. It skill the students to understand important mathematical models used in computer science branch

Course Outcomes :

Upon successful completion of the course, students will be able to:

1. Understand the concepts of Random variables.
2. Understand and use special probability distributions

Unit -I Random Variables :

Random Variables, Distribution functions of continuous & discrete random variables, Joint distributions, mathematical expectations, moment, Moment generating function & characteristic function

Unit –II : Special probability distribution:

Binomial, Poisson's, Geometric, Uniform, Exponential, Normal.

Unit-III : Hypothesis testing.

Recommended Reference Books:

3. Kreyszig, E.: Advanced Engineering Mathematics (Eighth Edition); John Wiley & Sons; 2000.
4. Jain, R.K. and Iyengar, S.R.K.; Advanced Engineering Mathematics; Narosa Publishers; 2003.

BCSL321/BCSP321 ADVANCED NETWORKS(offline)

Teaching Scheme				Credits	Continuous Evaluation					
					Theory			Practical		Total
Th.	Tu	Pr	Total Hours		TAE	CAE	ESE	Int	Ext	
1	-	4	5	3	10	15		10	15	50

Course Objectives:

10. To learn about Software Defined Networking.
11. To understand an emerging Internet architectural framework, including the main concepts, architectures, algorithms, protocols and applications
12. To be able to implement Network virtualization framework.

Course Outcomes:

Upon completion of course students will be able to:

19. Design a network with appropriate protocols selected according to requirement.
20. Analyze different routing protocols and traffic engineering methods deployed in networking.
21. Understand the concept of SDN (i.e. abstracting and centralizing the control plane).
22. Analyze the implications of shifting from traditional network architectures to software defined networks.
23. Apply and analyze network functions virtualization.
24. Implement a network service using the knowledge acquired throughout the lectures.

Syllabus

UNIT 1: Routing in Packet Networks

Circuit Switching and Packet Switching, Types of Routing Protocols: Interior and Exterior Gateway protocols, Adaptive and Non-adaptive Routing

Algorithms, Traffic Management at packet level,
Traffic management at flow level.

UNIT2: Introduction to Software Defined Networking (SDN)

Evolution of Switches and Control Planes,
Centralized and Distributed Control and Data
Planes Concepts, Advantages and Disadvantages,
OpenFlow protocol, SDN Controller:

General Concepts, Layer 3 Centric, Plexxi,
Cisco OnePK, Network Programmability

UNIT 3: Data Center Concepts and Constructs

Technologies for the Data Center, The Multitenant
Data Center, The Virtualized Multitenant Data
Center, SDN Solutions for the Data Center Network,
VLANs, EVPN, VxLan, NVGRE Network Topology
and Topological Information Abstraction:
Introduction, Network Topology, Traditional Methods,
LLDP, BGP-TE/LS, ALTO, I2RS Topology

UNIT 4: Building an SDN Framework

Introduction The Juniper SDN Framework IETF
SDN Framework(s) Open Daylight
Controller/Framework Use Cases for Bandwidth
Scheduling, Manipulation, and Calendaring, Use
Cases for Input Traffic Monitoring, Classification,
and Triggered Actions, Firewalls as a Service,
Network Access Control Replacement, Extending
the Use Case with a Virtual Firewall, Feedback and
Optimization, Intrusion Detection/Threat Mitigation

UNIT 5: Network Function Virtualization

Introduction, Existing Network Virtualization
Framework (VMWare and others), Virtualization
and Data Plane I/O, Services Engineered Path,
Service Locations and Chaining, NFV at ETSI,
Non-ETSI NFV Work

Textbook(s):

7. SDN: Software Defined Networks, An Authoritative
Review of Network Programmability Technologies,
By Thomas D. Nadeau, Ken Gray Publisher:
O'Reilly Media, August 2013, ISBN: 978-1-4493-
4230-2, ISBN 10: 1-4493-4230-2.
8. Software Defined Networks: A Comprehensive
Approach, by Paul Goransson and Chuck Black,
Morgan Kaufmann, June 2014, Print Book ISBN:
9780124166752, eBook ISBN : 9780124166844

References:

1. SDN and OpenFlow for Beginners by
Vivek Tiwari, Sold by: Amazon Digital Services, Inc.,
ASIN: , 2013.
2. Network Innovation through Open Flow and
SDN: Principles and Design, Edited by Fei Hu,
CRC Press, ISBN-10: 1466572094, 2014.
3. Open Networking Foundation (ONF) Documents,
<https://www.opennetworking.org>, 2015.
4. Open Flow standards, <http://www.openflow.org>,
2015.
5. Online Reading Lists, including: <http://www.nec-labs.com/~lume/sdn-reading-list.html>, 2015.

Certification Courses available:

1. CompTIA A+ Technician

This entry-level certification is a starting point for a
career in IT. Certified A+ techs handle
PC maintenance, operating systems, printers,
mobile devices and laptops. The CompTIA
A+ validates skills hiring managers need from
entry-level technicians and often provides entry-
level employment opportunities for aspiring IT
practitioners without work-related experience.

2. CompTIA Network+

Interested in a networking career? CompTIA
Network+ verifies the ability to design, manage
and troubleshoot wired and wireless networks. This
is another in-demand certification ideal for
beginning a career in IT, and serves as a
recommended prerequisite for more advanced
network training.

3. Cisco Certified Network Associate (CCNA)

Routing and Switching

The CCNA: Routing and Switching is an associate-
level certification and assures employers that
you're able to install, operate and configure
enterprise-level networks. CCNA-certified pros can
also detect and solve common network problems.
This is a fantastic certification for anyone building a
career in networking. With this certification, you
also have the options of specializing in security,
voice or wireless networking.

4. Microsoft Certified Solutions Expert (MCSE)

Cloud Platform and Infrastructure

The MCSE: Cloud Platform and Infrastructure is an
ideal certification for advanced-level
practitioners responsible for managing modern data
centers. MCSE certification is offered in
specializations that include server infrastructure,
desktop infrastructure, private cloud, enterprise
devices and apps, data platform, business
intelligence, messaging, communications and
SharePoint.

5. Certified Information Systems Auditor (CISA)

The CISA validates a high-level of audit skills and
knowledge, and certifies the ability to
identify vulnerabilities, report on compliance and
institute controls within an enterprise system. Earn
this certification and enjoy an amazing career in IT
auditing.

6. Certified Information Systems Security Professional (CISSP)

The CISSP validates skills required to protect large
enterprise systems from a host of modern
cyber threats. With less than 112,000 practitioners
in existence, those with this in-demand certification
find lucrative employment opportunities all over the
world.

7. AWS Certified Solutions Architect – Associate

The AWS Certified Solutions Architect – Associate
validates skills for designing distributed
applications and systems on the AWS platform.

This is an ideal certification for anyone wanting to ride the bleeding edge of the IT industry. Get certified in cloud computing and meet the business demands of today and tomorrow.

8. Certified Information Security Manager (CISM)

The CISM is another in-demand certification from ISACA, and validates skills required to design, build and manage enterprise-level security programs. Candidates for this certification will have many years of experience in managing enterprise systems and will fully understand the many enterprise-level risks and vulnerabilities that are involved. Achieve this expert-level certification and become the defender of your enterprise system.

9. Certified in Risk and Information Systems Control (CRISC)

This ISACA certification validates skills required to provide enterprise-level risk management and is arguably the top IT certification in the world. With less than 21,000 current practitioners, job security is essentially guaranteed for those willing to achieve this expert-level credential. Achieve this world-class certification and enjoy all that comes with a rewarding career in risk management.

Free Courses available:

- **Massachusetts Institute of Technology (MIT)**
 - MIT offers a free online course in network optimization. The course addresses problems in network flow, like minimum cost and maximum flow.
 - Network Optimization
- **Open University**
 - Open University offers students an intro to network security course which is designed for advanced-level students. The course takes 25 hours to complete.
 - The protocols in multi-service networks course explores communication protocols. Class topics include packet-switched and circuit-switched networks, the OSI (Open Systems Interconnection) reference model, TCP/IP (Transmission Control Protocol/Internet Protocol) architecture and protocol software. This networking course takes 30 hours to complete.
 - Network Security
 - Protocols in Multi-Service Networks

Expert Faculty:

- **Brad Hedlund**
<https://www.linkedin.com/in/bradhedlund/@BradHedlund>
 Brad is the Technical Account Manager for AWS and before that an engineering Architect for VMWare. Brad has extensive hands-on experience and specializes in Cloud networking, data center infrastructure, and network security. Check out an interview with Brad on VMWorld TV.
- **Greg Ferro**
<https://www.linkedin.com/in/etherealmind/@etherealmind>
 Greg is one of the co-founders of Packet Pushers

which is a weekly podcast about data networking by networking architects. Greg is a veteran of networking and a prolific writer. Sign up for his networking newsletter which gives the latest news on networking infrastructure and great hands-on advice too. Greg stated recently on Twitter: "Gonna talk about SD-WAN in 2018. It will be kind of ranty. Ok, maybe a lot ranty."

- **Prof. C P Katti,**
Dean

Tel.: + 91-11-26704767 (O)

Fax: + 91-11-26742526

Email: jnu_scss@mail.jnu.ac.in

School of Computer & Systems Sciences,

Jawaharlal Nehru University, New Delhi

(www.jnu.ac.in/SCSS/default.html)

BCSL320/BCSP320 INFORMATION SECURITY AND CRYPTOGRAPHY

(offline)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th	Tu	Pr	Total Hours		TA E	CA E	ES E	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objectives:

- This course covers the fundamentals of computer systems security.
- It introduces many different areas of security such as encryption, malicious code, authentication and access control, trusted computer systems, operating system and network security.
- The objective of this course is to provide students with a comprehensive overview of the threats to computer security, technologies for security assurance, and engineering approaches to security solutions.
- Create an ability to understand and use various open source security tools to improve personal information security & network security.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Use the fundamentals of Cryptography and standard algorithms to provide confidentiality, integrity and authenticity.

CO2: Use symmetric and asymmetric key encryption systems

CO3: Analyze various message authentication codes and hash functions.

CO4: Analyze detection and prevention of various attacks

CO5: Use open source tools like wireshark, keylogger etc to protect important data.

CO6: Design secure applications

Course Contents:

Unit-I: Introduction

Introduction to information and network security, Attacks, services, mechanisms, security attacks, security services, a model for internet work security, encryption model, steganography, classical encryption techniques, modern techniques - simplified DES, block cipher principles, data encryption standard, strength of DES, block cipher design principles, block cipher modes of operation.

Unit-II: Confidentiality and Key Management

Confidentiality using conventional encryption: placement of encryption function, random number generation. Public key cryptography: principles, RSA algorithm, key management, diffie-hellman key exchange, elliptic curve cryptography, Chinese remainder theorem, Euclidean algorithm, extended Euclidean algorithm, discrete logarithms, primality testing, Chinese remainder theorem, finite fields.

Unit-III: Message Authentication and Hash Functions

Authentication requirements, functions, codes, security of hash function & MACs. Hash & Mac algorithms. Messages digest, Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions. Digital signatures & authentication protocols, Elgamal digital signature algorithm, digital signature standard.

Unit-IV: Network Security

Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec. Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.

Unit-V: Open Source Tools

Hands-on sessions on open source network & information security tools such as Wireshark, Nmap & Zenmap, CryptoForge, VeraCrypt, Quick Checksum Verifier, KeePass, CrypTool, Metasploit.

Unit-VI: Trends and Applications of Network Security

Recent trends in Computer System & Security, Advanced topics & its Application

Books:

- Cryptography and networks security principles & practice by William Stallings (Pearson Education prentice Hall).
- Networks security Essentials Applications & standards by William Stallings (Pearson Education, LPF).
- Cryptography in C and C++ by Michael Welschenbach (A press IDG Books India).
- Introduction to Data Compression by Khalid Sayood (Morgan kaufmann/Harcourt India).

Reference Book

- Information Security: The Complete Reference, Second Edition 2nd Edition by Mark Rhodes-Ousley ISBN-13:978-0071784351 ,ISBN-10:0071784357
- Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
- Cryptography and Network Security : Forouzan Mukhopadhyay, McGraw Hill, 3rd Edition
- Information Security, Principles, and Practice: Mark Stamp, Wiley India.
- Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
- Introduction to Network Security: Neal Krawetz, CENGAGE Learning
- Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

MOOCS Courses:

❖ NPTEL LINKS:

- nptel.ac.in/courses/106105031 (IIT K)
- <https://nptel.ac.in/courses/106105031/39>
- <https://nptel.ac.in/courses/106106129>
- https://onlinecourses.nptel.ac.in/noc18_cs24

❖ MIT Courseware

- <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/exams/>

❖ Swayam Courses:

- <https://swayam.gov.in/course/1303-introduction-to-information-security-i>
- <https://swayam.gov.in/courses/4957-information-security>

❖ MOOCS Link

- <https://www.khanacademy.org/computing/computer-science/cryptography/modarithmetic/a/the-euclidean-algorithm>
- <https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/intro-to-cryptography>

Open Source Tools:

- ❖ Nmap
- ❖ OpenVAS
- ❖ OSSEC
- ❖ Security Onion
- ❖ Metasploit Framework
- ❖ OpenSSH
- ❖ Wireshark
- ❖ Kali Linux.
- ❖ Snort
- ❖ Salesforce
- ❖ CiscoPacketTracer
- ❖ OpenNMS

- ❖ Nikto.
- ❖ Truecrypt
- ❖ Moloch
- ❖ Bro IDS
- ❖ Snort
- ❖ OSQuery
- ❖ GRR - Google Rapid Response
- ❖ Omnet++
- ❖ Cacti
- ❖ NetDisco

Experts:

1. Bhaskar Raman, IIT Bombay
2. SachinDhedia - Professor - SGA
EDUCATION INSTITUTE, Mumbai
3. Dr. Abhijeet Das, IIT KGP,
abhij@cse.iitkgp.ac.in, +91-3222-282350

BECL204/BECP204 MICROCONTROLLER AND EMBEDDED SYSTEMS(online)

Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th.	Tu	P	Total Hours		TA	CA	SE	Int	Ext	
2	-	2	4	3	10	15	25	10	15	75

Course Objectives:

1. To study and understand various microcontrollers and embedded systems.
2. To understand the design parameters of embedded systems applications.
3. To study and impart different tools for embedded system and IoT application design.

COURSE OUTCOMES:

On successful completion of the course, Students shall be able to:

- CO7: Understanding principle of embedded systems and Microcontroller
- CO8: Develop programming for applications develop real time applications
- CO9: Perform interfacing of devices and peripherals
- CO10: Make Use Of ARM7 Controller for Designing of Embedded Applications
- CO11: Understand different IoT platform for Embedded applications
- CO12: Design and Develop different embedded system and IoT applications.

SYLLABUS

Unit 1: Embedded Systems: Introduction to embedded Systems, Requirements /Components of Embedded Systems, Design Process in Embedded System

Microcontrollers: Introduction to microcontrollers, 8051 architecture, Addressing modes and instruction set, 8051 programming in Assembly language and Embedded C.

Unit 2: Programming: Timer, Interrupts and serial communications, Serial I/O, Programming Tools
Interfacing with 8051: ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display, Sensors interfacing (LDR, IR, PIR etc.)

Unit 3: Advanced devices and peripheral interfacing with ATmega16: GSM, GPS, GPRS, Bluetooth

Unit 4: Introduction of 32-bit

Microcontroller: ARM7 Processors, ARM Architecture, Register and Memory organization, Addressing modes, Arm Thumb and instruction sets, Basic Assembly Programming

Unit 5: Advance Microcontroller and

Programming: Introduction to Raspberry PI and Intel Galileo Board, Python Programming, OOP's and Modules in Python Programming.

Unit 6: Design and perform different embedded system and IoT Applications: Robotic, Industrial Automations,

TEXT BOOKS:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Muhammad Ali Mazidi	The 8051 Micro-controller & Embedded System using assembly & C	Pearson Education	2008	Second
2	Muhammad Ali Mazidi	ARM Assembly language programming and Architecture			Second
3	Raj Kamal	Microcontrollers: Architecture, Programming, Interfacing and System Design	Pearson Education India	2009	Second

REFERENCE BOOKS:

Sr. No.	Title	Author Name	Publisher	Year of Publication	Edition
1	Shibu K. V.	Introduction to Embedded System,	The McGraw Hill,	2011	
2	Ajay V. Deshmukh	Micro-controllers - Theory and Applications,	Tata McGraw Hill		
3	Kenneth J. Ayala	The 8051 Micro-controller – Architecture, Programming & Applications,	Penram International & Thomson Asia,	1996	Second

ONLINE CERTIFICATION AVAILABLE:

Sr. No.	Course Name	Faculty Name	Institute Name	Link
1.	NPTEL video Course on Embedded Systems	Dr. Santanu Chaudhury	IIT-Delhi	https://nptel.ac.in/courses/108102045/#

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