G H Raisoni College of Engineering

(An Autonomous Institute affiliated to RTM Nagpur University Nagpur)

B. Tech. in Data Science

Scheme - 2020

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 creating AI Engineers who are empowered with latest tools and technologies to provide customer oriented innovations to 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 Data Science

Program Educational Objectives

PEO1	Apply data analysis, statistical modeling, optimization to formulate and solve complex statistical and multidisciplinary problems
PEO2	Take up higher studies, research & development and other creative efforts in the area of Data Science.
PEO3	Use their skills in an ethical & professional manner to raise the satisfaction level of stake holders.

Program Specific Outcomes

PSO1	Visualize, curate, and prepare data for use with a variety of statistical/AI methods and models and recognize how the quality of the data and the means of data collection may affect conclusions
PSO2	Use and adapt modern software packages and scalable computing infrastructure to formulate problems, identify and gather relevant existing data, and analyze the data to provide insights.
PSO3	Utilize contemporary computing technologies, such as machine learning, AI, parallel and distributed computing, to solve practical problems characterized by large-scale data

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 Data Science

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			L	T	P	Total Hours		TAE	CAE	ESE	INT	EXT	
SEMESTER-I													
UBSL151	Matrices and Differential Calculus	BS1	2	1	-	3	3	10	15	50	-	-	75
UBSL101 UBSP101	Engineering Physics	BS2	1	1	2	4	3	10	15	50	25	-	100
UCSL101 UCSP101	Computer Programming	C1	2	-	4	6	4	10	15	50	50	-	125
UCSL102 UCSP102	Foundation of Data Analytics	C2	1	-	2	3	2	10	15	50	25	-	100
UECL103 UECP103	Introduction to Discrete Devices and Circuits	C3	2	-	2	4	3	10	15	50	25	-	100
UITP101	Problem Identification and Design Thinking	A1	-	-	2	2	1	-	-	-	25	-	25
UAIP102	Introduction to Drones	A2	-	-	2	2	1	-	-	-	25	-	25
UECP101	Biomedical Engineering	A3	-	-	2	2	1	-	-	-	25	-	25
TOTAL			**8**	**2**	**16**	**26**	**18**						**575**

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			L	T	P	Total Hours		TAE	CAE	ESE	INT	EXT	
SEMESTER-II													
UBSL152	Integral Calculus and Differential Equations	BS3	2	1	-	3	3	10	15	50	-	-	75
UBSL153	Linear Algebra and Statistics	BS4	2	1	-	3	3	10	15	50	-	-	75
UBSL131 UBSP131	Environmental Chemistry	BS5	1		2	3	2	10	15	50	25	-	100
UHUL101 UHUP101	Communication Skills	H1	2	-	2	4	3	10	15	50	25	-	100
UITP102	Programming for Problem Solving	C4	-	-	4	4	2	-	-	-	50	-	50
UECL104 UECP104	Modeling of Digital Circuits	C5	3	-	2	5	4	10	15	50	25	-	100
UECP105	Internet of Things	A4	-	-	2	2	1	-	-	-	25	-	25
UHUP102	Foreign Language	A5	-	-	2	2	1	-	-	-	25	-	25
TOTAL			**10**	**2**	**14**	**26**	**19**						**550**

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-III													
UBSL255	Discrete Mathematics and Graph Theory	BS	3	1		4	4	10	15	50			75
UCSL206	Operating System	C	3			3	3	10	15	50			75
UCSL301 UCSP301	Database Management Systems	C	3		2	5	4	10	15	50	25		100
UAIL305/ UAIP305	Introduction To Data Science	C	3		2	5	4	10	15	50	25		100
UCSL201 UCSP201	Data Structures and Algorithms	C	3		2	5	4	10	15	50	25		100
UCSLXXX	Software Engineering and Project Management	C	3			3	3	10	15	50			75
UAIP201	Data Preprocessing	A			4	4	2				25		25
TOTAL			**18**	**1**	**10**	**29**	**24**						**550**

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-IV													
UBSLXXX	Probability Theory	BS	3	1		4	4	10	15	50			75
UITP201	Object Oriented Programming	C			4	4	2				25	25	50
UCSL203	Formal Languages and Automata	C	3			3	3	10	15	50			75
UITL202	Computer Network	C	3			3	3	10	15	50			75
UAIL301 UAIP301	Machine Learning Algorithms	C	3		2	5	4	10	15	50	25		100
UIDLXXX	Open elective-I	OE	2			2	2	10	15	50			75
UAIP103	Mini Project	P			2	2	1				25		25
UAIL XXX	Elective I	EL	3			3	3	10	15	50			75
UITP203	Data Analysis Using R	A9-A10			4	4	2				25		25
TOTAL			**17**	**1**	**12**	**30**	**24**						**575**

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-V													
UCSP303	Cloud Computing	C			4	4	2				25	25	50
UAIL304/ UAIP304	Information Retrieval and Text Mining	C	3		2	5	4	10	15	50	25		100
UCSL205 UCSP205	Design and Analysis of Algorithm	C	3		2	5	4	10	15	50	25		100
UBSLXXX	Statistics for Management	C	3			3	3	10	15	50			75
UAILXXX	Elective II	EL	3			3	3	10	15	50			75
UIDP301	Aptitude	A			2	2	1				25		25
UAIP203	Minor Project	P			4	4	2				25		25
UHUL301	Engineering Economics and Industrial Management	H	2			2	2	10	15	50			75
TOTAL			**14**		**14**	**28**	**21**						**525**

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-VI													
UAIL420/ UAIP420	Next Generation Databases	C	3		2	5	4	10	15	50	25		100
UAIL401 UAIP401	Computer Vision and Deep Learning	C	3		2	5	4	10	15	50	25		100
UITL305 UITP305	Big Data Computing	C	3		2	5	4	10	15	50	25	25	125
UAIL XXX	Open Elective II	OE	2			2	2	10	15	50			75
UHUL302	Universal Human Values 2: Understanding Harmony	H	3			3	3	10	15	50			75
UHULXXX	Humanities Elective	H	2			2	2	10	15	50			75
UIDP302	Employability Skills	A			2	2	1				25		25
UIDP303	Campus Recruitment Training	A			2	2	1				25		25
TOTAL			**16**	**0**	**10**	**26**	**21**						**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-VII													
UAIL XXX	Department Elective III	EL	3			3	3	10	15	50			75
UAIL XXX	Department Elective IV	EL	3			3	3	10	15	50			75
UAIL XXX	Department Elective-V	EL	3		2	5	4	10	15	50	25		100
UAIL XXX	Department Elective-VI	EL	3		2	5	4	10	15	50	25		100
UAIP4018	Project	P			8	8	4				100	100	200
TOTAL			**12**	**0**	**12**	**24**	**18**						**550**

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-VIII													
UAIP419	Internship	P					12				250	250	500
UIDL4XX	MOOCs based Open Elective	OE	3			3	3	10	15	50			75
TOTAL			**3**	**0**	**0**	**3**	**15**						**575**

SEMESTER-I

Course Title: **Matrices & Differential Calculus**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	2 Hrs.	1 Hr.	NA	3	10	15	50	NA	NA
Course Code	UBSL151									
Teaching Mode	Offline	3 Hrs			Total	75			–	
Duration of ESE	2 Hrs.					75				

Course Objectives	To introduce concepts of matrices in the field of Engineering.
	To develop skills in student to solve engineering problems based on Matrices.
	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	Upon successful completion of this course, student will be able to:
	CO1**:** Understand and use the theory of Matrices to solve the system of linear equations and engineering problems in respective disciplines.
	CO2: Determine the Eigen values and Eigen vectors of a matrix and apply to various engineering problems in respective disciplines.
	CO3: Apply concepts of differentiation in solving engineering problems.
	CO4: Use applications of partial differentiation to solve various problems in engineering.
	CO5: Apply the Knowledge of vector differentiation to solve various problems in engineering.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2		1							3			
CO2	3	3	2		1							3			
CO3	3	3	2		1							3			
CO4	3	3	2		1							3			
CO5	3	3	2		1							3			

Course Contents:

Unit	Contents	Hours
I	Matrices**:** Adjoint of Matrix, Inverse of matrix by adjoint method, Solution of simultaneous equations by adjoint method. Inverse of matrix by Partitioning method. Rank of matrix, Consistency for system of linear equations, Linear dependence.	8
II	Characteristics equation, Eigen values and its properties. Eigen vectors. Reduction to diagonal form, Cayley Hamilton theorem (statement & verification). Sylvester's theorem, Association of matrices with linear differential equations of second order with constant coefficient.	10
III	Differential Calculus of single variable function: Review of limits, continuity, differentiability and Mean value theorem. Successive differentiation, Leibnitz's Theorem, Taylor's series and Maclaurin series for single variable function.	7
IV	Differential Calculus of function of several variables: Functions of several variables, First and higher order partial derivatives, Euler's theorem, Chain rules. Jacobian, Properties of Jacobian, Maxima and minima of function of two variables, Lagrange's method of undetermined multipliers.	9
V	Vector Calculus: Differentiation of vectors, Gradient of a 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
Reference Books	1.	Advanced Engineering Mathematics: Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd, 2007, Third Edition
	2.	Advanced Mathematics for Engineers and Scientists: Spiegel, M. R, McGraw-Hill, 2010, Second Edition

Course Title: **Engineering Physics**										
Semester	I /II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	1 Hr.	1 Hr.	2 Hrs.	3	10	15	50	25	-
Course Code	UBSL101 UBSP101									
Teaching Mode	Offline	4 Hrs			Total	75			25	
Duration of ESE	2 Hrs					100				

Course Objectives	Demonstration of the fundamentals of uniform and non-uniform electric and magnetic fields and working of related devices.
	Familiarization and demonstration of the concepts of interference, laser and their applications.
	Explanation of working of various optoelectronic devices.
	Demonstration of the fundamentals of Quantum Mechanics and its related applications.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Identify the trajectories of electron in uniform Electric and Magnetic fields and operate related devices.
	CO2: Describe the phenomenon of interference & implement it for finding related parameters.
	CO3: Explain the working of Laser & use it for different applications.
	CO4: Identify various optoelectronic devices and use them for various applications.
	CO5: Apply the knowledge of Quantum Mechanics to solve related problems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	2										1			
CO6															

Course Contents:

Unit	Contents	Hours
I	**Electron Ballistics and Optics**: Trajectories of electron in uniform Electric and Magnetic field (Qualitative), Bethe's law, Electron Lens, Devices- Electron microscope (Theoretical), CRO	4
II	**Optics:** Interference-Interference in uniform & non-uniform thin films, AR Coatings, Surface Testing, Branch specific applications.	4
III	**LASER:** Characteristics, Spatial and Temporal Coherence, Einstein Coefficient & its significance, Basic requirements of Laser, Components of laser, He-Ne, Semiconductor laser and Branch Specific applications.	6
IV	**Semiconductor Physics:** Review of basic Semiconductor physics, Hall Effect, Review of working of PN junction diode with reference to energy level diagrams. Optoelectronic Devices:-Types of optoelectronic devices, LED-Types & working principle, OLED, properties & comparisons, OLED applications, PIN Photodiode, Solar Cell, Branch specific applications as sensors and detectors	6
V	**Quantum Physics:** Blackbody Radiation, Compton Effect, Wave particle duality: De Broglie wavelength, Group and Phase velocity, Heisenberg's Uncertainty principle & its applications, Schrödinger's Mechanics: Physical interpretation of Wave Function, Elementary Idea of Operators, Solution of Schrodinger equation for simple boundary value problems, Tunneling, Applications-TEM,SEM, Effect of Quantum constriction on properties of nano materials	6

Text Books	1.	Physics for Engineering, Dr. Bhavana P Butey, Oxford University Press, 2017, First Edition
EBooks	1.	https://www.phindia.com/Books/EBooks
Reference Books	1.	Fundamentals of Physics, David Halliday and Robert Resnik, New Age, 1994
	2.	Nanotechnology, Dr. Sulbha K Kulkarni, Capital Publishing Co., 2011
Online TL Material	1.	https://nptel.ac.in/courses/104/104/104104085/

Sr. No.	Name of Experiments
1	Application of CRO: To measure amplitude of AC voltage and determine unknown frequency using CRO
2	Determination of diameter of thin wire using interference by using Air Wedge
3	Determination of Wavelength of Laser source by Newton's ring.
4	Determination of Hall Coefficient of an Extrinsic Semiconductor by arranging it in a Hall Effect. Experiment.
5	Determination of Band gap of an Intrinsic semiconductor by using PN junction

	diode
6	PN junction diode as a rectifier-Find efficiency & ripple factor by using CRO
7	Application of diode: Voltage regulation by Zener diode.
8	Study of various Photo detectors as sensors
9	Application of interference: Determination of radius of curvature of plano-convex lens using Newton's ring set up.
10	Application of interference: Determination of refractive index using Newton's ring set up.
11	Laser: Determination of Birefringence of double image prism.
12	Determination of Band gap by four probe method.
13	Application of Diode: Determination of Planks Constant by using LEDs.
14	Comparison of V-I characteristics of various diodes.
15	Application of CRO: Determination of phase difference between two AC signals.

Course Title: **Computer Programming**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	2 Hrs	--	4Hrs	4	10	15	50	50	--
Course Code	UCSL101 UCSP101									
Teaching Mode	Online	6 Hrs			Total	75			50	
Duration of ESE	2 Hrs.					125				

Course Objectives	To introduce the basics of components of programming language and also develop logical thinking
	To implement concepts of mathematics into programming.
	To help students understand how to model real-world problems into the software and develop practical programming skills
Course Outcomes	**CO1**: Design algorithms and flowcharts for solving Mathematical and Engineering Problems
	CO2: Apply the suitable Control structures to solve the given problem
	CO3: Investigate the problems and Identify the use of Pointers and Functions in it.
	CO4: Assess the programming structure and recommend the type of array to be useful to find a solution for applications.
	CO5: Synthesize various problems to develop logical thinking

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3													
CO2			3												
CO3				3											
CO4			3												
CO5			3												

Course Contents:

Unit	Contents	Hours
I	**Introduction to Programming:** Evolution, Programming Paradigms, Features, Algorithm, Flow charts, Data types and storage classes, Strings, Scope of variables, Tokens, Type Casting, Operators	8
II	**Control Statements:** Decision Making Statements: if, if-else, nested if, nested if-else, switch, go-to. Loop Control Statements: Entry control, Exit Control, while, do-while, for, break, continue	7
III	**Arrays:** Definition, Declarations, Initialization, Accessing, Types of Arrays**: 2D,3D**	7
IV	**Pointers:** Definitions, Declarations, Applications **Functions:** Definitions, Declarations, Types**,** Calling, Function arguments: Call by Value, Call by Reference**, Recursion**	6
V	**Structure:** Definition, Accessing Structure Members, Structures as Function Arguments, Pointers to Structures **Union:** Definition, Accessing Union Members **Advance Topic: (As per the instructor)**	7

Text Books	1.	Kernighan and Ritchie, C programming language Prentice Hall of India,
	2.	Balguruswamy, “Programming in ANSI C”, Tata Mcgraw Hill Publishing
	3.	Kakde and Deshpande, “C and Data Structure”, Charles River Media Publisher
	4.	YashwantKanetkar, Let's C, BPB Publishers
Reference Books	1.	Herbert Schildt, C: The Complete Reference, Mcgraw Hill Publishing
	2.	Expert C Programming, Deep C Secrets by Peter van der Linden.
On-line TL Material	1.	https://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp

Sr. No.	Name of Experiments

1	Implement syntax of C with algorithm and flowchart
2	Implement Data Types and Type casting
3	Implement the Branch control statements in C
4	Implement the Loop control statements in C
5	Implement the concept of Pointers using C
6	Implement the Functions in C
7	Implement recursive functions in C
8	Implement the Linear Array Operations.
9	Implement the Matrix Array Operations Array for addition and multiplication
10	Implement Structures in C
Open Ended Experiments	
1	Student Record Management System
2	Simple CPP
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	https://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp
2	https://cse02-iiith.vlabs.ac.in/

Course Title: **Foundation of Data Analytics**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	1 Hr.	--	2 Hrs.	2	10	15	50	25	--
Course Code	UCSL102 UCSP102									
Teaching Mode	Online	3Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To perform descriptive statistics on the given dataset
	To perform inferential statistics on the given dataset
	Apply linear regression and logistic regression and perform data visualization on the given dataset with Tableau.
Course Outcomes	**CO1:**Analyze the dataset and perform Descriptive Statistics
	CO2:Analyze the dataset and perform an Inferential Statistics
	CO3: Apply linear regression on the given dataset
	CO4: Apply the logistic regression on the given dataset
	CO5: Create an interactive data visualization

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course	Program Outcomes and Program Specific Outcomes

Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3														
CO2	3														
CO3			3												
CO4			3												
CO5					3										

Course Contents:

Unit	Contents	Hours
I	Buzzwords of Data Science, Info-graphic representation of terminologies, Difference between Analysis and Analytics, Applications	3
II	Descriptive Statistics: Population and Sample, Types of Data, Measurement Levels, Representation of categorical variables, Measures of Central Tendency (Mean, Median, Mode), Skewness, Variance, Standard Deviation, Coefficient of Variation, Covariance, Correlation. Histogram Analysis.	3
III	Inferential Statistics: Distribution, Normal Distribution, Standard Normal Distribution, Central Limit Theorem, Standard Error, Estimators and Estimates, Confidence Interval, Students T Distribution, Margin of Error	3
IV	Linear Regression: Introduction to Regression, Simple and Multiple Linear Regression, Correlation vs. Regression, SST (Sum of Squares Total), SSR (Sum of Squares Regression), SSE (Sum of Squares Error) R-Square, Adjusted R-Squared. Multiple Linear Regression, Significance of p-value	3
V	Logistic Regression: Logistic regression, Logitvs logistic, Applications of logistic regression Introduction to data visualization and various graphical ways of data representation	3

Text Books	1.	The Art of Statistics: Learning from Data (Pelican Books), by David Spiegelhalter
	2.	Principles of Statistics by M. G. Bulmer, Dover Publications Inc.
	3.	Statistics 101: From Data Analysis and Predictive Modeling to Measuring Distribution and Determining Probability, Your Essential Guide to Statistics By David Borman, Adams Media
EBooks	1.	An Introduction to the Science of Statistics: From Theory to Implementation, by Joseph C. Watkins https://www.math.arizona.edu/~jwatkins/statbook.pdf
	2.	Introduction to Statistics, by David M. Lane http://onlinestatbook.com/Online_Statistics_Education.pdf
Reference Books	1.	Information Dashboard Design: Displaying Data for At-a-glance Monitoring by Stephen Few, Analytics Press
	2.	Beautiful Visualization, by Noah Iliinsky, Julie Steele Publisher(s): O'Reilly Media, Inc. ISBN: 9781449379865

Online TL Material	1.	The Business Intelligence Analyst Course 2020 https://www.udemy.com/course/the-business-intelligence-analyst-course-2018/
	2.	The Data Science Course 2020: Complete Data Science Bootcamp https://www.udemy.com/course/the-data-science-course-complete-data-science-bootcamp/

Sr. No.	Name of Experiments
1	Apply pivot table of Excel to perform data analysis
2	Perform Descriptive statistics of given dataset using Data Analysis Toolbox of Excel
3	Perform the Histogram Analysis of given dataset using Data Analysis Toolbox of Excel
4	Perform Simple Linear Regression using Data Analysis Toolbox of Excel or with Python and Interpret the regression table
5	Perform Multiple Linear Regression using Data Analysis Toolbox of Excel or with Python and Interpret the regression table
6	Perform the Logistic Regression and given dataset and Interpret the regression table
7	Install Tableau, Understand User Interface, Dimensions, Measures, Pages, Filters, Marks and Show Me, Dataset Connections and Create a visualization
8	Various graphs in Tableau, Integration of Map and geo-locations, Creating Interactive Dashboard and Publishing your Dashboard to Tableau Public Site
9	Scatter Plots, Data Highlighter, Pages and Cards, Annotations Creating Story and publishing on Tableau Public
10	Given a case study: Perform Interactive Data Visualization with Tableau
Open Ended Experiments	
1	Perform Data Visualization with Microsoft Power BI
2	Perform Data Visualization with R
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Google classroom on ‘Business Intelligence Analyst’ – Code: udsf4px

Course Title: **Introduction To Discrete Devices And Circuits**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course	C	2	-	2	3	10	15	50	25	-

Category		Hrs.		Hrs.						
Course Code	UECL103 UECP103									
Teaching Mode	Offline	4 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To give understanding on how current flows through the p-n junction and relating this phenomena to the characteristics and operation of the diodes, bipolar and field-effect transistors.
	To expose students to the function and application of the diodes, bipolar junction and field effect transistors in electronic circuits.
	To use appropriate experimentation techniques to evaluate circuit performance.
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Relate operation of diodes, types of diodes and their role in design of simple electronic applications.
	CO2: Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points for various biasing methods.
	CO3: Classify Power amplifiers, Oscillators & Display Devices
	CO4: Interpret the operation of the Field Effect Transistor (FET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and design FET circuits
	CO5: Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	3	3	2	1	1	1	1	2	3			
CO2	3	3	3	3	3	2	1	1	1	1	2	3			
CO3	3	3	3	3	3	2	1	1	1	1	2	3			
CO4	3	3	3	3	3	1	1	1	1	1	2	3			
CO5	3	3	3	3	3	1	1	1	1	1	2	3			

Course Contents:

Unit	Contents	Hours
I	**Semiconductor Devices:** PN junction diode review, Half and full wave rectifiers, Zener Diode,	6

	Varactor Diode, Tunnel Diodes, Clippers and Clampers circuits	
II	**BJT Transistors**- structure, Operations & characteristics, voltages and currents equations, CE, CB, CC configurations, Early Effect	6
III	**BJT Circuits** DC load line, Biasing circuits, Stability factor, thermal runaway, Compensation methods, h-parameters, Feedback Amplifiers,	6
IV	**Field Effect Transistor:** FETs – Drain and Transfer characteristics,- Current equations-Pinch off voltage and its significance, MOSFETs,	6
V	**Active and Passive sensors:** Temperature, humidity, light sensors, Piezo electrical Transducers, Relay	6

Text Books	1.	Electronics Devices and Circuits, S. Salivahanan, N Suresh Kumar, Tata McGraw-Hill 2008, Third Edition
	2.	Integrated Electronics Jacob Millman, Tata McGraw-Hill, 2009, Second Edition
	3.	Electronics devices and Circuits and Theory Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, Tenth Edition
E--Books	1.	Electronics Devices and Circuits, S. Salivahanan
	2.	Solid State Electronic Devices, 6th Edition, Ben G.Streetman&Sanjiv Kumar Banerjee
Reference Books	1.	Electronic Devices & Circuits, Sanjiv Gupta
	2.	Microelectronics Circuits A. S. Sedra& K. C. Smith, Oxford University Press, 2013, Seventh Edition
	3.	Electronics Devices and Circuits, Nagrath I J Phi Learning Pvt Ltd, 2009, Third Edition.
Online TL Material	1.	Virtual Lab,Electronic Devices & Circuits,IIT Bombay http://vlabs.iitb.ac.in/vlab/electrical/index.html

*: Every practical will be performed on Bread Board

Sr. No.	Name of Experiments / Mini Projects
0	Study of different electronic components
1	Observe and draw V-I Characteristics of PN Diode & LED Diode.
2	Observe and draw the V-I characteristics and Regulation characteristics of a Zener diode.
3	Design Clipper circuit using Diode.
4	Design Clamper circuit using Diode.
5	Obtain ripple factor of Half Wave/Full wave Rectifier circuit with & without filter
6	Draw the input and output characteristics of transistor connected in CE/CB/CC any one Configuration
7	Design bipolar junction transistor as a switch

8	Design Audio oscillator using BJT
9	Design Radio Oscillator using BJT
10	Design Oscillator for Laptop.
11	Draw the Drain and Transfer characteristics of a given FET in CS Configuration.
12	Draw the Drain and Transfer characteristics of a given MOSFET in CS Configuration.
Open Ended Experiments	
1	Design of Class B push pull power amplifier and observe cross over distortion.
2	Design Zener regulator circuits for Processor Motherboard.
3	Design of Simple analog application circuits.

Course Title: **Problem Identification and Design Thinking**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	--	--	2 Hrs.	2	--	--	--	25	--
Course Code	UITP101									
Teaching Mode	Offline	2Hrs			Total	--			25	
Duration of ESE	NA					25				

Course Objectives	Learn to illustrate the problem definition, significance of stakeholders and information gathering
	Conduct the brainstorming to generate ideas and refining of ideas
	Select the potential ideas and design potential solution
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Identify the problem definition and stakeholders
	CO2: Conduct primary and secondary research for problem
	CO3: Analyze the gathered information
	CO4: Identify potential ideas.
	CO5: Design a suitable prototype and evolve it.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO 1	PSO 2	PSO 3

	1	2	3	4	5	6	7	8	9	10	11	12			
CO1		**3**													
CO2				**3**											
CO3			**3**												
CO4															
CO5		**3**			**3**										
CO6		**3**	3	**3**									**3**	**3**	

Sr. No.	**Name of Experiments**
1	Define: Identify the problem definition and define it and identify the stakeholders. Enlist the constraints associated with Problem Definition and formulate the objectives.
2	Research: Conduct primary and secondary research in identified problem definition. Identify GAP and scope for improvement.
3	Information Gathering: Gather the information in the form of qualitative, quantitative and through surveys
4	Ideate: Perform brainstorming which can leads to generation of potential ideas
5	Refinement: Refine the ideas and increase the effectiveness
6	Prototype: Design a suitable prototypes for ideas generated in Ideate Phase.
7	Selection: Identify the proposed design solution for implementation or development phase
8	Implementation: Implement the solution or Deliver the solution to stakeholders
9	Evolve: Identify what worked well and where in the scope for improvement.
10	Report Writing: Write a detailed report for all the phases of design thinking.
Open Ended Experiments	
1	Define the Industry based problem and conduct the primary and secondary research and information gathering
2	Ideate the potentials ideas and design a prototype for industry based problem.

Text Books	1.	Basics Design 08: Design Thinking, By: Gavin Ambrose, Paul Harris, AVA Publishing
	2.	Jeanne Liedtka and Tim Ogilvie Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia University Press, 2011)
EBooks	1.	The Design Thinking: Guidebook by Mr Lee Chong Hwa (Lead Facilitator)
Reference Books	1.	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation(HarperBusiness, 2009)

Course Title: **Introduction to Drones**				
Semester	I/II	Teaching Scheme	Evaluation Scheme	
			Theory	Practical

Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	--	--	2 Hrs.	1	--	--	--	25	--
Course Code	UAIP102									
Teaching Mode	Offline	2 Hrs			Total	--			25	
Duration of ESE	NA					25				

Course Objectives	Be able to describe common components of drone
	Be able to define acronyms related to drone
	Be able to design the application oriented dron
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Recognize and describe the role of drone in present, past and future society
	CO2: Comprehend basic components of drone.
	CO3: Explain the impact of various payloads of drone.
	CO4: Interpret the aspects of legal issues
	CO5: Implement and design application oriented drone.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	2	2	3		3	3	2	3	1			
CO2	3	3	1	2	2	3		3	3	2	3	1			
CO3	3	3	1	2	2	3		3	3	2	3	1			
CO4	3	3	1	2	2	3		3	3	2	3	1			
CO5	3	3	1	2	2	3		3	3	2	3	1			

Course Contents:

Unit	Contents	Hours
I	**Introduction to Drone Technology** Types of Drones and Their Technical Characteristics, Main Existing Drone Types, Level of Autonomy, Size and Weight, Differences in Energy Source, Widely Used Drone models,	4
II	**Assembly of Drone** Parts of a Drone, Motor, Propellers, Flight Controllers, Electronic Speed Controllers, Safe Assembly of Drone and Drone air Flight for aerial Photos. Battery management systems	4

III	**Impact of Payloads** Types of Payloads and their application sensors, other payloads and frequency spectrum issues.	4
IV	**Legal Aspects** Legal issues on the use of frequency spectrum and electronic equipment, surveillance and compliance. Flight zones	4
V	**Case studies** Future Developments in Drone Technology. Advance topic	4

Text Books	1.	The future of Drone Use Opportunities and Threats from Ethical & Legal Perspectives
	2.	DIY Drones for the Evil Genius: Design, Build, and Customize Your Own Drones
E--Books	1.	Quad copters and Drones: A Beginner's Guide to Successfully Flying and Choosing the Right Drone
Reference Books	1.	Build a Drone: A Step-by-Step Guide to Designing, Constructing, and Flying Your Very Own Drone Barry Davies
	2.	Drones: An Illustrated Guide to the Unmanned Aircraft that are Filling our Skies

Sr. No.	Name of Experiments / Mini Project
1	Experimental study of customized drone components interfacing
2	Study of mAH battery capacity with flight time calculation and battery connection
3	Study of type of motors and ESC with connection in adopter
4	Experimental study of propeller blade rotation CC & CCL & it's role in control
5	Installation of Pluto X controller App & it's setting
6	Study of throttle control in quad copter and its controlling
7	Experimental study of role of yaw control in quad copter
8	Experimental study of role of roll control in balancing
9	Experimental study of role of pitch control in quad copter balance and its control
10	Study of sensor board X breakout and sensor interfacing to quad copter
Open Ended Experiments / New Experiments	
1	Chuck to ARM
2	Open Sesame: Drone take-off due to change in ambient pressure
3	Turn the Drone upright from it's flipped position
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Cygnus software

2.	Pluto X operating manuals
3.	Transmitter & Receiver console

Course Title: **Biomedical Engineering**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	---	---	2 Hrs.	1	---	---	---	25	---
Course Code	UECP101									
Teaching Mode	Offline	2 Hrs.			Total	---			25	
Duration of ESE	2 Hrs.					25				

Course Objectives	It helps students to understand importance of biological concepts in engineering fields.
	To understand application of engineering concepts in medical instrumentation.
Course Outcomes	**CO1:** Understand Human anatomy
	CO2: Relate various applications of sensors for Biomedical applications with safety standards.
	CO3: Analyses and apply various biomedical diagnostic methods.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	2	1	2	3	2	2	2			
CO2	2	2	2	2	3	2	1	2	3	2	2	3			
CO3	3	2	2	2	3	2	1	2	3	2	2	3			
CO4															
CO5															

Course Contents:

Unit	Contents	Hours
I	**Human Physiology and Anatomy:** Introduction to Human Physiology, Nervous system, Cardiovascular system,	4

II	**Biomedical Instrumentation**: Bio-electric Signals, Types of Electrodes, Electrodes for ECG, EMG, EEG, Transducers and sensors related to biomedical measurements, ECG Machine, B. P, Heart Rate, Heart Sound, Blood Flow Measurements. Electrocardiography, Pacemakers, Defibrillators, Biomedical Standards.	8
III	**Diagnostic Medical instruments**: X-ray, CT Scan, MRI, Ultrasonic Doppler Machine, Diathermy, Lasers in medical application, Robotics in medical application, Case studies, Advance topics in biomedical Engineering. Introduction to BCI. Application of AI in Biomedical.	8

Text Books	1.	Cromwell, “Biomedical Instrumentation and Measurement”, PHI.
	2.	R. S. Khandpur, “Biomedical Instrumentation”.
Reference Books	1.	Carr and Brown, “Biomedical Instrumentation”.
	2.	Webster, “Application and Design of Medical Instruments".

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	Study of Human Physiology by Skeleton model
2	Design and perform Heart Rate Detection System using Arduino
3	To study and measure the EEG signals
4	To study and measure the ECG signals
5	To study and measure the EMG signals
6	Mini project
7	Open Ended Experiments

SEMESTER-II

Course Title: **Integral Calculus and Differential Equations**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	2 Hrs.	1 Hr.	NA	3	10	15	50	NA	NA
Course Code	UBSL152									
Teaching Mode	Offline	3 Hrs			Total	75			–	
Duration of ESE	2 Hrs.					75				

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.
	To develop skills in student to solve problems of Ordinary Differential Equations and its applications in field of engineering.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand and use concept of definite integral & solve engineering problems.
	CO2: Evaluate the multiple integrals using different techniques and apply it to solve engineering problems.
	CO3: Understand vector integration and its applications related to real life problems.
	CO4: Solve first order, first degree & higher order differential equations.
	CO5: Form differential equations for simple engineering systems and find its solution.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2		1							3			
CO2	3	3	2		1							3			
CO3	3	3	2		1							3			
CO4	3	3	2		1							3			
CO5	3	3	2		1							3			

Course Contents:

Unit	Contents	Hours
I	Integral Calculus: Curve tracing (Cartesian Form), Gamma function, Beta function, Relation between beta and gamma function, Differentiation under integral sign. (Self-study: Area, Volume, Length, Surface area using simple integration.)	8
II	Multiple Integral: Double integral, Change of variables, Change of order of integration, Triple integral, Applications of multiple integral: Area, mass, volume.	10
III	Vector Integration: Line integral, Surface integral, Volume integral, Statement of Gauss theorem, Greens theorem and Stokes theorem and its applications.	8
IV	Differential Equations: Linear, Reducible to linear and exact differential equations of first order. Higher order linear differential equations with constant coefficients (Cases of CF & PI).	8
V	Method of variation of parameters, Cauchy's and Legendre homogeneous differential equations. Applications of Differential equations.	8

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 Edition
Reference Books	1.	Advanced Engineering Mathematics: Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd, 2007, Third Edition
	2.	Advanced Mathematics for Engineers and Scientists: Spiegel, M. R, McGraw-Hill, 2010, Second Edition

Course Title: **Linear Algebra and Statistics**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	2 Hrs.	1 Hrs.	NA	3	10	15	50	NA	NA
Course Code	UBSL153									
Teaching Mode	Offline	3 Hrs			Total	75			–	
Duration of ESE	2 Hrs.					75				

Course	Analyze problems, recognize appropriate methods to find the solution.

Objectives	Apply principles from mathematics to solve applied problems in engineering.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Apply simple operations like adding, multiplying, inverting, transposing, etc. in matrices and vectors.
	CO2: Apply the concepts of Linear Algebra in programming languages.
	CO3: Apply the concepts of least squares methods and linear regression analysis in engineering.
	CO4: Apply the knowledge of Random variables.
	CO5: Apply the knowledge of Probability distributions to solve engineering problems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2		1							3			
CO2	3	3	2		1							3			
CO3	3	3	2		1							3			
CO4	3	3	2		1							3			
CO5	3	3	2		1							3			

Course Contents:

Unit	Contents	Hours
I	Elimination with matrices, Inverse matrices, Factorization, Vector space, Column space and null space, Pivot variables, Row reduced form, Independence, Subspaces, Bases and dimensions, Four fundamental subspaces, Graphs, Networks, Incidence matrix.	10
II	Eigen values and eigenvectors, Diagonalization of a matrix, Symmetric matrices, Linear transformations, Singular Value Decomposition	8
III	Statistics: Introduction to measures of central tendency, Least Square method, Correlation and Regression.	7
IV	Random Variables, Distribution functions of continuous & discrete random variables, Mathematical expectations.	9
V	Special probability distributions: Binomial, Poisson's and Normal distributions.	8

Text Books	1.	Linear Algebra and Matrix Analysis for Statistics, Chapman &Hall, CRC Texts in Statistical Science
	2.	Linear Algebra and Its Applications, Gilbert Strang, Cengage Learning,2006,Fourth
EBooks	1.	https://faculty.atu.edu/mfinan/algebra2.pdf
	2	https://sites.math.northwestern.edu/~len/LinAlg/
	3.	https://faculty.atu.edu/mfinan/LINENG.pdf

Course Title: **Environmental Chemistry**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	1 Hrs.	NA.	2 Hrs.	2	10	15	50	25	NA
Course Code	UBSL131 UBSP131									
Teaching Mode	Offline	3 Hrs			Total	75			25	
Duration of ESE	2 Hrs					100				

Course Objectives	Demonstrate various methods of water treatment for domestic and industrial purpose.
	Explanation of different types of batteries and its commercial applications
	Demonstration and familiarization of impact of waste on environmental degradation.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Explain various methods of water treatment for domestic and industrial use
	CO2: Differentiate various categories of waste and its disposal techniques
	CO3: Identify various batteries and recognize its commercial applications
	CO4: Classify the different types of Energy and its future scope
	CO5: Apply the knowledge of environmental pollution and degradation to solve related problems

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1						2					1			
CO2	1						3					1			
CO3	1						2					1			
CO4	1						2					1			
CO5	1						3					1			

Course Contents:

Unit	Contents	Hours
I	**Water Technology:** Purification of Domestic water, Boiler troubles, softening methods of industrial water.	6
II	**Solid Waste Management and treatment Technology:** Introduction to E-Waste, Biomedical waste and Solid waste. Treatment: Collection, segregation, transportation and its disposal techniques	4
III	**Battery Technology:** Introduction to Battery, reversible and irreversible batteries. Examples: Lead-acid battery, Lithium ion battery and fuel cell	4
IV	**Energy Management:** Fuel- Characteristics, composition and determination of Solid, Liquid and gaseous fuel. Alternative forms of energy-Conventional and Non-Conventional sources – Hydroelectricity, Nuclear, Solar, Biomass and Geothermal energy and Bio-gas.	4
V	**Upcoming Technology for pollution control**: Air pollution- Urban air quality standards as per WHO, its sources and controlling methods. Water pollution- water quality index as per WHO, its sources and controlling methods	4

Text Books	1.	Text Book of Engineering Chemistry,S.S.Dara, S.Chand& company,2013, Eleventh Edition
	2.	Engineering Chemistry,Jain &Jain, Dhanpatrai&Dhanpatrai,2015, sixteenth edition
	3.	A Test Book of Environmental Chemistry &Pollution Control, S.S. Dara ,S. Chand & Co.,2006,eleventh edition
E books	1	Water purification,AlexandruGrumezescu,First edition
	2	Solid waste management by Stephen Burnley ,willey publication,2014
	3	Air Pollution,S. K. Agarwal,APH Publishing, 2005
Reference Books	1.	Environmental Chemistry , B.K. Sharma & H. Kaur, Goel Publishing House,2014,fourteen edition,
	2.	Environmental Studies, R. Rajgopalan, Oxford Publication,2016,Third[rd] edition

Online TL Material	1	Introduction to Household Water Treatment and Safe Storage,https://www.coursera.org/learn/water-treatment/home/welcome
	2.	Electronic waste Management-Issues and challenges by Dr. Brajesh Kumar Dubey,http://nptel.ac.in/courses/120108005/
	3	Integrated Waste Management for a Smart City, https://onlinecourses.nptel.ac.in/noc19_ce31/course
	4	Air pollution-Global threat to our Health https://www.coursera.org/learn/air-pollution-health-threat/home/welcome

Sr. No.	Name of Experiments / Case Studies
1	Physical parameters of water- Determination of PH, turbidity and conductivity of given water sample.
2	Chemical parameters of water- Determination of Hardness by Complexometric method and Alkalinity by Warders Method.
3	Demonstration on different types of cells and batteries.
4	Determination of Moisture present in given Solid waste
5	Case study on current scenario of region specific waste generation.
6	Determination of Proximate analysis of Solid fuel as Coal.
7	Determination of Acid value of Liquid fuel.
8	Demonstration on measuring air quality by using Air Quality Tester.
9	Determination of chloride ions from given water sample by Argentometric Method
10	Determination of DO of given water sample by Iodometric titration
11	Preparation of Biodiesel from edible oil
12	Determination of saponification value of liquid fuel

Course Title: **Communication Skills**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	H	2 Hrs.	-	2 Hrs.	3	10	15	50	25	-
Course Code	UHUL101 UHUP101									
Teaching Mode	Offline	4 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course	To Introduce the students on the importance of communication in

Objectives	Engineering
	To build up the listening, speaking, reading and writing skills
	To carve the students on their body language through practical approach
	To augment the presentation skills of the students for their technical Proficiency
	To enhance their higher order thinking skills through review activity
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Students shall realize the value and relevance of communication functionalities.
	CO2: Students shall coordinate, collaborate and corroborate through LSRW Skills
	CO3: Students shall attribute their Impactful communication through power body language
	CO4: Students shall confidently exhibit their technical proficiencies through effectual PPTs and Professional Conduct
	CO5: Students shall be strongly opinionated and thoughtful about the contents they are introduced to.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1										3					
CO2										3					
CO3										3					
CO4										3					
CO5									3	3					

Course Contents:

Unit	Contents	Hours
I	**Course Foundation :** **Ice-Breaker**- Activity on Group Introduction (Circle Activity) **Self- Realization** – Review on SWOC Analysis and self- Introspection **SMART Goals**- Preparation and presentation of Individual goal charts **Pre-Training Module**: Assessment on prior knowledge of the students	4
II	**Communication for Engineering :** Introduction, process, barriers, Types of Communication--Talk on Emerging trends and importance of communication skills in Engineering- Overview of Listening, Speaking, Reading and Writing skills (LSRW)- The techniques and usage of the interrelated LSRW skills- The practical execution of LSRW Skills in Classroom and Lab	4

III	**Formal Correspondence and Content Framing**: Introduction to formal Writing techniques- Difference between Formal and Informal Writing- Formats of Letter and Email Writing- Practice of letter and email writing with real time situations- The Art of framing communication with effective content- Implementation of High order thinking skills with Critical thinking to explore Creativity. Review Activity with Moral Case studies/Case Letters (Stereo Type/ Gender Bias)/ Abstract Writing/Newspaper article/Extempore	4
IV	**Presentation skills:** Structure of Presentations-Use of aids like Power point- Do's and Don'ts of presentation-Types of presentation- Body Language during presentation- The practical execution of Presentation skills (Individual and Technical) along with review and feedback	4
V	**Non-verbal Communication** Difference between Verbal and Non-verbal Communication-Physical Appearance-"Do Looks really Matter?"- Body Language Practice with Storytelling activity- Tips for improving Nonverbal communication (Gesture/Posture/Facial Expression/Personal Appearance/ Eye contact)	4

Text Books	1.	Communication Book – Global Education Ltd (In Progress)
E--Books	1.	Bridging the Soft Skills Gap- Bruce Tulgan
Reference Books	1.	Soft Skills for enhancing Employability(Connecting Campus to Corporate) – M S Rao
	2.	Communication Skills for Technical Students-Mr. Farahatulla
Online TL Material	1.	Online Lectures/Exercises/Assessment/Evaluation/Quizzes shall be made available with extended learning

Sr. No.	**Name of Activities**
1	Reading Skills: Read Aloud
2	Writing Skills :Abstract Writing
3	Read- Write Activity: Activity on Comprehension
4	Read-Speak Activity: Case Letters
5	Speak- Speak Activity: Turn Court
6	Write- Write: Triggering Mind
7	Presentation Skills: Practical of Creating PPTs

Course Title: **Programming for Problem Solving**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	--	--	4 Hrs.	2	--	--	--	50	--
Course Code	UITP102									
Teaching Mode	Online	4 Hrs			Total	--			50	
Duration of ESE	NA					50				

Course Objectives	This Course introduces basic idea of how to solve given problem.
	Focuses of paradigms of programming language.
	Aims at learning python as programming language.
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Analyze and understand the behavior of fundamental programming constructs.
	CO2: Develop & Analyze Algorithms for solving problems.
	CO3: Demonstrate the knowledge of various concepts of Python Language.
	CO4: Demonstrate knowledge of advanced concepts of Python Programming
	CO5: Develop solutions using functions & recursion

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3													
CO2			3												
CO3		3													
CO4				3											
CO5			3		3										

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).	8

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;	8
III	CONTROL FLOW, FUNCTIONS Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices,	8
IV	DICTIONARIES Dictionaries: operations and methods; advanced list processing – list comprehension; Object Oriented Programming: Classes and objects-inheritance-polymorphism	8
V	FILE HANDLING & EXCEPTION HANDLING Overview of exception classes and Types: try, except, finally: File processing: reading and Writing files, Recent Trends in Python	8

Sr. No.	List of Experiment
1	Implementing if else in Python
2	Implementing loop in Python
3	Implementing Functions in Python
4	Implementing Set, Tuple & Dictionary in Python
5	Project Using Python Module 1: Algorithms, Expression, Variables & I/O
6	Module 2: Control Structures
7	Module 3: List, Strings, Tuples & Dictionary
8	Module 4: Functions
9	Module 5: Object Oriented Programming
10	Module 6: Expression Handling & File Handling

Text Books	1.	Python Programming using problem solving Approach, By Reema Theraja, First Edition, 2017.
	2.	A Byte of Python By C. H. Swaroop, Edition 2.1

Course Title: **Modeling of Digital Circuits**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3 Hrs.	--	2 Hrs.	4	10	15	50	25	--
Course Code	UECL104 UECP104									
Teaching Mode	Offline	5Hrs			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To understand number system and optimization laws
	To apply knowledge on VHDL program in Combinational & Sequential
	To interpret complex problem in the field of digital system design
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Solve the problems on Number system codes and their conversions.
	CO2: Create and design canonical logic forms
	CO3: To demonstrate basic knowledge VHDL fundamentals
	CO4: Design VHDL Programs
	CO5: Design real time digital applications

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2							1	3			
CO2	3	3	3	2							1	3			
CO3	3	3	3	2							1	3			
CO4	3	3	3	2							1	3			
CO5	3	3	3	2							1	3			

Course Contents:

Unit	Contents	Hs
I	**D.C. Circuits:** Circuits Elements (R, L, C), Kirchhoffs Laws, Voltage source, Current Source (definition, characteristics of practical source, equivalent)	05
II	**Number Systems & Boolean Algebra:** Number system, Decimal, binary, octal, hexadecimal number system, 1s	08

	and 2s complement codes, Boolean algebra, De-Morgan's theorems, Logic Gates, canonical logic forms, sum of product & product of sums, Karnaugh maps.	
III	**Combinational & Sequential circuits:** Introduction to combinational circuits, code conversions, decoder, encoder, multiplexers & De-multiplexer, binary adder, Subtractor, BCD adder, Latches, Flip-flops, counters, Shift Registers, Finite state Machine.	11
IV	**Introduction to VHDL:** Introduction to VHDL, Methodologies, design units, data objects, VHDL data types, Attributes, Concurrent and sequential, Structural statements, inertial and transport delays, delta delay, signal drivers.	08
V	**Combination Logic design:** Gates, decoder, encoder, multiplexer, De-mux, adder, Subtractor, Latches, SR latch, Flip-Flops, Shift Registers, counters Subprograms – Functions, Procedures, generic, generate, package, IEEE standard logic library.	08

Text Books	1.	Digital Electronics R P Jain McGraw Hill 2017 Second Edition
	2.	Digital Logic and Computer Design Morris Mano PHI 2017 review Second Edition
	3.	VHDL Primer – J Bhasker – Pearson Education
EBooks	1.	Free Range VHDL-Bryan Mealy, FabrizioTappero
Reference Books	1.	Digital Electronic Principles-Malvino PHI 2011-13 Seventh Edition
	2.	Digital System Design – John Wakerley
Online TL Material	1.	IIT's NPTEL lectures

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	Design 4:1 multiplexer and write a VHDL code for same using data flow style of modeling.
2	Design Arithmetic and Logic Unit for 16 bit operation (Addition, Subtraction, Multiplication, Division, ORing, ANDing, XORing, XNORing)
3	Design BCD to seven segment decoder & display "GHRCE".
4	Design half adder and full adder and write a VHDL code for same using dataflow style of modeling.
5	Design & write Test bench for an 8 bit adder having range 0 to 255 decimal.
6	Design 4-to-16 decoder by combining two 3-to-8 decoders and write a VHDL code for Same using structural style of modeling.
7	Write a VHDL code for to design Flip-Flop (D, T, and SR) using behavioral style of modeling.
8	Write a VHDL code for 3-bit up-down counter using sequential style of modeling.
9	Write a VHDL code for high speed two-pole switch for power controlling on FPGA using sensitivity list.

10	Design of Finite state machine to detect a sequence “1011”using Mealy model and write VHDL code for the same.
Open Ended Experiments	
1	Write a VHDL code for to divide clock frequency of 50 Mhz.
2	Write a code for 8 Bit RAM Module
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Lab
8	Write a VHDL code for 3-bit up-down counter using sequential style of modeling.
9	Write a VHDL code for high speed two-pole switch for power controlling on FPGA using sensitivity list.
10	Design of Finite state machine to detect a sequence “1011”using Mealy model and write VHDL code for the same.
Open Ended Experiments	
1	Write a VHDL code for to divide clock frequency of 50 Mhz.
2	Write a code for 8 Bit RAM Module
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Lab

Course Title: **Internet of Things**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	-	-	02 Hrs.	01	-	-	-	25	-
Course Code	UECP105									
Teaching Mode	Offline	02 Hrs.			Total	-			25	
Duration of ESE	NA					25				

Course Objectives	To enable students to understand scope of Internet of things in Industry
	To introduce the concept of Internet of things
	To develop and apply Advance method for Implementation of Internet of Things
Course Outcomes	**CO1**: Analyze various IoT devices and its technology.
	CO2: Select and use of appropriate IoT technologies & Gateways protocols for application development.
	CO3: Design and development of IoT application with the use of different cloud technology.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	3	2	3							3			
CO2	2	1	3	2	3							3			
CO3	2	2	3	2	3						2	3			
CO4															
CO5															

Course Contents:

Unit	Contents	Hours
I	**Architecture of IoT** Introduction of IoT, Introduction Industry 4.0, Need of IoT for Industry 4.0, Block Diagrams of IoT System, Virtual Private server and IoT Cloud, Application Programming Interface(API)	6
II	**Development of Things using Arduino Platform:** Introduction of IoT Node with Sensor and Actuator, Interface sensors &devices, NodeMCU and ESP 32 wifi Microcontroller, Network: LORA, NRF, Xbee, IoT Gateway. **Communication protocol :** Introduction of Internet Protocol , Internet Layer: IP Transport layer-TCP,UDP , Application Layer- HTTP, MQTT, FTP, CoAP, SPDY.	6
III	**IoT Platform and Application :** Customized IoT Platform using Virtual Private Server, Amazon Alexa, Google API, Blynk, Cayenne, Thingsboard, Thigspeak. Case Study of applications.	8

Text Books	1.	Samuel Greengard ,The Internet of Things" by Samuel Greengard
	2.	Klaus Schwab ,The Fourth Industrial Revolution" by Klaus Schwab Author:
	3.	CunoPfister Author: CunoPfister ,Getting started with Internet of Things
EBooks	1.	IoT and Smart Building Data – by Senseware.
	2.	SkyHook, Everything You Need to Know About LPWAN Location
Reference Books	1.	CunoPfister, Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) 2018
	2.	Adrian McEwen , Designing the Internet of Things Kindle Edition

Sr.No.	Name of Experiments
1	To perform programming for Interfacing NodeMCU to Cloud Thingsboard

2	To perform programming for sending DHT Temperature sensor data to cloud.
3	To perform programming for control home appliance using NodeMCU controller and cloud.
4	Design and interface Water level indicator using Node MCU controller
5	Perform Raspberry PI program to interface of network device [wifi, GSM, GPRS] for device communication
6	Design and Perform digital Notice Board Application Using Raspberry pi3 Mega Board using NodeMCU.
7	Design and Perform smart Garbage indication system using NodeMCUcontroller and GLCD.
8	Design and Perform IOT Based Agriculture monitoring system using Wifi ESP8266 [Thinkspeak Cloud]
9	Project Module 6: Perform Automatic Plant Irrigation controlling System using NodeMCU and Cloud
10	Open Ended Experiment:

SEMESTER-III

Course Title: **Discrete Mathematics and Graph Theory**										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	3	1	--	4	10	15	50	--	--
Course Code	UBSL255									
Teaching Mode		4			Total	75			--	
Duration of ESE	3 Hrs					75				

Course Objectives	This course introduces size and kind of objects.
	It also skills to analyze objects meeting the criteria, finding "largest", "smallest", or "optimal" objects.
	It also introduces combinatorial structures and apply algebraic techniques to combinatorial problems
Course Outcomes	**CO1:** Know grouping of objects and operation, Relation, ordering of objects.
	CO2: Know Groups, their types and Applications.
	CO3: Know Rings, their types and Applications.
	CO4: Solve different kinds Graph, Trees.
	CO5: Know the basics of combinatorial structure
	CO6: Solve number theory applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3										3	2		
CO2	3	3										3	2		
CO3	3	3										3	2		
CO4	3	3										3	2		
CO5	3	3										3	2		
CO6	3	3										3	2		

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.	7
II	**Group** Algebra or Algebraic systems like semigroup, monoid and examples. Homomorphism, Isomorphism of semigroup&monoid. Groups, properties of algebraic groups. Permutations groups, Subgroups, Cosets, Lagrange's theorem, properties of cyclic groups, generator of group, kernel of Homorphism, quotient group, fundamental theorems & Homomorphism of groups, Residue classes &Fermats theorem.	8
III	**Rings** Rings, types of rings, Fields, subring, Integral domain. Simple properties of rings. Lattice as Poset& as algebraic system, Types of lattices, Hasse diagrams, Sublattice, direct product of Lattices, Lattice Homomorphism, complement of elements of lattices, Various lattices, composition tables, Lattice , Boolean algebra; Boolean Expressions, Equivalence of Boolean Expression by tables, Simplification of circuit & equivalent circuit by truth tables.	8
IV	**Graph Theory** Graphs and its types, Sub graph, 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, Prim's algorithm.	8
V	**Combinatorics** Definition of generating functions and examples, proof of simple combinatorial identities. Recursive relations: definitions & examples, explicitly formula for sequence, back tracking to find explicit formula of sequence, solving recurrence relations. Counting Theorem and application,multiplication principle of counting. Permutation & Combination with examples. The pigeon hole principle & extended pigeon hole principle and application of pigeon hole principle in solving simple problems.	8
VI	**Number Theory** Continued fractions, 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.	8

Text Books	1.	Discrete Mathematical structure with application to computer science by Trembley&Manohar (Mc. Graw Hill)
	2.	Discrete Mathematical Structure by Kolmann , Busby & Ross (PHI)
	3.	Discrete mathematics by Lipschutz& Lipson , Schaum's outline, TMH
Reference Books	1.	Discrete Mathematics by Liu
	2.	Discrete Mathematics by John Truss (Addison Wesley, 2000)
	3.	Foundations of Discrete Mathematical by K. D. Joshi (Willey Eastern).
	4.	Set Theory by Lipschutz (Schaum Series, Asian Student Edition).
	5.	Modern Algebra by M. L. Khanna (Jai Prakash Nath& Company Meerut).
on line TL Material	1.	https://onlinecourses.nptel.ac.in/noc20_cs37/unit?unit=41&lesson=42

Course Title: **OPERATING SYSTEM**										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	--	3	10	15	50	--	--
Course Code	UCSL206									
Teaching Mode	Online	3			Total	75			--	
Duration of ESE	3 Hrs.					75				

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	1.Identify basic structure and purpose of operating system.
	2. Interpret the concepts of process and illustrate various CPU scheduling algorithms.
	3. Interpret the concepts of inter process communication.
	4. Schematize Deadlock & security mechanisms in operating systems.
	5. Analyze different memory management techniques with advantages and disadvantages.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		2	3											1	
CO2		2	3										2		
CO3		3	3										2		
CO4		3	2										2		
CO5		3	2										3		

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.	6
II	**Process & Its Scheduling** Process concept, process control block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms,	4
III	Process management and synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems	4
IV	Deadlock definitions, Prevention, Avoidance, detection and Recovery, Goals of Protection, access matrix, Deadlock implementation	8
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; Galvin, Addison Wesley, 6 thEdn.
	2.	Modern Operating Systems – Tanenbaum, Pearson Edn. 2 ndedn
	3.	Operating Systems: Internals and Design Principles -- William Stallings
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.
on line TL Material	1.	https://nptel.ac.in/courses/106/108/106108101/

Course Title: **Database Management System**										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	10	15
Course Code	BCSL208/ BCSP208									
Teaching Mode	Online	5			Total	75			25	
Duration of ESE	2 Hrs					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	**CO1:** Analyze an information storage problem and derive an information model expression in the form of Entity relation diagram and design appropriate data model for it.
	CO2: Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database and perform inferential analysis of data model
	CO3: Identify features of database management systems and Relational database and Understand functional dependencies and various normalization forms
	CO4: Perform basic transaction processing and management and ensure database security, integrity and concurrency control
	CO5: Analyze the management of structured and unstructured data management with recent tools and technologies

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1			3		3								2		
CO2			3	3									3		
CO3		2	3											3	
CO4			3	2									2		
CO5			2		3								2		

Course Contents:

Unit	Contents	Hours
I	Introduction to DBMS, DBMS Architecture, Data Models, Relational Database design:	6
II	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.	8
III	Functional Dependency (FD) – Basic concepts, closure of set of FD, closure of attribute set, Decomposition, Normalization – 1NF, 2NF, 3NF, BCNF, 4NF	6
IV	Transaction control commands – Commit, Rollback, Save point. Cursors, Stored Procedures, Stored Function, Database Triggers. Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, Two- Phase Commit protocol, Deadlock, two-phase locking protocol	6
V	NoSQL Databases - Introduction, CRUD Operations, Data Mining	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.
	3.	RamezElmasri and ShamkantNavathe, Fundamentals of Database Systems 2nd Ed, Benjamin Cummings, 1994.
Reference Books	1.	G. K. Gupta :"Database Management Systems", McGraw – Hill.
	2.	Regina Obe, Leo Hsu, PostgreSQL: Up and Running, 3rd Ed, O'Reilly Media 2017.
	3.	Kristina Chodorow, Shannon Bradshaw, MongoDB: The Definitive Guide, 3rd Ed, O'Reilly Media 2018.
on line TL Material	1.	https://nptel.ac.in/courses/106/105/106105175/

Course Title: **Introduction To Data Science**										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	--
Course Code										
Teaching Mode	Online	5			Total	75			25	
Duration of ESE	3 Hrs					100				

Course Objectives	1.Understand the basics of the python programming environment, including fundamental python programming techniques
	2. Analyze, reading and manipulating csv files, and the numpy library.
	3. Identify data manipulation and cleaning techniques using the popular python pandas data science library.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: To take tabular data, clean it, manipulate it, and run basic inferential statistical analyses
	CO2: Applied Plotting, Charting & Data Representation in Python, Applied Machine Learning in Python.
	CO3: Evaluate a model based on test data
	CO4: Implement Machine Learning Algorithms to discover knowledge
	CO5: Apply hypothesis on various test dataset

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**											**3**	**3**	
CO2	**3**	**3**											**3**	**3**	
CO3	**3**	**3**	**1**	**3**	**2**									**2**	
CO4			**3**	**3**	**3**	**2**									**2**
CO5			**3**	**2**	**2**	**3**								**3**	**2**

Course Contents:

Unit	Contents	Hours
I	**Getting started with raw data**, the worlds of arrays with Numpy, creating an array, mathematical operation, indexing and slicing, the data structure of pandas series data frame and Panel, Reading files, exploratory data analysis, Data preparation and preprocessing inserting and exploring data CSV, XLS, JSON	6
II	Various forms of distribution, one tailed and two tailed test, Z test Vs T tests, F distribution, chi square distribution, ANOVA	6
III	**Making sense of data through advanced visualization** Controlling line properties of chart, creating multiple plots, Scatter plot, Line plot, bar plot, Histogram, Box plot, Pair plot, playing with text, styling your plot, 3d plot of surface	6
IV	**Uncovering Machine learning** Different types of machine learning, linear regression, logistic regression, naive bayes classifier, K-means clustering, hierarchical clustering	6
V	**Performing Prediction with regression** Simple linear regression, training and testing a model, logistic regression, data preparation, building a model, evaluating a model based on test data.	4

Text Books	1.	Introduction to linear algebra - by Gilbert Strang
	2.	Applied statistics and probability for engineers – by Douglas Montgomery
	3.	Python for Data Analysis - by W Mckinney
on line TL Material	1.	https://nptel.ac.in/courses/106/106/106106212/

Course Title: **Data Structure and Algorithms**										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	--
Course Code	UCSL201 UCSP201									
Teaching Mode	Online	5			Total	75			25	
Duration of ESE	3 Hrs.					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	**CO1:**Identify essential data structures and understand when it is appropriate to use..
	CO2: Explain use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated
	CO3: Apply linear data structures to solve various real world computing problems using programming language**.**
	CO4: Analyze standard algorithms for searching and sorting
	CO5: Implementation of linear data structure to find solution for given engineering applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3	2	3									1		
CO2		2	3	3									2		
CO3		3	3	3										1	**3**
CO4		3	3	3										2	**3**

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. **Sorting and Searching** Introduction, Sorting, Insertion Sort, Selection Sort, Merging, Merge-Sort, Shell Sort, Radix Sort, Searching and Data Modification, Hashing	9
II	Arrays :Introduction, Linear Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting, Sorting; Bubble Sort, Searching; Linear Search, Binary Search, : Linked List Introduction, Linked Lists, Representation of Linked Lists in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation; Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Header Linked List, Circularly Linked Lists, Two-Way Lists (or Doubly Linked Lists).	9

III	Stacks, Queue and Recursion-Introduction, Stacks ,Array Representation of Stacks ,Linked Representation of Stacks, Stack as ADT, Arithmetic Expression; Polish Notation, Application of Stacks, Recursion, Towers of Hanoi, Implementation of Recursive Procedures by Stacks, Queue, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques, Priority Queues, Applications of Queues	9
IV	.**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	10
V	**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	8

Text Books	1.	AVAho, J Hopcroft, JD Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
	2.	THCormen, CF Leiserson, RL Rivest, C Stein, Introduction to Algorithms, 3rd Ed., MIT Press, 2009.
	3.	Sahni, S., “Data Structures, Algorithms, and Applications in C++”, WCB/McGraw-Hill.
E--Books	1.	https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Dsa.pdf
Reference Books	1.	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
	2.	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)
	3.	Wirth, N., “Algorithms and Data Structures”, Prentice-Hall of India.
online TL Material	1.	https://nptel.ac.in/courses/106/102/106102064/
	2.	http://cse01-iiith.vlabs.ac.in/
	3.	https://ds2-iiith.vlabs.ac.in/data-structures-2/

Course Title: **Software Engineering**										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	--	3	10	15	50	-	-
Course Code	UCSL302									
Teaching Mode	Offline	3			Total	75			-	
Duration of ESE	3 Hrs.					75				

Course Objectives	Understand the phases in a software project
	Understand fundamental concepts of requirements engineering and Analysis Modelling.
	Understand the major considerations for enterprise integration and deployment.
	Learn various testing and maintenance measures
Course Outcomes	**CO1:** Identify the key activities in managing a software project
	CO2: Compare different process models.
	CO3: Implement the Concepts of requirements engineering and Analysis Modeling.
	CO4: Apply systematic procedure for software design and deployment.
	CO5: Compare and contrast the various testing and maintenance

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	2	3		2			-			3		-	-
CO2	-	2	3		3			-			3		-	-
CO3	-	3	3		2			1			3		3	2
CO4	-	3	3		3			-			3		3	3
CO5	-	-	3		1			-			3		-	3

Course Contents:

Unit	Contents	Hours
I	**SOFTWAREPROCESS** Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis – Risk Management.	6

II	**REQUIREMENTS ANALYSIS AND SPECIFICATION** Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.	6
III	**SOFTWARE DESIGN** Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.	6
IV	**TESTING AND** Software testing fundamentals-Internal and external views of Testing-white box testing – basis path testing-control structure testing-black box testing Debugging	7
V	**PROJECT MANAGEMENT** Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II – Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM – Scheduling and Tracking –	7

Text Books	1.	Roger S. Pressman, “Software Engineering – A Practitioner‟s Approach”, Seventh Edition, McGraw-Hill International Edition, 2010.
	2.	Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.
	3.	Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.
Reference Books	1.	Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
	2.	Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
	3.	Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited, 2007.

Course Title: Data Pre-processing										
Semester	III	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	--	--	4	2	--	--	--	25	--
Course Code	UAIP201									
Teaching Mode	Practical	4			Total	--			25	
Duration of ESE	3 Hrs.					25				

Course Objectives	To learn the applicability of the techniques in data pre-processing
	To understand the necessity of data pre-processing
	To relate the pre-processing techniques to real-world applications.
	Understanding data preprocessing techniques
Course Outcomes	**CO1:** Apply appropriate techniques to remove missing , noise data
	CO2: Formulate Clustering, data Sampling, Data Discretization on dataset
	CO3: Apply the knowledge to Selected appropriate Feature Scaling , Data Labeling techniques.
	CO4: Visualize data preprocessing techniques through graph plots
	CO5: Apply the data pre-processing techniques in multidisciplinary environments.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	1										1	2	3
CO2	1		2		3								2	3	1
CO3		3	1	2									3	2	1
CO4	3			1	2								1	3	2
CO5	2								2		3		3	1	2

Course Contents:

Unit	Contents	Hours
I	Introduction , Definitions, need of data preprocessing , understanding data preprocessing	4
II	Step and type of Data preprocessing , missing , noise data, data integration , data transformation	4
III	Data Reductions , Dimensionality Reduction,Clustering, data Sampling, Data Discretization	6

IV	Categorical Data, Feature Scaling, Encoding categorical features, Normalization and its type, Binarization, Data Labeling, Data Feature Selection, Principal Component Analysis (PCA),Correlation Matrix with Heatmap	8

Text Books	1.	Data pre-processing The Ultimate Step-By-Step Guide, GerardusBlokdyk
	2.	M. Shron, O'Reilly, Thinking with Data: How to Turn Information into Insights, Publisher: O'Reilly Media, 2014
	3.	T. Fawcett andF. Provost , Data Science for Business: What you Need to Know about Data Mining and Data Analytic Thinking, Publisher: O'Reilly Media, 2013
Reference Books	1.	Ralph Kimball, Margy Ross, The Data Warehouse Toolkit, 3rd edition, Publisher: Wiley, 2013
	2.	J. Han, M. Kamber and J.Pei, Morgan Kaufmann, Data Mining, Concepts and Techniques, Publisher: Elsevier, 2006
	3.	Ramesh Sharda, DursunDelen,EfraimTurban,Business Intelligence and Analytics: Systemsfor Decision Support, Publisher: Pearson/Prentice Hall, 2014
on line TL Material	1.	http://www.prolearninghub.com/courses/data-warehouse-concepts-design-data-integration/

Sr. No.	Name of Experiments
1	Implementation of Basic Python Libraries
2	Find out missing data in dataset
3	Perform the Categorization of dataset
4	Execute feature scaling on given dataset
5	Implement normalization on dataset
6	Perform proper data labeling operation on dataset
7	Implement principal component analysis algorithm
8	Perform Encoding categorical features on given dataset
Open Ended Experiments / New Experiments	
1	Apply the appropriate **Binarization** methods on given dataset
2	Perform the **Standardization** operation on dataset

Semester-IV

Course Title: **Probability Theory**										
Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BS	3	1	--	4	10	15	50	--	--
Course Code										
Teaching Mode		4			Total	75			--	
Duration of ESE	3 Hrs.					75				

Course Objectives	To learn basic of probability and random variables.
	To learn about joint and Conditions of Statistical Dependence
	To understand the random process and Decision Making.
Course Outcomes	**CO1:** Use statistical methodology and tools in the engineering problem-solving process.
	CO2: Analyze the given probabilistic model of the problem.
	CO3: Use correlation and regression tests for hypothesis testing.
	CO4: Solve problems related to stochastic processes.
	CO5: Apply best probability techniques on real life data set

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**											**2**		
CO2	**3**	**3**											**2**		
CO3	**3**	**3**											**2**		
CO4	**3**	**3**											**2**		
C05	**3**	**3**											**2**		

Course Contents:

Unit	Contents	Hours
I	Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems.	6
II	Random variables: Definition and examples, random vectors, distribution function, discrete and continuous random variables, pmf and pdf of random variables.	6

III	Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution, problems	6
IV	Probability : Introductory Ideas Probability: The Study of Odds and Ends , Basic Terminology in Probability ,Three Types of Probability , Probability Rules ,Probabilities Under Conditions of Statistical Independence ,Probabilities Under Conditions of Statistical Dependence	6
V	Probability Distributions ,What is a Probability Distribution,Random Variables, Use of Expected Value in Decision Making,The Binomial Distribution, The Poisson Distribution, The Normal Distribution: A Distribution of a Continuous Random Variable,Choosing the Correct Probability Distribution	4

Text Books	1.	Hoel, P. G., Port, S. C. and Stone, C. J, Introduction to Probability Theory,Universal Book Stall, New Delhi, Reprint 2003.
	2.	Statistics For Management - Richard I. Levin, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui.
	3.	An Introduction to Probability and Statistics by V.K. Rohatgi& A.K. Md. E. Saleh.

Course Title: **Object Oriented Programming**										
Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	-	-	4	2	-	-	-	25	25
Course Code	UITP201									
Teaching Mode	Online	4			Total	-			50	
Duration of ESE	3 Hrs.					50				

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	**CO1:** Articulate the principles of object oriented programming using C++
	CO2: Understand function overloading, constructor overloading, operator overloading, polymorphism & its uses in programming.
	CO3: Implement inheritance concepts and its use for application development
	CO4: Analyze of dynamic memory allocation and its use for software

	development
	CO5: Implement concept of file handling in real life problems

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	3							-		-	-	2
CO2	-	3	3	2	-								1	2	2
CO3	-	3	3	2											
CO4	-	3	1	3											
CO5	-	3	3	2											

Course Contents:

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

Text Books	1.	Object Oriented Programming in C++ -Robert Lafore, edition, Galgotia publications
	2.	The Complete Reference C++, Herbert Schildt, 4th Edition, TMH\
Reference Books	1.	Let's C++ by Y. Kanetkar, BPB publications
	2.	Object oriented programming with C++, E Balagurusamy, 4th edition, TMH
	3.	Object-Oriented Programming with C++, SouravSahay, Oxford University Press
on line TL Material	1.	https://nptel.ac.in/courses/106/105/106105151/

Course Title: **Formal Language And Automata**

Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	--	3	10	15	50	--	--
Course Code	UCSL203									
Teaching Mode	Offline	3			Total	75			--	
Duration of ESE	3 Hrs.					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	**CO1:** Able to understand the concept of abstract machines and their power to recognize the languages.
	CO2: Able to employ finite state machines for modeling and solving computing problems.
	CO2: Able to design context free grammars for formal languages.
	CO3: Able to distinguish between decidability and un-decidability.
	CO4: Able to gain proficiency with mathematical tools and formal methods.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3													**2**
CO2		3													**2**
CO3		3													**2**
CO4		3													**2**
CO5		3													**2**

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.	8
II	Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.	8
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	8
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.	8

Text Books	1.	Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
	2.	Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
E--Books	1.	
	2.	
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.

Course Title: **Computer Network**

Semester	4	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	-	3	10	15	50	--	--
Course Code	UITL202									
Teaching Mode	Offline	3			Total	75			--	
Duration of ESE	3 Hrs.					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.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3												2	3
CO2			3												3
CO3					3									3	2
CO4			3											2	3
CO5				3										3	2

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, 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,	8
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	1.	Jean Walrand , PravinVaraiya, High-Performance Communication

Books		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,

Course Title: **Machine Learning Algorithms**										
Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	-	2	4	10	15	50	25	-
Course Code	UAIL301 UAIP301									
Teaching Mode		5			Total	75			25	
Duration of ESE	3 hrs					100				

Course Objectives	1. The objectives of the course is to introduce students to the basic machine learning algorithms.
	2. To develop skills of using recent machine learning software for solving practical problems.
	3. To gain experience of doing independent study and research.
Course Outcomes	1. Recognize the characteristics of machine learning that make it useful to real-world problems.
	2. Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.
	3. Design and implement machine learning solutions to classification, regression, and clustering problems;.
	4. Be able to evaluate and interpret the results of the algorithms
	5. Effectively use machine learning toolboxes.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3	3	3		2							**2**		
CO2			3	2										**1**	
CO3			3	3	3	2							**1**		
CO4			3	3									**2**	**2**	
CO5					3								**2**	**2**	

Course Contents:

Unit	Contents	Hours
I	Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation	4
II	Linear regression, Decision trees, over fitting, Instance based learning, Feature reduction, Collaborative filtering based recommendation	6
III	Probability and Bayes learning,Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM	8
IV	Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network	8
V	Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning	6
VI	Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model	4

Text Books	1.	Mitchell Tom, Machine Learning. McGraw Hill, 1997.
	2.	Introduction to machine learning, EthemAlpaydin. —2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
	3.	Chris Bishop, Pattern Recognition and Machine Learning
	4	Dr. Nilesh Shelke, Dr. Gopal Sakarkar, Dr N V Choudhari, Introduction to Machine Learning, Ganu Prakashan
Reference Books	1.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference, and Prediction
	2.	Richard O. Duda, Peter E. Hart, David G. Stork. Pattern classification, Wiley, New York, 2001.
	3.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data (1st Edition) – Peter Falch
On line TL Material	1	https://www.coursera.org/learn/machine-learning
	2	https://www.udemy.com/course/machinelearning/
	3	https://nptel.ac.in/courses/106/105/106105152/

Course Title: **Data Analysis Using R**

Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	--	--	4	2	--	--	--	25	--
Course Code	UITP203									
Teaching Mode		4			Total	--			25	
Duration of ESE	3 hrs.					25				

Course Objectives	To understand the basics of data, Big data and Data Science.
	To understand the financial value of big data analytics and usage of data in solving real time problem.
	To explore fundamental concepts of big data analytics and data visualization.
	To explore tools and practices for working with R
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Apply the concepts of big data analytics for a domain.
	CO2: Understand and apply the data analytics technique for visualization
	CO3: Understand pull data from different sources (small dataset and large datasets),clean and manipulate data
	CO4: Analyze and design data analytics Framework.
	CO5: Use rich visualization libraries to deliver your findings as reports

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	3	3	-	3	-	-	-	-	-	-	-	-	-	-
CO2	-	3	3	-	3	-	-	-	-	-	-	-	-	-	2
CO3	-	3	3	2	3	-	-	-	-	-	-	-	3	2	3
CO4	-	3	3	-	3	-	-	-	-	-	-	-	3	3	3
CO5	-	3	3	1	3	-	-	-	-	-	-	-	-	3	-

Course Contents:

Unit	Contents	Hours
I	Introduction to big data analytics: big data overview, data pre-processing, concepts of supervised and unsupervised learning. Basic statistics: mean, median, standard deviation, variance, correlation, covariance.	7Hrs

II	Linear regression: simple linear regression, introduction to multiple linear regressions.	7Hrs
III	Classification: logistic regression, decision trees, SVM.	7Hrs
IV	Ensemble methods: bagging, random forests, boosting.Clustering: K-means, K-methods, Hierarchical clustering, X-means	7Hrs
V	Evaluation and validation: cross-validation, assessing the statistical significance of data mining results.Selection of advanced topics such as: scalable machine learning, big data related techniques, mining stream data, social networks. Tools: R.	7Hrs

Text Books	1.	Hands-on Programming with R, Garrett Grolemund.
	2.	R for Everyone: Advanced Analytics and Graphics, Jared Lander
	3.	Data Analytics: The Complete Beginner's Guide: the Black Book, Byron Francis, Create Space Independent Publishing Platform, 2016
E--Books	1.	R in Nutshell, Joseph Adler, O'Reilly Publications
	2.	Introduction to Statistical learning with R, Gareth James, Daniela Written, Trevor Hastie, Robert Tibshivani, Springer Publications
	3.	Data Analytics for Beginner: Paul Kinley
Reference Books	1.	Applied predictive modeling by Max Kuhn and Kejell Johnson
	2.	Introduction to statistical learning by Trevor Hastie
	3.	Data Manipulation with R, Springer Publications
On line TL Material	1.	NPTEL Course: https://nptel.ac.in/courses/110/106/110106072/
	2.	Coursera Course: https://www.coursera.org/specializations/statistics
	3.	Swayam Course: https://swayam.gov.in/nd1_noc20_ma53/preview

Semester-V

Course Title: **Cloud Computing**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	-	-	4	2	--	--	--	25	25
Course Code	UCSP303									
Teaching Mode	Online	4			Total	--			25	
Duration of ESE	3 Hrs.					**25**				

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	**CO1:** State the basics of distributed computing and cloud computing.
	CO2: Summarize the technical capabilities and business benefits cloud technology.
	CO3: Develop cloud-based application demonstrating its implications
	CO4: Develop cost effective solution using cloud technology
	CO5 : Develop solution for Society with minimized resources

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3			3								-		
CO2		3			3								2	**2**	
CO3		3			3								3	**2**	
CO4		3			3								3	**2**	
CO5		2			3								3	**2**	

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. Cloud Deployment Models Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Hardware-as-a-service: (HaaS), Oriented Architecture (SOA)	7
II	**Cloud Computing Architectural Framework** Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment. SLA	6
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.	8
V	**Open source & Commercial Cloud:** Service Oriented Architecture, Case Study on Open source Cloud Open stack, Case Study on Commercial Cloud Microsoft Azure, Google Cloud Platform , AWS ,Sales force. Mobile Cloud Computing, Docker Container ,Fog Computing, IoT Clouds	

Text Books	1.	Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012
	2.	Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
	3.	Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg,
	4.	Andrzej M. Goscinski, Wile, 2011
	5.	Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos,LeeGillam, Springer, 2012
E--Books	1.	http://index-of.co.uk/Cloud-Computing-Books/Essentials%20of%20cloud%20computing%20(2015).pdf
	2.	http://eddiejackson.net/web_documents/The_Definitive_Guide_to_Cloud_Computing.pdf

Reference Books	1.	Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
	2.	GautamShroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN:978-0521137355]
	3.	Dimitris N. Chorafas, Cloud Computing Strategies [ISBN: 1439834539]
	4.	Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010
	5.	Tim Mather, SubraKumaraswamy, and ShahedLatif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

Course Title: **Information Retrieval and Text Mining**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	--
Course Code										
Teaching Mode	Online	5			Total	75			25	
Duration of ESE	3 Hrs.					100				

Course Objectives	To understand how to independently obtain, parse, and analyze textual information for organization.
	Identify Text Mining Problems
	To introduce the basic concepts and techniques of Information Retrieval and Text Mining
Course Outcomes	**CO1:** Analysis of optimization, unstructured and semi-structured text.
	CO2: Implement text encoding and techniques.
	CO3: Analysis of index compression using advance mechanisms.
	CO4: Design and implement a fully functional text-based retrieval system.
	CO5: Implement methods and techniques used to extract useful knowledge from text to support decision making.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3				1							1		
CO2	3				2				1					2	1
CO3	2	3			2									3	1
CO4	2		3	2					2				3		2
CO5	3	1	3	2			1	1	3		2		2		3

Course Contents:

Unit	Contents	Hours
I	Introduction to Information Retrieval. Inverted indices and boolean queries. Query optimization. The nature of unstructured and semi-structured text. Course administrivia.	6
II	Text encoding: tokenization, stemming, lemmatization, stop words, phrases. Further optimizing indices for query processing. Proximity and phrase queries. Positional indices, Introduction to text classification. Naive Bayes models. Spam filtering.	8
III	Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law. Blocking. Extreme compression.	6
IV	Query expansion: spelling correction and synonyms. Wild-card queries, permuterm indices, n-gram indices. Edit distance, soundex, language detection	6
V	Link analysis, Text classification and mining, Naive Bayes Vector space classification, Sentiment analysis on the Web. Text classification. Exploiting text-specific features. Feature selection. Evaluation of classification. Micro- and macro-averaging. Comparative results.	8

Text Books	1.	Information Storage and Retrieval, by Robert R. Korfhage, Publisher: John Wiley & Sons (ISBN: 0471143383)
	2.	Document Warehousing and Text Mining: Techniques for Improving Business Operations, Marketing, and Sales, by Dan Sullivan, Publisher: Wiley, 2001 (ISBN: 0471399590)
	3.	Introduction to Information Retrieval by Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze. Cambridge University Press, 2008
Reference Books	1.	Information Retrieval: Searching in the 21st Century, by Dr. AyseGoker, Dr John Davies, Publisher: John Wiley & Sons (ISBN: 9780470033647)
	2.	Information Retrieval: Implementing and Evaluating Search Engines, by Charles L. A. Clarke, Gordon Cormack, and Stefan Buttcher, Publisher: The MIT Press, Cambridge, Massachusetts.
	3.	Readings in Information Retrieval, by Karen Sparck Jones, Publisher: The Morgan Kaufmann Series (ISBN: 9781558604544)

S.	Contents	Hours
1	Implement a program to demonstrate bitwise operation.	2
2	Implement Page Rank Algorithm	2
3	Write a program to Compute Similarity between two text documents.	2
4	Implement a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive	2
5	Write a program to Compute Similarity between two text documents.	2
6	Implement a program for Pre-processing of a Text Document: stop word removal.	2
7	Write a program to implement web crawler.	2
8	Implement a program to parse XML text, generate Web graph and compute topic specific page rank.	2

Course Title: **Design And Analysis Of Algorithms**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	-
Course Code	UCSL205 UCSP205									
Teaching Mode	Online	5			Total	75			25	
Duration of ESE	3 Hrs.					100				

Course Objectives	Analyse the asymptotic performance of algorithms.
	Demonstrate a familiarity with major algorithms and data structures
	Apply important algorithmic design paradigms and methods of analysis.
	Synthesize efficient algorithms in common engineering design situations
Course Outcomes	**CO1:** Analyse worst-case running times of algorithms using asymptotic analysis.
	CO2: Describe the divide-and-conquer, greedy, dynamic programming, backtracking paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize algorithm and analyse them.
	CO3: Explain what competitive analysis is and to which situations it applies. Perform competitive analysis.
	CO4: Compare between different data structures. Pick an appropriate data structure for a design situation.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	-	-								2	3	
CO2	-	3	3	3	-								2	3	
CO3	-	-	3	3	-								3	2	
CO4	-	-	2	2	-								2	3	

Course Contents:

Unit	Content	Hrs
I	Introduction to algorithm, analysing control structures, space and time complexities of an algorithm, worst case and average case analysis,	**8**

	Asymptotic notations, mathematical foundations, summation of arithmetic and geometric series, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions.	
II	Divide and conquer basic strategy, quick sort, merge sort etc. Graphs: representation of graphs, BFS, DFS, connected components, topological sorting of DAGs, biconnected components, and strongly connected components in directed graphs.	**8**
III	Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, shortest path problems, fractional knapsack problem	**7**
IV	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, optimal binary search trees, Matrix-chain Multiplication, traveling salesman problem.	**7**
V	Branch and bound, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, decision and optimization problems, polynomial reduction	**8**

Text Books	1.	Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein, MIT Press, Third Edition, 2009
Reference Books	1.	Algorithms, by Dasgupta, Papadimitrou and Vazirani, McGraw-Hill Education, 2006.
	2.	Computer Algorithms, by Horowitz, Sahni, and Rajasekaran, Silicon Press, 2007.
	3.	Algorithm Design, by Kleinberg and Tardos, Pearson, 2005.
	4.	Algorithm Design, by Goodrich and Tamassia, Wiley, 2001.
	5.	Sara Baase, Allen van Gelder: "Computer Algorithms: Introduction To Design & Analysis", 3/E, Pearson Education, 2000

LIST OF PRACTICALS

Sr. No	Name of Practical
1	**Analysis of algorithms:** Analyse selection sort (or bubble sort) and insertion sort algorithms on different input size. Analyse best case and worst-case performance. Use random number generator function to generate an input sequence. Measure time complexity empirically and theoretically.
2	**Analysis of algorithms:** write recursive and non-recursive version of binary search, factorial, Fibonacci series and GCD. Measure time complexity empirically and theoretically.
3	**Divide and conquer basic strategy:** Analyse Merge sort (or Quick sort) algorithm on different input size. Use random number generator function to generate an input sequence. Measure time complexity empirically and theoretically.

4	**Basic graph search algorithms:** Breadth First Search (BFS) or Depth First Search (DFS). Extend experiment to check whether the graph is connected or not
5	**Greedy algorithm**: Minimum cost Spanning Tree using Kruskal's Algorithm (or Prim's algorithm)
6	**Dynamic Programming**: All pair shortest path **--** Floyd-Warshall Algorithm, Multi-stage graph (forward and backward approach)
7	**Backtracking:** 8 – Queen's problem
8	**Backtracking:** Graph Coloring problem
9	**Mini Project** (Solve a real-life problem by using algorithm design techniques). Progress evaluation before every MSPA.
	Case studies 1. Optimal binary search tree 2. Travelling salesperson problem 3. Fibonacci series: top-down, Bottom-up and dynamic programming 4. Hamiltonian cycle and Eluer's walk 5. Clique and vertex cover problem

Course Title: **Statistics for Management**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	-	3	10	15	50	-	--
Course Code										
Teaching Mode	Online	3			Total	75			-	
Duration of ESE	NIL					75				

Course Objectives	To learn basic of statistics and Sampling Distributions .
	To learn about Hypotheses and Standard Deviation
	To understand the Simple Regression and Correlation .
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Use statistical methodology and tools for Arranging Data to Convey Meaning
	CO2: Analyze the given Testing Hypotheses.
	CO3: Use multiple Regression and Modeling.
	CO4: Solve problems using Flow Chart.
	CO5: Implement Regression and Correlation problem using real life problems

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3
CO1	3	3	1	2	2					2			**3**	**2**	
CO2	3	3	1	2	2					2			**3**	**2**	
CO3	3	3	1	3	2	3			3	2					**3**
CO4	3	3	1	2	2				3	2	3				**3**
C05			3						3		3				**3**

Course Contents:

Unit	Contents	Hours
I	Introduction, Grouping and Displaying Data to Convey Meaning: Tables and Graphs , How Can We Arrange Data, Examples of Raw Data, Arranging Data Using the Data Array and the Frequency, Distribution , Constructing a Frequency Distribution, Graphing Frequency Distributions, Statistics at Work , Arranging Data to Convey Meaning	6
II	Sampling and Sampling Distributions, Introduction to Sampling, Random Sampling ,Non-random Sampling, Design of Experiments, Introduction to Sampling Distributions, Sampling Distributions in More Detail, An Operational Consideration in Sampling: The Relationship Between Sample Size and Standard Error, Statistics at Work, Chapter Review, Flow Chart: Sampling and Sampling, Estimation, Introduction , Point Estimates	6
III	Testing Hypotheses: One-sample Tests, Introduction Concepts Basic to the Hypothesis-testing Procedure, Testing Hypotheses, Hypothesis Testing of Means When the Population ,Standard Deviation, Measuring the Power of a Hypothesis Test ,Hypothesis Testing of Proportions: Large Samples , Hypothesis Testing of Means When the Population, Standard Deviation .	6
IV	Testing Hypotheses: Two-sample Tests, Hypothesis Testing for Differences Between Means and Proportions ,Tests for Differences Between Means: Large Sample Sizes, Tests for Differences Between Means: Small Sample Sizes, Testing Differences Between Means with Dependent Samples, Tests for Differences Between Proportions: Large Sample Sizes	6
V	Simple Regression and Correlation, Introduction , Estimation Using the Regression Line, Correlation Analysis , Making Inferences About Population Parameters, Using Regression and Correlation Analyses: Limitations, Errors, and Caveats, Statistics at Work, Chapter Review, Flow Chart: Regression and Correlation , Multiple Regression and Modeling, Multiple Regression and Correlation Analysis, Finding the Multiple-Regression Equation, The Computer and Multiple Regression	4

Text Books	1.	Statistics For Management - Richard I. Levin, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui
	2.	Statistics for Management- N Chandrashekaran, M Parvathi
	3.	
E--Books	1.	
	2.	
Reference Books	1.	Statistics For Management - Richard I. Levin, David S. Rubin, Sanjay Rastogi, Masood Husain Siddiqui
	2.	
	3.	
on line TL Material	1.	https://www.tutorialspoint.com/statistics/index.htm
	2.	https://www.coursera.org/specializations/statistics-with-python
	3.	

Course Title: **Engineering Economics and Industrial Management**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	H	2	--	-	2	10	15	50	--	--
Course Code	UHUL301									
Teaching Mode	Classroom	2			Total	75			--	
Duration of ESE	3 Hrs.					75				

Course Objectives	Understanding of basic knowledge of Economics and its application.
	Understanding of Management as discipline and its practices.
	Strengthening knowledge of management in the functional area of Marketing and Finance.
Course Outcomes	**CO1:** The students should be able to understand the basic concepts of Micro-Economics, which shall be helpful in their Engineering career.
	CO2: The students should be able to understand the basics concepts of Macro-Economics and its applications.
	CO3: The student should be able to understand different functions of Management and its importance in managing an organization.
	CO4: The student should be able to understand the relevance of Marketing of Product or Services and its applicability in profit maximization.
	CO5: The student should be able to understand the importance of Financial Management and its applicability in Industrial scenario.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1			1				2								
CO2				1			2								
CO3						2			2	3	3				
CO4			2								2				
CO5											3				

Course Contents:

Unit	Contents	Hours
I	Demand, Utility and Indifference curves, approach to Analysis of demand, Elasticity of demand, Measure of demand elasticity, Factors of Production, Advertising elasticity. Market and Market Structures: Price and output determination under perfect competition, monopolistic competition, oligopoly &monopoly, Depreciation and methods for its determination.	7
II	Functions of central and commercial banks, Inflation, Deflation, Stagflation, Direct and Indirect Taxes, New economic policy, Liberalization, Globalization, Privatization, Monetary &Fiscal policies of the government, Meaning and phases of business cycles.	6
III	Definition, nature and scope of Management, Functions of management- Planning, Organizing, Directing, Controlling, Principles of management, Communication.	5
IV	Meaning of Marketing management, concepts of marketing, Marketing Mix, Service Marketing, Product Life Cycle, New Product Development, Pricing strategies, Channels of distribution, Promotion Mix	7
V	Meaning, nature and scope of Financial Management, Sources of Financing, Ratio Analysis. Time value of money.	5

Text Books	1.	Modern Economics Theory, by K.K. Dewett, S. Chand & company ltd., 3rd Edition, 2006
	2.	Essentials of Management by Harold Koontz &Hein&Weihrich Tata McGraw Hill Publishing, 7th Edition, 2008.
	3.	Marketing Management by Philip Kotler, Kevin Keller, 14th Edition, 2016.
	4.	Financial Management by M.Y. Khan & P.K. Jain, Tata McGraw Hill Publishing, 5th Edition, 2008.

E--Books	1.	http://164.100.133.129:81/econtent/Uploads/Managerial_Economics%20(1).pdf[Economics]
	2.	http://164.100.133.129:81/econtent/Uploads/Financial_Management.pdf[Financial Management]
Reference Books	1.	Management by Stephen P. Robbins Mary A. Coulter, 14th Edition.
	2.	Marketing Management by Ramaswamy V S and Namakumari, Macmillan India Ltd.
	3.	Financial Management by I M Pandey, Vikas Publishing House, New Delhi.

Semester-VI

Course Title: **Next Generation Databases**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	--
Course Code										
Teaching Mode		5			Total	75			25	
Duration of ESE	3 Hrs.					100				

Course Objectives	To understand the basic concepts and terminology related to Unstructured Database.
	Familiarize students with databases like NOSQL, XML
	Implement and evaluate complex, scalable database systems, with emphasis on providing experimental evidence for design decisions.
Course Outcomes	**CO1:** Understand basic of Unstructured Database system
	CO2: Demonstrate the management of structured and unstructured data management with recent tools and technologies.
	CO3: Demonstrate competency in designing NoSQL database management systems
	CO4: Demonstrate competency in designing XML Databases
	CO5: Demonstrate competency in selecting a particular database for specific use cases

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3	2	2	2								**2**		
CO2		3	2	2	3								**2**	**2**	**2**
CO3		3	2	3	3										**2**
CO4		3	2	3	3										**2**
CO5		3	2	2	3										

Course Contents:

Unit	Contents	Hours
I	Introduction : Three Database Revolutions, The Third Database Revolution, Google, Big Data, and Hadoop	6
II	Sharding, Amazon, and the Birth of NoSQL, Document Databases, JSON Document Databases, Tables are Not Your Friends: Graph Databases, Column Databases, Column Database Architectures	6
III	XML, XML Databases – XML Tools and Standards, XML Databases, XML Support in relational systems, JSON Document Databases, MOngoDB, Column Databases, Graph Databases	6
IV	Distributed Database Patterns, Non relational Distributed Databases, Mongo DB Sharding and Replication, HBase	6
V	Consistency Models, Consistency in Mongo DB, Data Models and Storage, Languages and Programming Interfaces, NoSQL APIs	4
VI	Databases of the Future and Advance Databases, Counter revolutionaries, Oracle JSON Support, Disruptive Database Technologies	4

Text Books	1.	Next Generation Databases, Mr. Guy Harrison, Apress
	2.	Beginning JSON, by Mr. Ben Smith, Apress
	3.	Practical Mongo DB, By Shakuntala Gupta Edward Navin Sabharwal, Apress

Course Title: **Computes Vision and Deep Learning**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	--
Course Code	UAIL401 UAIP401									
Teaching Mode		5			Total	75			25	
Duration of ESE	3 Hrs.					100				

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 understand basic type of neural networking
	To apply Deep learning Techniques to various engineering and social applications.

Course Outcomes	**CO1:** Ability to identify the deep learning techniques.
	CO2: Ability to select and implement Machine learning and deep learning.
	CO3: Ability to Train machine and solve problems associated with batch learning and online learning,
	CO4: Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
	CO5: Ability to integrate deep learning libraries and mathematical and statistical tools.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		**3**	**3**	**3**	**2**								**1**		**3**
CO2		**3**	3	**2**									**2**	**2**	
CO3		**3**	3											**2**	
CO4		**3**	3												**3**
CO5	**2**	**3**	3												**3**

Course Contents:

Unit	Contents	Hours
I	(Partial) History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Threesholding Logic, Perceptron's, Perceptron Learning Algorithm Multilayer Perceptron's (MLPs),Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks	6
II	Representation Power of Feed forward Neural Networks Feed Forward Neural Networks, Back propagation Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam, Eigenvalues and eigen vectors, Eigen value 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, Back propagation 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, Mahmoud Hassaballah, 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/

Course Title: **Big Data Computing**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	3	--	2	4	10	15	50	25	25
Course Code	UITL305 UITP305									
Teaching Mode		5			Total	75			50	
Duration of ESE	3 Hrs.					125				

Course Objectives	To understand the Hadoop architecture
	To learn Hadoop Distributed File System (HDFS) and YARN building, and its functionality for limit and resource organization
	To understand Map Reduce, Pig and HIVE architecture
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Understand basic concepts and techniques of Hadoop and Big data concept.
	CO2: Design different component of Hadoop ecosystem
	CO3: Develop skills of implementation of various Hadoop ecosystem components.
	CO4: Apply ecosystem knowledge to real time problems of moderate complexity.
	CO5: Understand the domain of data science and analysis of big data.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		2	3	-	3	-	-	-	-	-	3	-	-	-	-
CO2		2	3	-	3	-	-	-	-	-	3	-	-	-	2
CO3		3	3	2	3	-	-	-	-	-	3	-	3	2	3
CO4		3	3	-	3	-	-	-	-	-	3	-	3	3	3
CO5		3	3	1	3	-	-	-	-	-	3	-	-	3	-

Course Contents:

Unit	Contents	Hours
I	**Big data and Hadoop:** Introduction to Hadoop and Big Data, Big data, challenges for processing big data, technologies support big data, History of Hadoop, Use cases of Hadoop, RDBMS vsHadoop When to use and when not to use Hadoop.	7Hr
II	**HDFS:** Hadoop Distributed File System, Significance of HDFS in Hadoop, Features of HDFS, Data Storage in HDFS Introduction about Blocks, Data replication. Accessing HDFS: CLI (Command Line Interface) and admin commands, Java Based Approach, Fault tolerance. Download Hadoop, Installation and set-up of Hadoop, Start-up & Shut down process	7Hr
III	**Map Reduce**: Map Reduce: Map Reduce Story, Map Reduce Architecture, How Map Reduce works, Developing Map Reduce, Map Reduce Programming Model, Different phases of Map Reduce Algorithm, Different Data types in Map Reduce	7Hr
IV	**Pig** Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Execution in Pig, Loading data, Exploring Pig Latin commands, HIVE: Hive introduction, Hive architecture, Data types and schemas, Partitions and buckets.	7Hr
V	**HIVE** Hive introduction, Hive architecture. Data types and schemas, Partitions and buckets. BASE Architecture and schema design, Spark Shell, Spark Application, Flume, SQOOP introduction and application	7Hr

Text Books	1.	Tom White, “Hadoop: The Definitive Guide", 3rd edition, O'Reilly Media.
	2.	Big Data (Black Book), Wiley Publications
	3.	V. Prajapati, "Big Data Analytics with R and Hadoop", Packt Pub.
E--Books	1.	https://nptel.ac.in/courses/106106142/ ------ Algorithm for Big data

	2.	https://nptel.ac.in/courses/106104135/48 --- Big Data
	3.	Hadoop Definitive Guide**,** Tom White, O'Reilly Media
Reference Books	1.	V. Ankam, Big Data Analytics, Packt Publication Ltd.
	2.	N. Dasgupta, Practical Big Data Analytics, Packt Publication Ltd.
	3.	MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems, Adam Shook and Donald Miner
On line TL Material	1.	https://www.udemy.com/big-data-hadoop-the-complete-course/
	2.	https://www.cloudera.com/more/training/certification.html
	3.	https://www.edureka.co/big-data-and-hadoop https://www.simplilearn.com/big-data-and-analytics/big-data-and-hadoop-training

List of Practical

Practical No	Name of Practical
1	Installation of Hadoop& starting of Hadoop.
2	Copy the files from and to local
3	Map-Reduce for word counting
4	Creating the HDFS tables and loading them in Hive
5	Exporting data from Hive
6	Implementation of Pseudo Code using Spark
7	Word Count implementation Using Pig Script
8	Using Sqoop& Flume implement data aggregation

Course Title: **Universal Human Values 2 : Understanding Harmony**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	H	3	--	--	3	10	15	50	--	--
Course Code	UHUL302									
Teaching Mode		3			Total	75			--	
Duration of ESE	3 Hrs.					75				

Course Objectives	Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence
	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
	Strengthening of self-reflection and development of commitment and courage to act.
Course Outcomes	**CO1:** Students are expected to become more aware of themselves.
	CO2: Students are expected to become more aware of their surroundings (family, society, nature).
	CO3: Students should become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
	CO4: Students would have better critical ability, they would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
	CO5: Students would be able to apply what they have learnt to their own self in different day-to-day settings in real life.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1						2		3	1			2			
CO2			3			2		2		2		2			
CO3			3			3	3	2							
CO4			2			2	2	2							
CO5			1			1	1	2				3			

Course Contents:

Unit	Contents	Hours
I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:** Purpose and motivation for the course, Self-Exploration, Continuous Happiness and Prosperity, Right understanding relationship and physical facility, Understanding happiness and prosperity correctly, Method to fulfill the above human aspirations.	8
II	**Understanding Harmony in the Human Being - Harmony in Myself!** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body', Understanding the Body as an instrument of	8

	'I', Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body.	
III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding values in human-human relationship, Understanding the meaning of Trust, Understanding the meaning of Respect, Understanding the harmony in the society, Visualizing a universal harmonious order in society	8
IV	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature, Understanding Existence as Co-existence, Holistic perception of harmony	8
V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics, Strategy for transition from the present state to Universal Human Order: a) At the level of individual, b) At the level of society.	8

Text Books	1.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010
Reference Books	1.	JeevanVidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
	2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
	3.	The Story of Stuff (Book)
	4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
	5.	Small is Beautiful - E. F Schumacher.
	6.	Slow is Beautiful - Cecile Andrews
	7.	Economy of Permanence - J C Kumarappa
	8.	Bharat Mein Angreji Raj - PanditSunderlal
	9.	Rediscovering India - by Dharampal
	10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
	11.	India Wins Freedom - Maulana Abdul Kalam Azad
	12.	Vivekananda - Romain Rolland (English)
	13.	Gandhi - Romain Rolland (English)

Course Title: **Employability Skills**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	--	--	2	1				25	--
Course Code	UIDP302									
Teaching Mode		2			Total	--			25	
Duration of ESE	3 Hrs.					25				

Course Objectives	To introduce them with the current market scenarios
	To equip the students with the essential skills for employability
	To demonstrate self-sufficiency to be highly employable or venture their start-ups
Course Outcomes	**CO1:** Students shall exhibit their ability to set clear and realistic professional objective
	CO2: Enabling them to make well informed choices and commercially equipped
	CO3: Master Verbal (LSRW) and non-verbal communication skills required in the process of recruitment
	CO4: Students shall exhibit improved Interpersonal skills for better professional conduct
	CO5: Students shall exercise higher order thinking skills, creativity skills, convincing and Negotiation skills

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1							**3**								
CO2						**3**	**3**	**3**							
CO3										**3**					
C04						**3**	**3**	**3**		**3**					
C05						**3**					**3**	3			

Course Contents:

Unit	Contents	Hours
I	**Orientation - Researching Job and Company- Emerging Market Trends:** Experience sharing of Major Campus interviews, Skill	4

	Requirements, Current Market trends, Researching the Job and company	
II	**Personal and company commercial:** Guidelines for preparing a 30-90 second self Introduction .Questions to think about in developing a commercial Understand " What to avoid" in a commercial - **Self Selling Proficiency**: What to say and do, How to demonstrate commercial awareness in an interview ,Post Interview activity, Telephone etiquette in a phone Interview **Resume Building :**Guidelines on framing resume and cover letter Checklist to ensure completeness , Sample resumes and cover letter references Basic Guidelines on Video Resume an its difference with conventional	6
III	**Verbal and Non-Verbal Communication:** Format of Business Correspondence, Email and Letter writing etiquette, Hands on training on email and letter writing with case study, Body Language in an Interview- Dos' and Donts', Tips and techniques on Essay Writing How to knot the crux on Essay writing Practise on some common essay writing topics in an interview - **Voice Versant Neutralization :** Voice Modulation, Pitch and tone training and Accent Neutralization	6
IV	**Personal Interview- Group Discussion**: Preparation tips on GD and Extempore: Dos' and Donts', Presentation on PI Preparation and FAQs -Role Plays/ Mock Interview with Technical Faculty and Mock Interview by Faculty **Assessment and feedback series:**	4

Text Books	1.	Employability Book – Global Education Ltd(Under Review)
Reference Books	1.	Employability Skills by NIMI Chennai, First Edition Aug 2019
	2.	What employers wants by Karen Holmes, March 2017 Edition
E-Learning	1.	Udemy , Coursera, Alison, Edx, WPA Apprentice, Hubspot, Codecademy

Course Title: **Campus Recruitment Training**										
Semester	VI	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	--	--	2	1	--	--	--	25	--
Course Code	UIDP303									
Teaching Mode		2			Total	--			25	
Duration of ESE	3 Hrs.					25				

Course Objectives	The Curriculum aims to equip students in order to apply quantitative reasoning and Mathematical analysis methodologies to understand and solve problems.
	The students shall attain conceptual clarity to comprehend reasoning questions in a simple way and arrive at decisions at a logical manner.
	The program intends to enhance student's Critical Thinking, Analytical, Evaluative and Creative skills that make them best fit and sustain in the corporate/competitive world.
Course Outcomes	Students shall draw conclusions or make decisions based on analysis and critique of quantitative information. This leads them to effectively justify the conclusion and execute their plans.
	Students shall solve real life problems requiring interpretation and comparison of various probabilities to ascertain the best outcomes expected.
	Students shall identify logical relation to analyze, comprehend and apply mathematical techniques instead of assumptions to different real time situations.
	Shall solve the campus placements aptitude papers that qualifies them to get employed.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3							3				2		
CO2		3	3	3		3			3			3	2	2	
CO3	3	3	3	3					3				2		
C04						3			3			3	2		3

Course Contents:

Unit	Contents	Hours
I	**Orientation to Aptitude**: Orientation on syllabus, Emerging aptitude requirement, Pre-assessment on existing knowledge	4
II	**Quantitative Aptitude**: Number System, Problem on Numbers, Ratio and Proportion, Averages, Percentage, Profit/ Loss and Discount, Simple Interest and Compound Interest, Partnership, Mixtures and Alligations, Speed, Time & Distance, Time & Work, Boats and Stream, Pipes and Cistern, Permutation & Combination, Probability, Progression, Mensuration	8
III	**Logical Reasoning**: Blood Relation, Direction, Analogy, Puzzles, Seating Arrangement, Syllogism, Clocks, Calendar, Cubes & Dices,	5

	Coding and Decoding, Spatial and 2-D Ability, Data Sufficiency, Number Series	
IV	**Data Interpretation**: Table chart, pie chart, bar graph and line graph, problems based on the various data , such as combination of gender, city, profession, salary, sports, vehicle, problems based on Pie chart, degree of fraction occupied by the commodity, line chart and bar chart	4

Text Books	1.	Book on Aptitude and Verbal Ability- Global Education Ltd(Under Review)
Reference Books	1.	Quantitative Aptitude- R S Aggarwal - 2017 Edition- S. Chand
	2.	Campus Recruitment- Paxis Group
E-Learning	1.	Wifi study, indiabix.com, freshers world, sawal.com, unacademy

Semester-VII

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-VII													
UAIL XXX	Department Elective III	EL	3			3	3	10	15	50			75
UAIL XXX	Department Elective IV	EL	3			3	3	10	15	50			75
UAIL XXX	Department Elective-V	EL	3		2	5	4	10	15	50	25		100
UAIL XXX	Department Elective-VI	EL	3		2	5	4	10	15	50	25		100
UAIP4018	Project	P			8	8	4				100	100	200
TOTAL			**12**	**0**	**12**	**24**	**18**						**550**

Semester-VIII

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-VIII													
UAIP419	Internship	P					12				250	250	500
UIDL4XX	MOOCs based Open Elective	OE	3			3	3	10	15	50			75
TOTAL			**3**	**0**	**0**	**3**	**15**						**575**