G H Raisoni College of Engineering

(An Autonomous Institute affiliated to RTM Nagpur University Nagpur)

B. Tech. in Artificial Intelligence

Scheme – 2019

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.

Institute 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

Department Vision

To achieve excellent standards of quality-education by using the latest tools, nurturing collaborative culture and disseminating customer oriented innovations to relevant areas of academia and industry towards serving the greater cause of society.

Department Mission

To develop professionals who are skilled in the area of Artificial Intelligence. To impart quality and value based education and contribute towards the innovation of computing, expert system, Data Science to raise satisfaction level of all stakeholders. Our effort is to apply new advancements in high performance computing hardware and software.

B. Tech. in Artificial Intelligence

Program Educational Objectives

The Program Educational Objectives of the Artificial Intelligence and Machine Learning Under graduate program are designed to produce knowledgeable Machine Learning Engineers who are ready to contribute effectively to the advancement of Intelligent Computing systems .The graduates shall:

PEO1	Apply analysis, predictions, optimization, decision making and develop skills in order to formulate and solve complex Intelligent computing and multidisciplinary problems
PEO2	Take up higher studies, research & development and other creative efforts in the area of Machine Learning.
PEO3	Use their skills in an ethical & professional manner to raise the satisfaction level of stake holders.

Program Specific Outcomes

PSO1	Apply the skills in the areas of Health Care, Education, Agriculture, Intelligent Transport, Environment, Smart Systems & in the multi-disciplinary area of Artificial Intelligence and Machine Learning.
PSO2	Demonstrate engineering practice learned through industry internship to solve live problems in various domains.
PSO3	

Program Outcomes

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	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.

Scheme of B.Tech. in Artificial Intelligence

Course Code	Name of Courses	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		TOTAL MARKS
			L	T	P	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
BAIL101	Artificial Intelligence & Its Applications		2	-	-	2	2	10	15	25	--		50
BEEL103	Energy Sources and Audit		1	-	-	1	1	10	15	25	--		50
BECL224/ BECP224	Introduction to Drones		1	-	2	3	2	10	15		25		50
BITL101 BITP101	Programming for Problem Solving		1	-	4	5	3	10	15	25	50	-	100
BAIL103	Bio-System with AI		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	10	15	--	--		25
TOTAL			**9**	**4**	**16**	**29**	**21**	**90**	**135**	**175**	**200**	**0**	**600**

Course Code	Name of Courses	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		TOTAL MARKS
			L	T	P	Total Hours		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	Introduction to Data Structures		-	-	4	4	2	--	--	--	50		50
BFYP152	Internet of Things		-	-	2	2	1	--	--	--	25		25
BAIL102/ BAIP102	Introduction to Machine Learning		1		4	5	3	10	15	25	50	-	100
BECL106/ BECP106	Signal Processing and Applications		1	-	4	5	3	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**	**3**	**30**	**37**	**22**	**50**	**75**	**100**	**375**	**0**	**600**

SEMESTER- III												
Subject Code	**Name of the course**	**Teaching Scheme**			**Total**	**Credit**	**Evaluation Scheme**					**Total**
							Theory			**Practical**		
		Th	**Tu**	**Pr**			**TAE**	**CAE**	**ESE**	**Int**	**Ext**	
BFYL141	Discrete Mathematics	1	1	-	2	2	10	15	25	-		50
BCSL203 BCSP203	Data Structures & Algorithms	2	-	2	4	3	10	15	25	25	25	100
BCSL211	Operating Systems	2	-	-	2	2	10	15	25	-	-	50
BAIL205/ BAIP205	AI Knowledge Representation & Reasoning	2	-	2	4	3	10	15	25	25	-	75
BCSL223	Computer Architecture & Organization	3	-	-	3	3	10	15	50	-	-	75
BCSL207	Problem Identification & Design Thinking	1	-	-	1	1	10	15	-	-		25
BITL303	Software Engineering	3	-	-	3	3	10	15	50	-		75
BECP212	Introduction to Robotics	-	-	2	2	1			-	25		25
BAIP202	Skill Development I	0	-	4	4	2	-	-	-	50		50
BHUP202	Reasoning	-	-	1	1	0.5	-	-	-	25		25
BHUP203	Quant	-	-	1	1	0.5	-	-	-	25		25
BHUP204	Liberal arts /creative arts (hobby Module)/Power Yoga	-	-	1	1	0.5	-	-	-	25		25
BHUP205	Business English Certification	-	-	4	4	2	-	-	-	50		50
BHUP206	Aptitude 1	-	-	1	1	0.5	-	-	-	25		25
Total		**14**	**1**	**18**	**33**	**24**	**70**	**105**	**200**	**275**	**50**	**675**

Semester IV													
Subject Code	**Name of the course**	**Teaching Scheme**			**Total**	**Credit**	**Evaluation Scheme**					**Total**
							Theory			**Practical**		
		Th	**Tu**	**Pr**			**TAE**	**CAE**	**ESE**	**Int**	**Ext**	
BFYL142	Graph Theory and Number System	1	1	-	2	2	10	15	25	-		50
BCSP205	Object Oriented Programming	-	-	4	4	2	-	-	-	50		50
BCSL210	Theory of Computation	3	-	-	3	3	10	15	50			75
BITL206	Computer Networks	3	-	-	3	3	10	15	50	-	-	75
BAIL203/ BAIP203	Machine Learning Algorithms	2	-	2	4	3	10	15	25	25	25	100
BAIP206	Probability & Statistics Using R	-	-	4	4	2				50	-	50
BXXLXXX	Open Elective I	2	-	-	2	2	10	15	25			50
BMBP102	EDP	-	-	2	2	1	-	-	-	25		25
BAIP207	Mini Project	-		4	4	2				50		50
BHUP207	Soft Employability Skills	-	-	1	1	0.5	-	-	-	25		25
Total		**11**	**1**	**17**	**29**	**20.5**	**50**	**75**	**175**	**225**	**25**	**550**

Semester V												
Subject Code	**Name of the course**	**Teaching Scheme**			**Total**	**Credit**	**Evaluation Scheme**					**Total**
							Theory			**Practical**		
		Th	**Tu**	**Pr**			**TAE**	**CAE**	**ESE**	**Int**	**Ext**	
BFYL143	Integral Transforms	1	-	-	1	1	10	15	25	-		50
BAIL301/ BAIP301	Genetic Algorithms & Fuzzy Logic Systems	2	-	2	4	3	10	15	25	25	25	100
BAIL302 BAIP302	Natural Language Processing	2	-	2	4	3	10	15	25	25	25	100
BCSL208 BCSP208	Database Management System	2	-	2	4	3	10	15	25	25	25	100
BCSL315 BCSP315	Cloud Computing	2	-	2	4	3	10	15	25	25		75
BAIP308	Skill Development-2	-	-	2	2	1	-	-	-	25		25
MBP104	Advanced Communication Skills (Voice Versant & Essay)	-	-	4	4	2	-	-	-	50		50
BAIP304	Application of Artificial Intelligence in Finance		-	1	1	0.5				25		25
BHUP302	Aptitude 2	-	-	1	1	0.5				25		25
BAIP309	Internship & Technical Report (LATEX) (Social +Minor Project)	-	-	2	2	1	-	-	-	50		50
BHUL305	Universal Human Values-2: Understanding Harmony	3	-		3	3	10	15	50	-		75
Total		**12**	**0**	**18**	**30**	**21**	**60**	**90**	**175**	**275**	**75**	**675**

Semester VI												
Subject Code	Name of the course	Teaching Scheme			Total	Credit	Evaluation Scheme					Total
							Theory			Practical		
		Th	Tu	Pr			TAE	CAE	ESE	Int	Ext	
BCSL316 BCSP316	Design & Analysis of Algorithms	2	-	2	4	3	10	15	25	25		75
BAIL305/ BAIP305	Deep Learning	2	-	2	4	3	10	15	25	25	25	100
BAIL307 BAIP307	Big Data Tools & Techniques	2	-	2	4	3	10	15	25	25	25	100
BXXLXXX	Open Elective II	2	-	-	2	2	10	15	25	-		50
BAILXXX	Elective I	2	-	-	2	2	10	15	25	-		50
BAILXXX	Elective II	2	-	-	2	2	10	15	25	-		50
BCSL324	Information Sciences	2	-	-	2	2	10	15	25	-		50
BMEL319	Product Design & IPR	1	-	-	1	1	10	15	-	-		25
BHUP303	Aptitude 3	-	-	1	1	0.5	-	-	-	25		25
Total		**15**	**0**	**7**	**22**	**18.5**	**80**	**120**	**175**	**100**	**50**	**525**

Semester VII												
Course Code	Name of the Course	Teaching Scheme				Credits	Evaluation Scheme					Total
							Theory			Practical		
		Th.	Tu	Pr.	Total Hours		TAE	CAE	ESE	Int	Ext	
BAILXXX	Department Elective III	2	-	-	2	2	10	15	25			50
BAILXXX	Department Elective IV	2	-	-	2	2	10	15	25			50
BAILXXX	Department Elective V	2	-	-	2	2	10	15	25	-		50
BAILXXX	Department Elective VI	2	-	-	2	2	10	15	25	-		50
BAILXXX	Department Elective VII	2	-	-	2	2	10	15	25	-		50
BAIP401	Project Phase I	-	-	4	4	4	-	-	-	100		100
BAIL402	Open Elective III	2	-	-	2	2	10	15	25	-		50
Total		**10**	**0**	**6**	**16**	**16**	**50**	**75**	**125**	**150**		**400**

Semester VIII												
Course Code	**Name of the Course**	**Teaching Scheme**				**Credits**	**Evaluation Scheme**					
							Theory			**Practical**		**Total**
		Th.	**Tu**	**Pr.**	**Total Hours**		**TAE**	**CAE**	**ESE**	**Int**	**Ext**	
BAIP403	6 Month Internship	-	-	-	-	12	-	-	-	150	150	300
BAIP404	Project Phase 2	-	-	-	-	3	-	-	-	50	25	75
BAIP405	Open Elective IV	2	-		2	2	10	15	25	-	-	50
Total		**2**	**-**	**-**	**-**	**17**	**-**	**-**	**-**	**250**		**425**
		First Year Credits				43	First Year Marks					1200
		Total Credits SE-BE				117	Total Marks SE-BE					3250
		Grand Total Credits				**160**	**Grand Total Marks**					**4450**

SEMESTER-I

BFYL101: MATRICES

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
1	1	--	2	2	10	15	25	--	--	50

Course Objectives	To introduce concepts of matrices in the field of Engineering.
	To develop skills in student to solve engineering problems based on Matrices.
Course Outcomes	To understand the concept of Matrix and solve system of linear equations using different methods for real time engineering problems in respective disciplines.
	Determine the Eigen values and Eigen vectors of a matrix for various engineering problems in respective disciplines.
	To formulate the real engineering problems in terms of matrices and find the solution as well as its interpretation in terms of original problem.

Course Contents:

Unit	Contents	Hours
I	Adjoint of Matrix, Inverse of matrix by adjoint method, Solution of simultaneous equations by adjoint method. Solving system of liner equation by Gauss elimination method	6
II	Inverse of matrix by partitioning method. Rank of matrix, Consistency for system of linear equations, Linear dependence. Basis and Span of vectors.	6
III	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	6
IV	Cayley Hamilton theorem (statement & verification). Sylvester's theorem, Association of matrices with linear differential equations of second order with a constant coefficient. Applications of matrices in Mesh analysis.	6

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

BFYL102: DIFFERENTIAL & VECTOR CALCULUS

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	1	--	2	2	10	15	25	--	--	50

Course Objectives	To introduce concepts of Differential Calculus & Vector Calculus in the field of Engineering.
	To develop skills in students to solve applications based problems on Differential Calculus.
Course Outcomes	Apply concepts of differentiation in solving engineering problems.
	Use applications of partial differentiation to solve various problems in engineering.
	Apply the Knowledge of vector differentiation to solve various problems in engineering.

Course Contents:

Unit	Contents	Hours
I	**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.	8
II	**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	8
III	**Vector Calculus:** Differentiation of vectors, Gradient of scalar point function, Directional derivatives Divergence and Curl of vector point function. Solenoidal & Irrotational vector field.	8

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

BAIL101: Artificial Intelligence & Its Applications

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	--	2	2	10	15	25	--	--	50

Course Objectives	It helps students to understand importance AI.
	To understand application of AI in engineering and in real life.
Course Outcomes	Identify problems where artificial intelligence techniques are applicable.
	Understand the relation between AI & various domains.
	Apply selected basic AI techniques; judge applicability of more advanced techniques.
	Participate in the design of systems that act intelligently and learn from experience.

Course Contents:

Unit	Contents	Hours
I	**Introduction to AI:** Introduction to Artificial Intelligence, History of AI, Logic and Computation, Artificial Intelligence Languages, Multi Agent Systems ,Case study: Google Duplex	4
II	**Search and Planning :**Problem spaces and search, Heuristic search strategies, Search and optimization (gradient descent), Adversarial search, Planning and scheduling, Case study: Health Care System	4
III	**Knowledge Representation and Reasoning:** Knowledge and Knowledge based system, Knowledge and rationality, Logic and inference, Ontologies, Bayesian Reasoning, Temporal reasoning, Knowledge Discovery: Data and Web Mining Case study: Medical diagnosis	6
IV	**Applications of AI** **The various domains:** 1.AI in Marketing 2. AI in Banking 3. AI in Finance 4. AI in Agriculture 5. AI in Health Care 6. AI in Gaming 7. AI in Space Exploration 8. AI in Autonomous Vehicles 9. AI in Chatbots 10. AI in Artificial Creativity 11. Not Limited	4

Text Books	1.	Artificial Intelligence' R B Mishra, PHI
	2.	Knowledge and Knowledge based system' Russell
	3.	Introduction to Artificial Intelligence, CHARNIAK, PEARSON
	4.	Artificial Intelligence, Stuard Russell & Peter Norvig, Prentice Hall

BEEL103: Energy Sources & Audit

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	--	1	1	10	15	25	--	--	50

Course Objectives	To study the various types of Electrical Sources
	To study the comparison of various sources.
	To study the Non-conventional electrical sources
Course Outcomes	To understand present scenario of energy & its importance
	To Learn Conventional energy sources &Non conventional Energy sources
	To Understand concept of Energy Management
	To apply knowledge of energy audit to industry
	To understand importance of safety components

Course Contents:

Unit	Contents	Hours
I	**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	6
II	**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.	6
III	**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.	4

Text Books	1.	Non-Conventional Energy Resources, B H Khan, Tata McGraw-Hill Education, 2006, Second Edition
	2.	Energy Management Audit and Conservation, Barun Kumar De, Vrinda Publications, 2007, Third Edition
	3.	Handbook of Energy Audit, Sonal Desai
	4.	Energy Management, Audit & Conservation by Barun Kumar De

BECL224/BECP224: Introduction to Drones

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	2	3	2	10	15	--	25	--	50

Course Objectives	Be able to describe common components of drone
	Be able to define acronyms related to drone
Course Outcomes	Recognize and describe the role of drone in present, past and future society
	Comprehend and explain basic components of drone.
	Comprehend and explain various payloads of drone.

Course Contents:

S. No.	Contents	Contact Hours
1	**Unit-I: Introduction to Drone Technology** Types of Drones andTheirTechnical Characteristics,Widely Used Drone Models,Future Developments in Drone Technology, Use of Frequency Spectrum and Electronic Equipment, Frequency Spectrum Issues, Legal Issues	2
2	**Unit-II: Drone flight aerodynamics** Lift & Drag forces, Frame & propeller design,, Airfoil shape propellers, Effect of relative air velocity in drone flight, effect of angle of attack on drone flight, Stability of Drone, Different mode of motions, Throttle, Yaw, Pitch, Roll,	4
3	**Unit-III: Applications of Drone Technology** Types of Payloads, Sensors & their application in drone technology, Calibration of sensors, Radio transmitter & receiver, Surveillance and Compliance, Use of Drone in various fields of applications,	6
4	**Unit-IV: Safe Assembly & flight test of Drones** Parts of a Drone, BLDC motor, Electronic Speed Controllers, Flight Controllers, Power Management, Demonstration of all motions, Aerial Filming & Aerial Photos, Safe Flight Practices	6

Text Books	1.	The future of Drone Use Opportunities and Threats from Ethical & Legal Perspectives, TMC Asser Press XXIII, 386p, ISBN 978-94-6265-131-9, 2016
	2.	http://www.springer.com, 978-94-6265-131-9

BITL101/ BITP101: Programming for Problem Solving

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	4	5	3	10	15	25	50	--	100

Course Objectives	This Course introduces basic idea of how to solve given problem.
	Focuses on paradigms of programming language.
	Aims at learning python as programming language
Course Outcomes	Analyze and understand the behavior of fundamental programming.
	Develop & Analyze Algorithms for solving problems.
	Demonstrate the knowledge of various concepts of Python Language.
	Develop solutions using functions & recursion.
	Demonstrate knowledge of Dictionaries.
	Demonstrate knowledge of advanced concepts of Python Programming.

Course Contents:

Unit	Contents	Hours
I	**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).	5
II	**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.	6
III	**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	6
IV	**DICTIONARIES:** Operations and methods; advanced list processing – list comprehension	5
V	**Object Oriented Programming**: Classes and objects-inheritance-polymorphism **Exception Handling & File Handling**: Overview of exception classes and types: try, except. Finally, File processing: reading and Writing files. Recent Trends in Python	7

Text Books	1.	Python Programming using problem solving Approach, Reema Theraja, Oxford, 2017, First Edition
	2.	

BAIL103: Bio-System with AI

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	1	--	2	2	10	15	25	--	--	50

Course Objectives	It help students to understand importance of biological concepts in engineering fields.
	To understand application of engineering concepts in medical instrumentation.
Course Outcomes	Understand the use of basic biology in engineering.
	Understand & apply the concepts of engineering for design of biomedical instrumentation.
	Understand application of engineering in bio sensors & robotic prosthesis.
	Understanding telemedicine & wireless telemetry in medical field.

Course Contents:

Unit	Contents	Hours
I	Human Physiology & Anatomy : Introduction to Human Physiology….Complete Human Body system	2
II	AI in Healthcare Introduction to AI, Role of AI in medical Healthcare sector, Applications & Future of AI in Healthcare	4
III	Use of AI in medical imaging systems for analysis & prediction, AI in smart healthcare wearable devices, medical records	4
IV	AI in telehealth, telemedicine, disease managements, chatbots	4
V	AI in robotic surgeries , role of 3D printing in medical 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- Neuro translator & prosthesis	4

Text Books	1.	Biomedical Instrumentation, Dr. M. Arumugam, Anuradha Publication, 2002, Second Edition
	2.	Introduction to Biomedical Equipment, Joseph & John, Pearson education, 2002, Forth Edition

BCSP101: Data Analytics

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	This course helps to understand data and usage of data in solving real time problems.
	It introduces general idea of database management systems.
	It also explains the fundamental concepts of big data analytics and data visualization.
Course Outcomes	Understand data and usage of data in data analytics.
	Apply data analytics techniques for visualization through Excel.
	Analyze and design multidimensional data models.
	Visualize trends and discover insights of data.
	Derive Entity- Relationship (E-R) model from specifications and transform it into relational model.
	To design SQL queries to perform CRUD operations on database (Create, Retrieve, Update, and Delete)

Course Contents:

Unit	Contents	Hours
I	**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/Un hiding Columns & Rows, Merging Cells), Setting Colors.	2
II	**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.	6
III	**Basics of DBMS:** Introduction, Characteristics, Data models (Entity-Relationship Model, Relational Model, Network model), Relational algebra	2
IV	**Getting started with basic design templates:** Multidimentional Models, Basic Design, Chart Generation, Dashboard Creation, Data Visualization	6
V	**Basics of Open Source RDBMS:** Introduction, Installation, My SQL Commands (Administrative Commands), Various Syntax of SQL, DDL and DML Commands	4

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

BECL101/BECP101: Introduction to Digital Systems

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	

Course Objectives	To familiarize with various Digital IC
	To understand basic fundamentals of Digital circuits.
	To prepare for various engineering applications.
Course Outcomes	Solve the problems on Number system codes and their conversions.
	Identify Digital IC and implement in the circuits.
	Create, design and simulate canonical logic forms
	Demonstrate the application of combinational and sequential logic circuits.

Course Contents:

Unit	Contents	Hours
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. Logic families: TTL, ECL, CMOS.	10
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, QuineMcluskey 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	10
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.	10

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

BHUP103: Foreign Language : (Japanese)

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	Written communication: student can create basic-level German written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
	Oral communication: student can create basic-level German oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.
Course Outcomes	Exchange basic greetings in the social context.
	Respond to classroom directions and basic commands.
	Express basic needs in day-to-day life.
	Provide and acquire basic personal and social information.
	Read and write all 71 phonetic Hiragana characters and compound characters.
	Write and understand basic vocabulary written in Hiragana.
	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.
	Ask about the locations and understand the simple directions given to reach there.
	Talk about oneself, one's family and friends, likes and dislikes, surrounding objects etc.; using limited vocabulary of nouns, adjectives, verbs, counters etc.
	Become familiar with Japanese customs, greetings, etiquettes and manners.
	Obtain information about Japanese life style, cultural events, food, products, geographical locations, and other socio-cultural phenomena.
	Develop background for advanced Japanese language studies.

Course Contents:

Unit	Contents	Hours
I	Introduction of Japanese Language: Origin, history, development, modern contemporary Japanese language, Role of language in modern Japanese society. Aspects of Japanese language: written, spoken, communicative Introduction of Japan as country.	4
II	Introduction of Japan as country: General class discussion about Japan and its cultural aspects. E.g. Japanese Language, Society, History, Geography, Dressing, Food.	4
III	Economy, Government and Politics, Technological innovations, Scientific advances, Fine arts, Religion and beliefs, War and peace.	
IV	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.	4
V	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 flash cards - 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 flash cards - General words based on completed hiragana characters(15) - Hiragana Script - Characters (16) from Ma to N: Stroke order writing, practice with	6

	flash cards - 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.	
VI	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'.	4
VII	Hiragana Script: Rules for writing compound characters and its expression using hiragana. Small characters 'Ya', 'Yu', 'Yo' and B. Small character' Tsu' General words based on hiragana compound characters, Grammar.	4

BHUP103: Foreign Language (Spanish)

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	Written communication: student can create basic-level Spanish written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
	Oral communication: student can create basic-level Spanish oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.
Course Outcomes	Exchange basic greetings in the social context.
	Respond to classroom directions and basic commands.
	Express basic needs in day-to-day life.
	Provide and acquire basic personal and social information.
	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.

Course Contents:

Unit	Contents	Hours
I	Introduction to Spain – its culture and people Pronunciation – BASIC and ADVANCED Basic Greetings and Self-Introduction	2
II	Grammar- Nouns- genders, article Grammar- Nouns - Plural forms Vocabulary- Months, weekdays and daytimes and number system Vocabulary-Time and date Grammar – Personal Pronouns	4
III	Vocabulary-Family, professions Vocabulary- Directions, Common words Vocabulary –Job-Related and Modes Of Transport Grammar – Possessive Pronouns Vocabulary- House	4
IV	Furniture and Draperies Vocabulary- Food and Drinks Grammar- Regular verbs Vocabulary- Vegetables and fruits Grammar-Irregular verbs	4
V	Grammar-Modal verbs and Imperative Verbs WH – Questions Vocabulary- Body parts and Clothes Grammar – Sentences- types and Framing	4
VI	Grammar-Imperative sentences and Framing questions Vocabulary- Common Places, Hobbies Grammar- Adjectives and Opposites. Test – Viva and Written.	4
VII	Basic numbers- Count and understand basic numbers	2

BHUP103: Foreign Language (German)

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	Written communication: student can create basic-level German written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
	Oral communication: student can create basic-level German oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.
Course Outcomes	Exchange basic greetings in the social context.
	Respond to classroom directions and basic commands.
	Express basic needs in day-to-day life.
	Provide and acquire basic personal and social information.
	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.

Course Contents:

Unit	Contents	Hours
I	Introduction to Germany – its culture and people Pronunciation – BASIC and ADVANCED Basic Greetings and Self-Introduction	2
II	Grammar- Nouns- genders, article Grammar- Nouns - Plural forms Vocabulary- Months, weekdays and daytimes and number system Vocabulary-Time and date Grammar – Personal Pronouns	4
III	Vocabulary-Family, professions Vocabulary- Directions, Common words Vocabulary –Job-Related and Modes Of Transport Grammar – Possessive Pronouns Vocabulary- House	4
IV	Furniture and Draperies Vocabulary- Food and Drinks Grammar- Regular verbs Vocabulary- Vegetables and fruits Grammar-Irregular verbs	4
V	Grammar-Modal verbs and Imperative Verbs WH – Questions Vocabulary- Body parts and Clothes Grammar – Sentences- types and Framing	4
VI	Grammar-Imperative sentences and Framing questions Vocabulary- Common Places, Hobbies Grammar- Adjectives and Opposites. Test – Viva and Written.	4
VII	Basic numbers- Count and understand basic numbers	2

BHUP103: Foreign Language (French)

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	Written communication: student can create basic-level French written communications that correctly employ and incorporate the grammar, vocabulary, and cultural material presented in class.
	Oral communication: student can create basic-level French oral communications using correct Spanish grammar, vocabulary, cultural material, and pronunciation presented in class.
Course Outcomes	Exchange basic greetings in the social context.
	Respond to classroom directions and basic commands
	Express basic needs in day-to-day life
	Provide and acquire basic personal and social information.
	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.

Course Contents:

Unit	Contents	Hours
I	Introduction to France – its culture and people, Pronunciation and basic greetings.	2
II	Grammar- Nouns- genders, article Vocabulary- Months, weekdays and daytimes and number system Vocabulary-Time and date Grammar-Auxiliary verbs (Avoiretre)	2
III	Vocabulary-colors, Vocabulary-Family, profession Vocabulary-Directions, Common words Test (30 min), Listening to CD	2
IV	Vocabulary- House and Furniture and Draperies Vocabulary- Food and Drink and Cutlery Grammar-Regular, verbs Vocabulary- Vegetables and fruits	2
V	Grammar-Irregular verbs Grammar-Modal verbs Listening to CDS Vocabulary- Body parts and Clothes Translation passage and spoken Test (30 min)	2
VI	Listening to CD Translation passage and spoken Grammar-Imperative sentences and Framing questions Vocabulary- School and college and stationary Grammar cases in French Vocabulary	2
VII	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. Count and understand basic numbers.	2

BHUP104: Liberal/ Creative Arts

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	1	1	0.5	--	--	--	25	--	25

Course Objectives	The Students shall be given exposure on various musical instruments like Guitar, Sitar, and Piano etc. according to their interest.
	To inculcate healthy life style in students
	To impart discipline in students
	The students will be given exposure on Indian Classical music. It is aimed at a close interaction between students, artistes and craftsmen.
	The students will be offered a Film & television Workshop for hands on experience on interactive learning.
Course Outcomes	Play various musical instruments of their interest.
	Understand and emphasize importance of good health in life
	Be in self-discipline.
	Apply the interactive learning experience in the diverse arts.

Course Contents:

Unit	Contents	Hours
I	Musical Instruments, Power Yoga / Pranayam, National Credit Corp, Spic Macay, Film & Television	

BFYP131: Waste Management

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	To study industrial waste generation patterns, as well as management and disposal techniques.
	To categorize different types of wastes.
Course Outcomes	To apply creative & innovative practices for waste management.
	To identify hazardous and non-hazardous waste.
	To describe the major categories of waste disposal techniques and technologies.

Course Contents:

Unit	Contents	Hours
I	Case study of Physiochemical analysis of water from different sources (River/lake/well/bore well)	2
II	Case study of physiochemical analysis of solid waste (industrial / municipal)	2
III	E-waste generation & management from electronic shops: Nagpur Scenario	2
IV	New and old plastic waste comparison: Plastic ban story	2
V	Case study on chloride contamination in nearby area.	2
VI	Food waste generation and management at hotels and restaurants.	2
VII	Dairy waste management in Nagpur city.	2
VIII	Paper waste generation and utilization from Raddiwala point of view	2
IX	Comparative biomedical waste techniques at hospitals and clinics	2
X	Solid waste management from the Kabadiwala‘s point of view	2
XI	Visit to Industrial waste water treatment plant	2
XII	Grey water management in apartments.	2

Text Books	1.	Solid and Hazardous Waste Management, M. N. Rao & Razia Sultana, BS Publications

BFYP132: Environmental Science

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	1	1	0.5	10	15	--	--	--	25

Course Objectives	Students will develop a sense of community responsibility by becoming aware of scientific issues in the larger social context.
	To recognize the interconnectedness of multiple factors in environmental challenges.
Course Outcomes	Students apply the knowledge of environmental pollution to current environmental issues.
	Able to understand environment quality standards.
	Able to utilize natural resources optimally.

Course Contents:

Unit	Contents	Hours
I	**Environmental Pollution & Current Environmental Issues of Importance:** Air Pollution, Water pollution, Climate Change and Global warming, Effects of Acid Rain, Ozone Layer depletion, Photochemical Smog. Waste water treatment.	4
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.	4
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.	4

Text Books	1.	Environmental Chemistry, B.K. Sharma & H. Kaur, Goel Publishing House, 2014, Fourteen Edition
	2.	Environmental Studies, R. Rajgopalan, Oxford Publication, 2016, Third Edition
	3.	A Test Book of Environmental Chemistry & Pollution Control, S. S. Dara, S. Chand & Co., 2007, Seventh Edition

SEMESTER – II

BFYL103: Integral and Multiple Calculus

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	1	--	2	2	10	15	25	--	--	50

Course Objectives	To introduce the concepts of Integral calculus & vector integration in the field of Engineering.
	To develop skills in student to apply the concepts of integrals in various engineering problems.
Course Outcomes	Understand and use concept of definite integral & solve engineering problems.
	Evaluate the multiple integrals using different techniques and apply it to solve engineering problems.
	To understand vector integration and its applications related to real life problems

Course Contents:

Unit	Contents	Hours
I	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.	6
II	Double integral, Change of variables, Change of order of integration, Triple integral, Applications of multiple integral: Area, mass, volume.	6
III	Vector Integration: Line integral, Surface integral, Volume integral, Statement of Gauss theorem, Greens theorem and Stokes theorem and its verification.	6

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

BFYL104: Ordinary and Partial Differential Equations

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	--	1	1	10	15	25	--	--	50

Course Objectives	To develop skills in student to solve problems of Ordinary Differential Equations and its applications in field of engineering.
	To introduce the concepts of Partial Differential Equations and its applications in the field of Engineering.
Course Outcomes	Solve first order, first degree & higher order differential equations.
	Form differential equations for simple engineering systems. Find the solution & interpret the results.
	Understand the concept of Partial differential equations and use it to solve simple engineering problems.

Course Contents:

Unit	Contents	Hours
I	Linear, Reducible to linear and exact differential equations of first order. Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Legendre homogeneous differential equations.	4
II	Simultaneous differential equations. Applications of differential equations to engineering systems.	4
III	Introduction to Partial Differential equations, Partial differential equation of first order and its types, applications to real life problems..	4

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

BCSP102: Introduction to Data Structures

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	4	4	2	--	--	--	50	--	50

Course Objectives	This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
	It also aimed at developing skill to implement methods to solve specific problems using basic data structures.
	The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.
Course Outcomes	Identify essential data structures and understand when it is appropriate to use.
	Explain use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated.
	Apply linear data structures to solve various real world computing problems using programming language.
	Analyze standard algorithms for searching and sorting.

Course Contents:

Unit	Contents	Hours
I	**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	7
II	**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	7
III	**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).	7
IV	**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	8

Text 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.

BFYP152: Internet of Things

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	To understand key technologies in Internet of Things.
	Analyze, design or develop parts of an Internet of Things solution
	Students will understand the concepts of Internet of Things and can able to build IoT applications.
Course Outcomes	Identify and adopt knowledge of the terminology, applications, requirements and constraints for IoT development.
	Explain development of software and hardware in real time environment via advanced automated designing and testing tools.
	Identification and application of various technology & methods for IoT design and implementation
	Design & implementation of IoT with advanced microcontroller and interfaces
	Testing of complex and critical real world IoT, interfaced to digital hardware in real world situations.
	Evaluate a real-time, IoT industrial control system using an embedded microcontroller with associated interface and communication devices

Course Contents:

Unit	Contents	Hours
I	Getting familiar with Intel Galileo Gen2 board and understand the procedure of creation and compilation of C source code.	2
	To write C source code for blinking of LED with Intel Galileo Gen 2	2
	To write C source code to Fade LED using Intel Galileo Gen 2	2
	To write C source code to vary Blinking Rate of LED using Intel Galileo Gen 2	2
	To write C source code for Seven Segment Display using Intel Galileo Gen 2	2
	To write C source code Push Button using Intel Galileo Gen 2	2
	To write C source code to control LED lightning via Array	2
	Perform SD card testing using Intel Galileo Gen2	2
	To write C source code to Interface LCD with Intel Galileo Gen 2 and display GHRCE on LCD Display	2
	To write C source code to Interface Temperature Sensor (LM35) with	2

	Intel Galileo Gen 2 and display the temperature on LCD.	
	To write C source code to develop interfacings of wifi sensors with cloud service.	2
	Case Studies: Weather Monitoring System using IoT.	
	Case Studies: Smart Irrigation System using IoT.	
	Case Studies: Automated Street Lighting System Project.	

Text 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 Arduino Yún, Marco Schwartz**,** Packt Publishing Ltd., 2014
	3.	Building Arduino Projects for the Internet of Things, Adeel Javed, Apress, 2016
	4.	The Internet of Things, Donald Norris, McGraw-Hill Education, 2015

BAIL102/ BAIP102: Introduction to Machine Learning

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	4	5	3	10	15	25	50	--	100

Course Objectives	To introduction to the fundamental concepts in machine learning and popular machine learning algorithms
	To understand the standard and most popular supervised learning algorithm
	To study various Feature reduction methods
Course Outcomes	Identify utilization and implementation proper machine learning algorithm
	Understand basic packages that used to implement Machine learning algorithms
	Able to understand the basic supervised machine learning algorithms.
	Understand the difference between supervise and unsupervised learning

Course Contents:

Unit	Contents	Hours
I	**Introduction: Getting Started in Python:** Introduction, Types-Integers, Types -Booleans, Operators, Expressions, Tuples, dictionaries, sets, sequences, comprehension, Functions, modules packages Introduction to NumPy Arrays NumPy	5

	N-dimensional Array Functions to Create Arrays Combining Arrays Extensions Index, Slice and Reshape NumPy Arrays From List to Arrays Array Indexing Array Slicing Array Reshaping IV Matrices	
II	**Vectors and Vector Arithmetic and vector Norms** Vector Arithmetic, Norm L1 Norm, Vector L2 Norm, Matrix Arithmetic Matrix Symmetric Matrix Triangular Matrix Diagonal Matrix Identity Matrix Orthogonal Matrix Transpose Inverse Trace Determinant Rank Sparse Matrix Problems with Sparsity Sparse Matrices in Machine Learning Working with Sparse Matrices Sparse Matrices in Python Eigenvectors and Eigen values Singular-Value Decomposition Calculate Singular-Value Decomposition, mean, median, mode, Confusion Matrix, weights, bias, and covariance.	6
III	**Supervised Machine Learning Algorithm** Regression, Decision Tree, Random Forest, KNN, Logistic Regression, Classification	6
IV	**Un-Supervised Machine Learning Algorithm** Apriori algorithm, K-means, Clustering	5
V	**Mini Project**	

Text Books	1.	*Introduction to machine learning*,*EthemAlpaydin. — 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
	3.	Basics of Linear Algebra for Machine Learning, Jason Brownlee

BECL106 / BECP106: Signal Processing & Applications

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	4	5	3	10	15	--	25	--	50

Course Objectives	To introduce the student to the idea of signal and system analysis and characterization.
	To provide a foundation to numerous other courses that deal with signal and system concepts directly or indirectly: viz: communication, control, instrumentation, and so on.
Course Outcomes	Represent and classify continuous and discrete signals
	Perform various operations on signals
	Understand the basic properties of system functions and frequency responses of LTI Systems
	Investigate various speech processing devices.

Course Contents:

Unit	Contents	Hours
I	**Introduction to Digital Signals** Signals-Definition, Basic CT Signals, Basic DT Signals, Classification of CT Signals**,** Classification of DT Signals, Miscellaneous Signals	4
II	**Operations on Signals** Shifting**,** Scaling**,** Reversal**,** Differentiation**,** Integration**,** Convolution	4
III	**Basic Properties** Basic System Properties Dynamic Systems, Causal Systems, Non-Causal Systems, Anti-Causal Systems, Linear Systems, Non-Linear Systems, Time-Invariant Systems, Time-Variant Systems, Stable Systems, Unstable Systems	5
IV	**Speech Processing Devices** Alexa, Google Home, Siri	2
V	**Application of Signal Processing** Intro to Alexa, The future of voice-based experiences, Overview of Echo, Alexa, and the tools used to build Alexa skills, Skill Building Basics , Intents, Slots and Samples, Handling Requests with AWS Lambda and Node.JS, Build your first skill,Voice Design, Best practices for engaging skills, Remembering with Session Attributes, Brainstorming and flow diagrams, Using the Skill Builder tool, Skill Building , Gathering data via slots, Multi-turn dialogs, Calling external APIs , Build your second skill	5

Text Books	1.	A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

	2.	R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
	3.	Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
	4.	B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
Reference Books	1.	Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
	2.	Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

BECP103: Embedded Programming

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	To give the awareness of major embedded devices.
	To give the knowledge about interfacing devices.
Course Outcomes	Recognize and analyze given embedded system design and its performance.
	Demonstrate application based competencies in Embedded Programming

Course Contents:

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

Text 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.

BMEP102: Digital Fabrication

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	4	4	2	--	--	--	50	--	50

Course Objectives	To familiarize with basic CAD modeling and digital manufacturing methods.
	To equip with various techniques to create prototype & product design and developments.
	To train in 3 D part modeling and additive manufacturing appropriately
	To understand the concept of rapid tooling and its requirement
Course Outcomes	Understand and use techniques for processing of CAD models for rapid prototyping
	Understand and apply fundamentals of rapid prototyping techniques.
	Use appropriate tooling for rapid prototyping process.
	Select the processing parameters best suited to the production of prototype
	Incorporate and select right approaches and considerations for successfully developing new product designs.

Course Contents:

Unit	Contents	Hours
I	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	30

	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	

Text 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.

BFYP151: Mini Model Through Innovation & Creativity

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
--	--	4	4	2	--	--	--	50	--	50

Course Objectives	To enhance the skill of planning ad designing.
	To implement basic concepts.
	To develop innovative and creative learning.
Course Outcomes	Demonstrate the skills of planning and designing for developing a working mini model.
	Implement knowledge of concepts learnt and workshop practices to prepare a model. Use innovative ideas and convert these into physical models

BHUL101: Communication Skills

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	2	2	4	3	10	15	25	50	--	100

Course Objectives	To develop an understanding in the students regarding communication skills
	To develop the four essential communication skills in students i.e. – reading, writing, listening and speaking
	To develop the vocabulary and English proficiency of the students
Course Outcomes	Development of Confidence & Self Esteem
	Development of presentation skills
	Development Leadership Skills
	Development of Reading Skills
	Development of Writing Skills
	Development of Listening Skills
	Development of Speaking skills

Course Contents:

Unit	Contents	Hours
I	**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.	36

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

BHUP102: ETHICS & PROFESSIONAL COMPETENCY

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	To inculcate the highest level of ethical awareness and conduct among students. To make students ethically and socially aware and active
	To have a critical reflection of one's personality thereby creating and developing professional competency.
Course Outcomes	To create awareness regarding Ethical Issues in Professional Life
	To develop self-confidence and self-esteem keeping clarity in the goals and prioritizing time
	To understand different perceptions for better communication
	To develop effective Communication, Leadership and efficient team work skills in their professional Life.

Course Contents:

Unit	Contents	Hours
I	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.	24

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

BMBP101: ENTREPRENEURSHIP

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	2	2	1	--	--	--	25	--	25

Course Objectives	To make students aware of the need self-earning system.
	To develop interest in creative business ideas.
	To make them capable of becoming entrepreneurs.
Course Outcomes	Develop self-confidence to become an entrepreneur.
	Develop a creative thinking for growth of self and society.

Course Contents:

Unit	Contents	Hours
I	**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.	2
II	**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.	2
III	**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.	2
IV	**Characteristics of a Successful Entrepreneur** Understand the entrepreneurial journey and the concept of different entrepreneurial styles. Understand each of the five entrepreneurial styles in the model and how they differ from each other. Identify your potential entrepreneurship style based on personality traits, strengths, and weaknesses. Understand how different entrepreneurship styles work, and how people with different styles work together.	2
V	**Design Thinking** Understand Design Thinking as a problem-solving process. Describe the principles of Design Thinking. Describe the Design Thinking process.	2
VI	**Sales Skills to Become an Effective Entrepreneur** Understand what customer focus is and how all selling effort should be kept customer-centric. Use the skills/techniques of personal selling, Show and Tell, and Elevator Pitch to sell effectively.	4
VII	**Managing Risks and Learning from Failures** Understand that risk-taking is a positive trait Identify risk-taking traits and resilience traits	2

	Appreciate the role of failure on the road to success and understand when to give up	
VIII	**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.	2

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

Semester-III

BFYL141: Discrete Mathematics

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	1	--	2	2	10	15	25	--	--	25

Course Objectives	Understand basics of the set theory and some of its applications.
	Learn Group and Rings.
	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
Course Outcomes	Apply concept of Set theory in field of engineering.
	Understand and use concepts of Groups and Rings
	Apply the concepts of Lattices and Boolean algebra in computer science engineering.

Course Contents:

Unit	Contents	Hours
I	**Set Theory**: 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.	4
II	**Group and Rings:** 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, Homorphism, quotient group. Rings , Fields and Integral domain	4
III	**Group and Rings:** 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, Homorphism, quotient group. Rings , Fields and Integral domain	6

Text Books	1.	Discrete mathematical structure with application to computer science, Trembley & Manohar, Mc. Graw Hill, 2011, Sixth
	2.	Discrete Mathematical Structure ,Busby & Ross PHI,2009 Sixth
	3.	Discrete Mathematics, John Truss, Addison Wesley, 2000, Third

BCSL 203 / BCSP203: Data Structure and Algorithms

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	This course introduces basic idea of data structure while making aware of methods and structure used to organize large amount of data.
	It's also aimed at developing skill to implement methods to solve specific problems using basic data structures.
	The course also provides career opportunities in design of data, implementation of data, technique to sort and searching the data.
Course Outcomes	Acquire and Apply basic concepts of data type and their types.
	Implement non linear data structure to find solution for given engineering applications.
	Implement Graph data structure to solve various computing problems
	Design and analyze different algorithms techniques.

Course Contents:

Unit	Contents	Hours
I	**Introduction** –Common operations on data structures, Types of data structures, Data structures & Programming, Program Design, Complexities, Time Complexity, order of Growth, Asymptotic Notation.	4
II	**Trees and Binary Trees -**Binary Trees • Representation, Operations: Insert, Delete , Traversal: Preorder, Inorder, Postorder, Traversal Algorithms Using Stacks, Header Nodes; Threads ,Threaded Binary Trees ,Binary Search Trees ,Searching and Inserting in Binary Search Trees ,Deleting in a Binary Search Tree, Balanced Binary Trees, AVL Search Trees, Insertion in an AVL Search Tree ,Deletion in an AVL Search Tree, m-way Search Trees, Searching, Insertion and Deletion in an m-way Search tree, B-Trees, Searching, Insertion and Deletion in a B-tree, B+-Trees Graph Algorithms	6
III	**Graphs and their Applications** -) Introduction, Graph Theory Terminology, Sequential Representation of Graphs, Adjacency Matrix; Path Matrix, Linked Representation of a Graph, Operations on Graphs, Traversing a Graph ,Posets; Topological Sorting ,Spanning Trees.	6
IV	**Advanced Data structure:** Segment tree, advanced lists, Binary index tree, Splay tree	4

Text Books	1.	AVAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
	2.	T HCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.
E--Books	1.	
	2.	
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.

BCSL211: OPERATING SYSTEM

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	--	2	2	10	15	25	--	--	50

Course Objectives	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 Outcomes	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.

Course Contents:

Unit	Contents	Hours
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.	4
II	**Process & Its Scheduling** Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms,	6
III	Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process	8

	communication problems	
IV	Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation	6
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.	8

Text Books	1.	Operating System concepts – Silberchatz & amp; Galvin, Addison Wesley, 6 th Edn.
	2.	Modern Operating Systems – Tanenbaum, Pearson Edn. 2 nd edn.
E--Books	1.	
	2.	
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.

BAIL205/ BAIP205: Artificial Intelligence Knowledge Representation And Reasoning

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	2	4	3	10	15	25	25	--	75

Course Objectives	Gain Historical Perspective of AI and its foundations
	Become familiar with basic principles of AI towards problem solving, inference, perception, knowledge representation and reasoning
	Investigate applications of AI techniques in intelligent agents, expert systems and other machine learning models
Course Outcomes	Understand various searching techniques, constraint satisfaction problem and game playing techniques.
	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and reasoning
	Acquire the knowledge of real world knowledge representation
	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system
	1. Understand the limitations and complexity of reasoning algorithms

Course Contents:

Unit	Contents	Hours
I	Introduction: Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents.State Space Search: Depth First Search, Breadth First Search, DFID.	6
II	Heuristic Search: Best First Search, Hill Climbing, Beam Search, Tabu Search. Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization.	6
III	Finding Optimal Paths: Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search:Problem Decomposition: Goal Trees, AO*, Rule Based Systems, Rete Net. Game Playing: Minimax Algorithm, AlphaBeta Algorithm, SSS*. Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Constraint Propagation	7

IV	Logic and Inferences: Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining.	5
V	Structured Knowledge Representations: The Schema, Semantic Net, Scripts Goals, Plans and MOPS, Inheritance in taxonomies, Descritpion Logics, Conceptual Graphs	6

Text Books	1.	Patrick Henry Winston. Artificial Intelligence, Addison-Wesley, 1992.
	2.	Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.
Reference Books	1.	Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009
	2.	R. C. Schank and C. K. Riesbeck: Inside Computer Understanding: Five Programs Plus Miniatures, Lawrence Erlbaum, 1981.
	3.	Murray Shanahan: A Circumscriptive Calculus of Events. Artif. Intell. 77(2), pp. 249-284, 1995.
	4.	John F. Sowa: Conceptual Structures: Information Processing in Mind and Machine, Addison Wesley Publishing Company, Reading Massachusetts, 1984.
	5.	John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks /Cole, Thomson Learning, 2000.

BCSL202: Computer Architecture & Organization

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
3	--	--	3	3	10	15	50	--	--	75

Course Objectives	This course introduces basic fundamental Units of a computer system and its operation and flow of information between these Units.
	It is aimed at developing skills to implement control Unit performing operations such as Addition, Subtraction, Multiplication and Division
	The course provides career opportunities in the subject areas of designing an advanced computer system.
Course Outcomes	Understand the impact of instruction set architecture on cost-performance of computer design
	Understand the organisation of a computer system in terms of its main components
	Carry out basic arithmetic on numbers of differing base.
	Understand memory hierarchy and its impact on computer cost/performance.
	Designing ways for communication with I/O devices and interfaces.
	Apply the concept of RISC philosophy for performance improvement of computer design

Course Contents:

Unit	Contents	Hours
I	**Unit I: BASIC STRUCTURE OF COMPUTERS** Functional units, Basic operational concepts, Bus structures Addressing modes, subroutines: parameter passing, Instruction formats, expanding opcodes method.	7
II	**Unit II: BASIC PROCESSING UNIT:** Bus architecture, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Microprogrammed Control, microinstruction format, Bit slice concept.	8
III	**Unit III: ARITHMETIC UNIT**: Number representations and their operations, Design of Fast Adders, Signed multiplication, Booth's Algorithm, bit-pair recoding, Integer Division, Floating point numbers and operations, guard bits and rounding.	7
IV	**Unit IV: THE MEMORY SYSTEM:** Various technologies used in memory design, higher order memory design, multimodal memories and interleaving, Associative Memory, Cache memory, Virtual Memory	8
V	**Unit V: INPUT/OUTPUT ORGANIZATION:** I/O mapped I/O and memory mapped I/O, interrupts and interrupts handling mechanisms, vectored interrupts, synchronous vs. asynchronous data transfer, Direct Memory Access COMPUTER PERIPHERALS: I/O devices such as magnetic disk, magnetic tape, CDROM systems.	7
VI	**Unit VI: RISC Philosophy:** Pipelining, basic concepts in pipelining, delayed branch, branch prediction, data dependency, influence of pipelining on instruction set design, multiple execution units, performance considerations, Basic concepts in parallel processing & classification of parallel architectures. Vector Processing, Array Processors. Recent trends in Computer Architecture & Organization, Advanced topics & its Application.	8

Text Books	1.	V.C.Hamacher, Z.G.Vranesic and S.G. Zaky, 'Computer Organisation', McGraw Hill, 5thedition, 2002
E--Books	1.	
	2.	
Reference Books	1.	A.S.Tanenbaum, "Structured Computer Organization" 4th Edition, Pearson Education
	2.	M Mano, "Computer System and Architecture", Pearson Education
	3.	W. Stallings, "Computer Organization & Architecture", Pearson Education

BCSL207: Problem Identification And Design Thinking

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	--	1	1	10	15	--	--	--	25

Course Objectives	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.
	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.
	Teach students to translate broadly defined opportunities into actionable innovation possibilities and recommendations for key stakeholders and their organizations
Course Outcomes	Have an awareness of how design thinking can be applied in a wide range of contexts, from the personal to the global
	Initiate an attitude of playfulness to aid design thinking
	Use computing tools and online environments

Course Contents:

Unit	Contents	Hours
I	Why Design Thinking, The Design Process, Stages of Design Thinking, Research- Identifying drivers, Information gathering, Target groups, Samples and feedback	6
II	Idea generation- Basic design, Themes of thinking, Inspiration and References, Brainstorming ,Value, Inclusion, Sketching, Presenting ideas , Refinement - Thinking in images, Thinking in signs, Appropriation , Humour, Personification, Visual metaphors, Modification, Thinking in words,Words and language , Type ‘faces’, Thinking in shapes, Thinking in proportions, Thinking in color,	8
III	Prototyping-Developing designs, ‘Types’ of prototype, Vocabulary, Implementation-Format, Materials, Finishing, Media, Scale, Series/Continuity	6

Text Books	1.	Jeanne Liedtka and Tim Ogilvie Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia University Press, 2011)
Reference Books	1.	Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America’s Leading Design Firm (Profile Books, 2002)
	2.	Tim Brown, Change by Design: How Design Thinking Transforms

		Organizations and Inspires Innovation(Harper Business, 2009
	3.	Roger Martin, The Design of Business: Why Design Thinking Is The Next Competitive Advantage (Harvard Business Review Press, 2009)
	4.	Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers (John Wiley and Sons, 2010)
	5.	Nigel Cross, Design Thinking: Understanding How Designers Think and Work(Bloomsbury Academic, 2011)

BITL303: SOFTWARE ENGINEERING

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
3	--	--	3	3	10	15	50	--	--	75

Course Objectives	This course introduces basic idea of software engineering while making them aware of basic mechanism of software engineering.
	It is aimed at developing skills to provide development solutions to variety of real life situations which involve software engineering.
	Students learn appropriate cost estimations for developed software.
	This course provides career opportunities in subject area of software requirement, software design, and software testing quality management, Configuration management.
Course Outcomes	Identify life cycle models involved in designing software.
	Develop an appropriate design technique for software development problems and analyze them with proper requirements.
	Apply advanced development technique and tools in software analysis, modeling , design and testing software
	To be aware of different life cycle models , requirement dictation process analysis modeling and specification & architectural detailed
	Apply Project planning and management, Use of CASE tools In recent Areas

Course Contents:

Unit	Contents	Hours
I	**SOFTWARE PROCESS** 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.	8
II	Software• project estimation and planning, decomposition techniques, LOC and FP estimation, effect estimation, risk analysis, identification, projection, assessment, management and monitoring, software reengineering, requirement analysis, tasks, analyst, software prototyping, specification principles, representation and the software	7

	requirements specification.	
III	Object oriented analysis and data modeling object oriented concepts, identifying objects, specifying attributes, defining operations, inter object communication finalizing object definition, object oriented analysis modeling. data modeling, data objects, attributes and relationships entity relationship diagrams, alternative analysis techniques, requirement analysis methods, data structure oriented methods, data structured system development warner diagrams and the DSSD approach, Jackson system development.	8
IV	Software design fundamentals, The design process, design fundamentals, effective modular, design dataflow oriented design, transform analysis, transaction analysis, design heuristics, object oriented design. Object oriented design concepts, object oriented design methods. Refining operations, program components & interfaces, implementation detail design, User interface design, human factors, human computer interface design, interface-design guidelines, interface standards.	7
V	Software quality assurance, software quality factors quality assurance, quality metrics, Halstead's S/W science, software testing techniques, S/W testing fundamentals; White box testing, black box-testing, validation testing, system testing, debugging software maintenance maintainability, maintenance tasks, reverse engineering and re-engineering.	7
VI	Recent Trends And Applications	3

Text Books	1.	Roger S. Pressman, "Software Engineering – A Practitioner‟s Approach", Seventh Edition, McGraw-Hill International Edition, 2010.
E--Books	1.	
	2.	
Reference Books	1.	Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
	2.	Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
	3.	PankajJalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
	4.	Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
	5.	Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.
	6.	http://nptel.ac.in/.

BECP212: Introduction To Robotics

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
	--	2	2	1	-	-	-	25	--	25

Course Objectives	To enlighten the students about the fundamentals of robotic systems.
Course Outcomes	Apply the basic concepts of robot
	To Analyse End effectors and robot controls
	To formulate Robot Transformations and Sensors
	To develop Robot cell design and applications

Course Contents:

Unit	Contents	Hours
I	**INTRODUCTION** Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system.	6
II	**END EFFECTORS AND ROBOT CONTROLS** Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.	6
III	**ROBOT TRANSFORMATIONS AND SENSORS** Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation-Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.	6
IV	**ROBOT CELL DESIGN AND APPLICATIONS** Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.	6
V	**MICRO/NANO ROBOTICS SYSTEM** Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.	6

Text Books	1.	S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
	2.	Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
	3.	Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012

Semester-IV

BFYL142: **Mathematics – VI (Graph Theory & Number System)**

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	1	--	2	2	10	15	25	--	--	50

Course Objectives	Represent a graph using an adjacency list and an adjacency matrix and apply graph theory to application problems in engineering.
	Learn basic concepts of Combinatorics.
	Exposed to some foundational ideas in number theory.
Course Outcomes	Understand and use different kinds of Graph, Trees in engineering field.
	Develop algebraic technique to solve combinatorial problems.
	Apply the concepts of group, ring and number theory in Programming application.

Course Contents:

Unit	Contents	Hours
I	**Unit –I: Graph Theory** :Graphs and its types, subgraph, Quotient graph, Euler path, Complete path, indegree, outdegree, reachability, cycle, matrix representation of graph. Transitive closure of graph, Adjacency matrix, Trees, Venn diagram, Representation of trees, binary trees, spanning trees, Prims algorithm..	6
II	**Unit -II: Combinatorics :** Definition of generating functions and examples, proof of simple combinatorial identities G.F., 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..	8
III	**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	6

Text 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

BCSP205: **Object Oriented Programming**

Teaching Scheme					**Evaluation Scheme**					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	4	4	2	--	--	--	50	25	75

Course Objectives	This course introduced features of object oriented programming.
	The course provide carrier opportunities in implementation of various applications as object oriented concepts plays dominant role in software development.
Course Outcomes	Articulate the principles of object oriented programming using C++
	Understand function overloading, constructor overloading, operator overloading, polymorphism & its uses in programming.
	Implement inheritance concepts and its use for application development
	Analyze of dynamic memory allocation and its use for software development
	Implement concept of file handling in real life problems
	Implement a project for real world problems

Course Contents:

Unit	Contents	Hours
I	**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	6
II	**Unit-II: Functions & Polymorphism -** Functions, Types of Functions, Constructor, Destructor, Function overloading & Ambiguity, Operator Overloading, Function Overriding, Friend Function	8
III	**Unit-III: Inheritance & Virtual Functions -** Inheritance and the access specifies, Types of Inheritance, Pointers and references to derived types, Virtual Functions	8
IV	**Unit-IV: Pointers & Dynamic allocations -** Static & Dynamic allocation using new and delete,* and ->* operators, Creating conversion functions, this pointer.	6

Text Books	1.	Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications
	2.	The Complete Reference C++, Herbert Schildt, 4th Edition, TMH
	3.	
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++, Sourav Sahay, Oxford University Press

BCSL210: Theory of Computation

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
3	--	--	3	3	10	15	50	--	--	75

Course Objectives	To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
	To introduce the fundamental concepts of formal languages, grammars and automata theory.
	Classify machines by their power to recognize languages.
	Employ finite state machines to solve problems in computing.
	To understand deterministic and non-deterministic machines.
	To understand the differences between decidability and un-decidability.
Course Outcomes	Able to understand the concept of abstract machines and their power to recognize the languages.
	Able to employ finite state machines for modeling and solving computing problems.
	Able to design context free grammars for formal languages.
	Able to distinguish between decidability and un-decidability.
	Able to gain proficiency with mathematical tools and formal methods.

Course Contents:

Unit	Contents	Hours
I	Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with €- moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA"s with and without €-moves – Equivalence of finite Automaton.	6
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	8

	Properties of Regular Languages, Decision Properties of Regular Languages.	
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 Tress, 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.	8
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	7
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.	7

Text Books	1.	Introduction to Automata Theory, Languages, and Computation, 3nd Edition,
	2.	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
	3.	Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
Reference Books	1.	Introduction to Languages and The Theory of Computation, John C Martin, TMH.
	2.	Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
	3.	A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
	4.	Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
	5.	Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

BITL302: Computer Networks

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
3	--	--	3	3	10	15	50	--	--	75

Course Objectives	To understand the computer network architectures.
	To make aware of design and performance perspective of network architectures.
	To discuss current trends in communication
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Analyze the need for OSI reference model in computer networking
	CO2: Studying the various transmission medium used in physical layer
	CO3: Analyzing different Elementary protocols for communication and Identify IEEE standards employed in computer networking
	CO4: Solve and apply various Routing Algorithm and Protocols
	CO5: Use techniques involved in developing transport and application layer of computer networking.

Course Contents:

Unit	Contents	Hours
I	Unit-I: Introduction The use of computer networks. Network hardware. LAN's, Man's, WAN's, internet works, Network software, protocol hierarchies, design issues for layers, interfaces and services, Connectionless oriented and connectionless services, service primitives, relationship of Services to protocols, the OSI reference model, TCP/IP reference model, comparison of OSI And TCP/IP reference model.	8
II	Unit-II: Physical Layer The theoretical basis for data communication-Fourier analysis, bandwidth-limited signals, Maximum data rate of a channel, transmission media-magnetic media, and twisted pair coaxial Cable, fiber optics. Wireless transmission, microwave transmission. Multiplexing, switching, Narrow and ISDN - services, architecture, interface, perspective on N-ISDN, broadband ISDN & ATM-virtual circuits versus circuit switching, transmission in ATM networks, ATM Switches.	8
III	Unit-III: Data Link Layer Design issues - services provided to the network Layer, framing, error control, flow control, Error correcting & detecting codes, elementary data link protocols, simplex stop and wait Simplex protocols for noisy channel, sliding window protocols-one bit protocol, go back Protocol,	8

	selective repeat protocol. The medium access sub layer - static and dynamic channel Allocation in LANs and MANs, Multiple access protocols - ALOHA. CSMA, collision free Protocols, limited contention protocols, IEEE 802.11 wireless LAN protocols, IEEE Standards 802 for LAN and MANs-802.3 & Ethernet, token bus. Token ring,	
IV	Unit-IV: The Network Layer Design issues, services provided to the transport layer, internal organization, comparison of Virtual circuit and datagram subnets, routing algorithms. Optimality principle, shortest path Routing, flooding, flow-based routing, distance vector routing, link state routing, hierarchical Routing, broadcast & multicast routing, congestion control algorithms, general principles Prevention policies, traffic shaping. flow specifications, congestion control in virtual circuit Subnets. choke packets, load shedding, jitter control. IP protocol, IP address. Subnets, internet Control protocols, OSPF. BGP.	8
V	Unit V: Transport and Application Layer Transport and Application Layer - services provided to the upper layer, Quality of Service, Transport service primitives, elements of transport protocols, addressing, establishing a Connection, releasing a connection, flow control & buffering, multiplexing, crash recovery,	8

Text Books	1.	Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, Pearson
	2.	Data Communication And Networking, Behrouz A. Forouzam, Fourth Edition, McGraw Hill
	3.	An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
E--Books	1.	Fayez Gebali, Analysis of Computer and Communication Networks, First Edition, Springer
	2.	An Introduction to Computer Networks, Peter L Dordal, Department of Computer Science, Loyola University Chicago(http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf)
	3.	TCP/IP Network Administration, Craig Hunt
Reference Books	1.	Jean Walrand , Pravin Varaiya, High-Performance Communication Networks (The Morgan Kaufmann Series in Networking), Second Edition, Morgan Kaufmann Publishers
	2.	V. S. Bagad, I. A. Dhotre, Computer Communication Networks, Third Edition, Technical Publications, Illustrated
	3.	Norman Abramson, Franklin F. Kuo, Computer-communication networks, Fourth Edition, Prentice-Hall, 1973, Illustrated
on line TL Material	1.	Coursera – “Data communication Network Services” by Cisco
	2.	NPTEL – “Data Communication” by IIT Kharagpur
	3.	Swayam – “Computer Networks” by Anand More,

BAIL203 / BAIP203: Machine Learning Algorithms

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	The objectives of the course is to introduce students to the basic machine learning algorithms.
Course Outcomes	Understand complexity of Machine Learning algorithms and their limitations;
	Understand modern notions in machine learning and computing;
	Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
	Be capable of performing experiments in Machine Learning using real-world data.

Course Contents:

Unit	Contents	Hours
I	Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation	6
II	Linear regression, Decision trees, over fitting Instance based learning, Feature reduction, Collaborative filtering based recommendation	8
III	Probability and Bayes learning ,Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM	8
IV	Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning	6
V	Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model	6

Text Books	1.	Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
	2.	Introduction to Machine Learning Edition 2, by Ethem Alpaydin

BAIP206: Probability & Statistics Using R

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
--	--	4	4	2	--	--	--	50	--	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	Recall the basic concepts and techniques of artificial Intelligence & Machine Learning.
	Summarize and compare a range of machine learning algorithms along with their strengths and weaknesses
	Develop skills of using recent machine learning software for solving practical problems.
	Classify machine learning algorithms to solve real time problems of moderate complexity.
	Gain experience of doing independent study and research through case studies.

Course Contents:

Unit	Contents	Hours
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	6
II	**Understanding Machine Learning:** Introduction, What Is Machine Learning? , Examples of Machine Learning Applications, Learning Associations, Supervised& Unsupervised Learning, Reinforcement Learning, Classification, Regression	8
III	**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	6
IV	**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	6
V	**Clustering & Application of ML:** Introduction to clustering, k-Means Clustering, Hierarchical clustering, Introduction to Chat Bot, creation of Chat Bot	7
VI	**Case Study** of Artificial Intelligence and Machine Learning using Nvidia.	2

Text Books	1.	*Introduction to machine learning*,*EthemAlpaydin. — 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

Semester-V

BFYL143: Integral Transforms

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
1	--	--	1	1	10	15	25	--	--	50

Course Objectives	Understand the mathematical descriptions in Laplace Transform & Fourier Transform
	Formulate problems and use appropriate methods to find the solutions.
Course Outcomes	Understand and use Laplace transform to solve engineering problems.
	Apply the concept of Laplace transform in control system engineering.
	Use Fourier Integrals to solve engineering problems.

Course Contents:

Unit	Contents	Hours
I	**Laplace Transforms:** 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	6
II	**APPLICATIONS OF LAPLACE TRANSFORM**: Applications of Laplace transforms 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 signals. Mathematical modelling using Transfer function.	8
III	**FOURIER TRANSFORMS:** Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem.	8

Text Books	1.	Kreyszig, E.: Advanced Engineeing Mathematics (Eighth Edition); John Wiley & Sons; 2000.
	2.	Jain, R.K. and Iyengar, S.R.K.; Advanced EngineeringMathematics; Narosa Publishers; 2003

BAIL301/ BAIP301: Genetic Algorithms & Fuzzy Logic Systems

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
	To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems
	To provide the mathematical background for carrying out the optimization associated with neural network learning
Course Outcomes	Able to design a neural network to solve any problem
	Able to design fuzzy controller
	Identify and select a suitable Soft Computing technology to solve the problem;
	Construct a solution and implement a Soft Computing solution

Course Contents:

Unit	Contents	Hours
I	Neural Networks: Introduction to Biological Neural Networks: Neuron physiology, Neuronal diversity, specification of the brain, the eye's Neural Network. Artificial Neural Network Concepts: Neural attributes, modeling learning in ANN, characteristics of ANN, ANN topologies, learning algorithm.	8
II	Neural Network Paradigm: MeCulloch-Pitts, Model, the perception, Back-propagation networks. Associative Memory, Adaptive Resonance (ART) paradigm, Hopfield Model, Competitive learning Model, Kohonen Self-Organizing Network.	8
III	Fuzzy Logic: Introduction to Fuzzy sets: Fuzzy set theory Vs Probability Theory, classical set theory, properties of Fuzzy sets, Operation on Fuzzy sets. Fuzzy relations, Operations of Fuzzy relation, the extension principle. Fuzzy Arithmetic	8
IV	Approximate reasoning: Introduction, linguistic variables, Fuzzy proposition, Fuzzy if-then rules. Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models –Input Space Partitioning and Fuzzy Modeling.	8

Text Books	1.	Introduction to Artificial Neural Systems,J acek M. Zurada, Jaico Publishing House, 1994
	2.	Neural Network, Fuzzy Logic and Genetic Algorithm, S. Rajshekahran, G.A. Vijaylaxmi Pai, PHI Learning Pvt. Ltd,2003
	3.	Fuzzy sets & fuzzy logic, George J Klir, B. Yuan PHI,1995,1 edition
	4.	Swarm Intelligence: From Natural to Artificial Systems E. Bonabeau, M. Dorigo, and G. Theraulaz, Oxford University Press, 1999

BAIL302/ BAIP302: Natural Language Processing

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	Introduces students to leading trends and systems in natural language processing.
	Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
	Teach them to recognize the significance of pragmatics for natural language understanding.
Course Outcomes	Understand approaches to syntax and semantics in NLP.
	Demonstrate approaches to discourse, generation, dialogue and summarization within NLP.
	Apply current methods for statistical approaches to machine translation.

Course Contents:

Unit	Contents	Hours
I	Introduction and Basic Text Processing, Spelling Correction, Language Modeling, Advanced smoothing for language modeling, POS tagging	6
II	Models for Sequential tagging – MaxEnt, CRF, Syntax – Constituency Parsing, Dependency Parsing, Distributional Semantics Lexical Semantics, Topic Models	8
III	Entity Linking, Information Extraction, Text Summarization, Text Classification, Sentiment Analysis and Opinion Mining	8

Text Books	1.	Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing,
	2.	Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.
	3.	Chris Manning and Hinrich Schütze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.

BCSL208/ BCSP208: Database Management Systems

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	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 Outcomes	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.
	Demonstrate an understanding of various normalization forms and apply knowledge of normalization for creation of database.
	Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database and perform inferential analysis of data model
	Demonstrate query processing and able to design optimized query execution plan.
	Perform basic transaction processing and management and ensure database security, integrity and concurrency control
	Demonstrate the management of structured and unstructured data management with recent tools and technologies

Course Contents:

Unit	Contents	Hours
I	Introduction to DBMS, DBMS Architecture, Data Models, UML	6
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.	8
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	8
IV	Query Processing & Query Optimization: Overview, measures of query	6

	cost, selection operation, sorting, join, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans, materialized views	
V	Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, Two- Phase Commit protocol, Deadlock, two-phase locking protocol	8
VI	NoSQL Databases - Introduction, CRUD Operations, Data Mining, XML	4

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, Mongo DB: The Definitive Guide, 3rd Ed, O'Reilly Media 2018.
		Ramez Elmasri and Shamkant Navathe, Fundamentals of Database Systems 2nd Ed, Benjamin Cummings, 1994.

BCSL315/ BCSP315: CLOUD COMPUTING

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
2	--	2	4	3	10	15	25	25	--	75

Course Objectives	Understand the new technologies for resources sharing
	Explain classification of Cloud deployment
	Discuss capacity planning for cloud configuration
	Understand Cloud service model
	Cloud Security and privacy issue
	Cloud business model for cost effectiveness
Course Outcomes	State the basics of distributed computing and cloud computing.
	Summarize the technical capabilities and business benefits cloud technology.
	Develop cloud-based application demonstrating its implications
	Develop cost effective solution using cloud technology
	Develop solution for Society with minimized resources

Course Contents:

Unit	Contents	Hours
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)	6
II	**Cloud Computing Architectural Framework** Cloud architectural principles, Role of Web services, Benefitsand 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.	8
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,	8
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.	6

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: RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
	4.	Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, LeeGillam, 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, SubraKumaraswamy, and ShahedLatif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

BAIP308: Skill Development -2

MBP104: Advanced Communication Skills (Voice Versant & Essay)

BAIP304: Application of Artificial Intelligence in Finance

BAIP302: Aptitude -2

BAIP309: Internship & Technical Report (LATEX) (Social +Minor Project)

BHULXXX: Understanding Human Values-2: Understanding Harmony

Semester-VI

BCSL316/ BCSP316: Design And Analysis Of Algorithms

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	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.
	It is also aimed at developing skills to solve real life applications which involve algorithm development.
	The course also provides career opportunities in analysis, design and optimization technique in algorithms.
Course Outcomes	Apply basic concepts of algorithm in analysis and Design of algorithms.
	Identify and apply methods used for analysis and Design of Algorithm
	Develop an appropriate mathematical formulations in designing algorithm Develop an appropriate mathematical formulations in designing algorithm Use advanced techniques and tools available for algorithm analysis and development

Course Contents:

Unit	Contents	Hours
I	**Mathematical foundations** summation of arithmetic and geometric series, n, n2, 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	6
II	**Asymptotic notations** Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, application of amotorized analysis, Sorting networks, comparison networks, biotonic sorting network.	7
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.	7
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	8

	Programming basic strategy, multistage graphs, all pairs shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem, Maximum flow networks.	
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	6

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
	3.	
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.

BAIL305 / BAIP305: Deep Learning

Teaching Scheme					Evaluation Scheme					
					Theory			Practical		
Th	Tu	Pr	Total	Credit	TAE	CAE	ESE	INT	EXT	Total
2	--	2	4	3	10	15	25	25	--	75

Course Objectives	To understand the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data.
	To apply Deep learning Techniques to various engineering and social applications.
Course Outcomes	Ability to identify the deep learning techniques.
	Ability to select and implement Machine learning and deep learning.
	Ability to Train machine and solve problems associated with batch learning and online learning,
	Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
	Ability to integrate deep learning libraries and mathematical and statistical tools.

Course Contents:

Unit	Contents	Hours
I	History of Deep Learning,Deep Learning Success Stories,McCulloch Pitts Neuron, ThresholdingLogic, Perceptrons, PerceptronLearning Algorithm Multilayer Perceptrons (MLPs),Representation Power of MLPs,Sigmoid Neurons, Gradient Descent,Feedforward Neural Networks	6
II	Representation Power of FeedforwardNeural Networks FeedForward Neural Networks,Backpropagation Gradient Descent (GD), MomentumBased GD, Nesterov Accelerated GD,Stochastic GD, AdaGrad, RMSProp,Adam, Eigenvalues and eigenvectors,Eigenvalue Decomposition, Basis	8
III	Principal Component Analysis and its interpretations, Singular Value Decomposition Autoencoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders	8
IV	Regularization: Bias Variance Tradeoff,L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization	8
V	Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Learning Vectorial Representations Of Words	5
VI	Recurrent Neural Networks, Backpropagation through time (BPTT),Vanishing and Exploding Gradients,Truncated BPTT, GRU, LSTMs Encoder Decoder Models, Attention Mechanism, Attention over images.	5

Text Books	1.	"Computer Vision Metrics: Survey, Taxonomy, and Analysis" by Andy Krig Scott
	2.	Deep Learning in Computer Vision,Principles and Applications,MahmoudHassaballah, Ali Ismail Awad
	3.	Modern Deep Learning and Advanced Computer Vision, A Perspective Approach, Dr.P.S.Jagadeesh Kumar, Prof. Thomas Binford, Dr.J. Ruby, J. Lepika
on line TL Material	1.	https://nptel.ac.in/courses/106/106/106106224/

BCSL215/BCSP215: Big Data Tools & Techniques

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	
2	--	2	4	3	10	15	25	25	25	100

Course Objectives	Understand basic concepts and techniques of Hadoop ecosystem and Big data.
	Design different component of Hadoop ecosystem.
	Understand the domain of data science and analysis of big data.
Course Outcomes	Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications
	Ability to solve problems associated the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
	Integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.
	Analyze large datasets

Course Contents:

Unit	Contents	Hours
I	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	7
II	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	6
III	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.	6

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.
	3.	

BCSL324: **Information Sciences**

Teaching Scheme					Evaluation Scheme					
Th	Tu	Pr	Total	Credit	Theory			Practical		Total
					TAE	CAE	ESE	INT	EXT	

Course Objectives	To introduce concepts of Information Science in the field of Engineering.
	To develop skills in students to utilize vast amount of Information Properly
Course Outcomes	Apply concepts of information science in solving engineering problems.
	Developed applications using information in engineering
	Apply the Knowledge of science to solve various problems in engineering.

Course Contents:

Unit	Contents	Hours
I	Introduction to Information Science ,Definition, scope, transition to modern information science, research in information science	4
II	Information and references Sources Types and Importance; Documentary Sources: Primary, Secondary and Tertiary; Non print materials including digital information sources, Traditional Vs. Digital sources of information; Institutional and Human Sources; Reference Sources including Indian reference sources; Evaluation of Reference and Information Sources	8
III	Fundamental concepts of Information and Reference, Services Definition & Characteristics of Information, Linguistic & biological approaches to Information ,Concept, definition, scope and types of references Search strategy and techniques;	8
IV	Users of information -Information users and their information needs; Categories of information users; Information needs – definition, scopes and models; Information seeking behaviour; User studies: Methods, techniques and evaluation and User education.	6
V	Introduction to ICT -Data, information and knowledge, ICT – definition, scope, application in human activities, social implication, Application of ICT in activities of library and information centres;	6

Text Books	1.	Encyclopedia of Information Science and Technology, Mehdi Khosrow-Pour, Idea Group Reference
	2.	Fundamentals of information studies: understanding information and its environment, L. June, K.Wallace C, Neal Schuman, 2007.

	3.	Library and information science: an introduction, B. Chakraborty, P. Mahapatra, World Press, 2008.
	4.	International encyclopedia of information and library science, F. John, S. Paul, 2003.
	5.	Information science in theory and practice, V. Brain C, V. Alinas, 2004.
	6.	Information users and usability in the digital age, G. C. Chowdhury, S. Chowdhury

Semester VII

Course Code	Name of the Course
BAIP401	Project Phase 1
BAIL402	MOOCs-1

Semester VIII

Course Code	Name of the Course
BAIP403	6 Months Internship
BAIP404	Project Phase 2
BAIP405	MOOCs-2