



Dayananda Sagar University

School of Engineering

Innovation Campus, Kudlu Gate, Hosur Road, Bengaluru

Department of
Computer Science & Technology

SCHEME

B.Tech. PROGRAMME- 2022 BATCH

Academic Year 2022-23

(1st semester to 4th semester)



Dayananda Sagar University

School of Engineering

Devarakaggalahalli, Harohalli, Kanakapura Main Road, Ramanagar District - 562112

Definitions / Descriptions

Definition of Credit:	
1 Hour Lecture (L) Per Week	01 Credit
1 Hour Tutorial (T) Per Week	01 Credit
1 Hour Practical (P) Per Week	0.5 Credit
1 Hour Project (J) Per Week	0.5 Credit

Course code and Definition:	
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management Courses
IPCC	Integrated Professional Core Course
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
SEC	Skill Enhancement Courses
UHV	Universal Human Value Course
PROJ	Project Work
INT	Internship



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Implementation of National Education Policy (NEP) 2020 for the B.Tech students of Batch 2022-2026

The implementation of Curriculum follows NEP 2020 and addresses the following features and categories of courses:

1. Student Centric flexible curriculum.
2. Inter-disciplinary Courses,
3. Multi-disciplinary Courses,
4. Ability Enhancement Courses,
5. Skill Enhancement Courses,
6. Value Added Courses,
7. Product Design and Development,
8. Internship (Rural Internship, Industry Internship, Research/Development Internship), and
9. Multiple Exit and Multiple Entry
 - Certificate in Engineering after completion of first year.
 - Diploma in Engineering after completion of second year.
 - Advanced Diploma in Engineering after completion of third year.
 - Degree in Engineering after completion of fourth year.



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General Instructions:

- **Open Elective Courses:** At least two courses must be provided from each department and the courses shall be general course on emerging areas with broad coverage of syllabus so that student shall choose without any difficulty.
- **Honors Degree:** An Honors degree typically refers to a higher level of academic achievement in the major area. That is, certificate in his/her OWN major for Research orientation. The Credit requirement: **172 to 178 credits** (Major worth 160 credits + Honors 12 to 18 credits)
- **Minor Degree:** Minor is a secondary concentration of courses that often complements the honors. Minor in any OTHER branch for Improving Employability.
 - > Minor is an option rather than a requirement for B. Tech students. They may opt for one of the Engineering or Non-engineering discipline as Minor, earning additional credits ranging from 12 to 18. However, students are permitted to choose only one Minor either from engineering or non-engineering discipline.
 - > This opportunity is ideal for students who took a Major out of necessity but would still like to pursue their passion in another discipline or to enrich/equip them for a specific profession where greater job opportunities exist. Another advantage of opting for a Major with a Minor is to earn standing credits for pursuing a Master's degree abroad or within India too.
 - > Only students who satisfy a set of minimum eligibility criteria set forth by the university and meet certain pre-requisites, will be permitted to opt for a Minor.
 - > Credit requirement: **172 to 178 credits** (Major worth 160 credits + Minor 12 to 18 credits)
 - > Degree nomenclature: The degree will contain the Major / Major with Specialization. The Minor pursued by the student will be provided in the transcript along with details on courses completed and associated credits earned.
 - > For e.g., For a student who pursued Computer Science and Engineering with a Minor in Industrial Psychology, the degree will read "B. Tech in Computer Science and Engineering", Transcripts of B. Tech will reflect the Minor courses and the Minor certificate in Industrial Psychology will be issued separately.

SCHEME - B.TECH - 2022-23 ONWARDS
LSEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	c	SEM	COURSE CODE
1	101-105 & 121-123	22EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1102	C PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	*	***
3	101-105 & 121-123	22EN1103	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	22EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	*	***
5	101-105 & 121-123	22EN1105	INTRODUCTION TO ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
6	101-105 & 121-123	22EN1106	BIOLOGY FOR ENGINEERS	CR	3	-	-	-	3	*	***
7	101-105 & 121-123	22EN1107	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1108	KANNADA KALI / MANASU	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2022-23 ONWARDS

ISEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	c	SEM	COURSE CODE
1	101-105 & 121-123	22EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1102	C PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	*	***
3	101-105 & 121-123	22EN1109	ENGINEERING PHYSICS	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	22EN1110	ENGINEERING MECHANICS	CR	3	-	-	-	3	*	***
5	101-105 & 121-123	22EN1111	INTRODUCTION TO ELECTRONICS	CR	3	-	-	-	3	*	***
6	101-105 & 121-123	22EN1112	ENGINEERING GRAPHICS AND DESIGN THINKING	CR	2	-	2	-	3	*	***
7	101-105 & 121-123	22EN1113	ENVIRONMENTAL SCIENCE	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1114	TECHNICAL ENGLISH	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2022-23 ONWARDS
I SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	22EN1201	SINGLE AND MULTIVARIATE CALCULUS	CR	3	-	-	-	3	*	***
2	101-105 & 121-123	22EN1202	PYTHON PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	•	***
3	101-105 & 121-123	22EN1103	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	•	***
4	101-105 & 121-123	22EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	*	***
5	101-105 & 121-123	22EN1105	INTRODUCTION TO ELECTRICAL ENGINEERING	CR	3	-	-	-	3	•	...
6	101-105 & 121-123	22EN1106	BIOLOGY FOR ENGINEERS	CR	3	-	-	-	3	*	***
7	101-105 & 121-123	22EN1107	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	CR	1	-	-	-	1	*	***
8	101-105 & 121-123	22EN1108	KANNADA KALI / MANASU	CR	1	-	-	-	1	*	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2022-23 ONWARDS
IISEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	22EN1201	SINGLE AND MULTIVARIATE CALCULUS	CR	3	-	-	-	3	*	***#
2	101-105 & 121-123	22EN1202	PYTHON PROGRAMMING FOR PROBLEM SOLVING	CR	2	-	2	-	3	•	...
3	101-105 & 121-123	22EN1109	ENGINEERING PHYSICS	CR	3	-	2	-	4	•	...
4	101-105 & 121-123	22EN1110	ENGINEERING MECHANICS	CR	3	-	-	-	3	*	***
5	101-105 & 121-123	22EN1111	INTRODUCTION TO ELECTRONICS	CR	3	-	-	-	3	•	...
6	101-105 & 121-123	22EN1112	ENGINEERING GRAPHICS AND DESIGN THINKING	CR	2	-	2	-	3	*	***
7	101-105 & 121-123	22EN1113	ENVIRONMENTAL SCIENCE	CR	1	-	-	-	1	•	***
8	101-105 & 121-123	22EN1114	TECHNICAL ENGLISH	CR	1	-	-	-	1	•	***
					18	-	06	-	21		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits



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III SEMESTER

III SEMESTER													
S.N	Course Type	Course Code	Course Name	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Project	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J					
1	BSC	22CT2301	Transforms and Numerical Techniques	MAT	3	0	0	0	03	60	40	100	3
2	IPCC	22CT2302	Data Structures	CSE	3	0	2	0	03	60	40	100	4
3	IPCC	22CT2303	Digital Logic Design	ECE	3	0	2	0	03	60	40	100	4
4	PCC	22CT2304	Discrete Mathematics and Graph Theory	CSE	3	0	0	0	03	60	40	100	3
5	PCC	22CT2305	Full Stack Development	CST	3	0	0	0	03	60	40	100	3
6	AEC	22LSXXXX	Liberal Studies – I	Any Dept.	1	0	0	0	01	50	--	50	1
7	SEC	22CT23XX	Skill Enhancement Course – I	CST	1	0	2	0	01	100	--	100	2
			Total		17	00	06	00	17	450	200	650	20



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Liberal Studies			
1	22LS0001	Introduction to Drama	
2	22LS0002	Introduction to Dance	
3	22LS0003	Introduction to Music	
4	22LS0004	Introduction to Photography	
5	22LS0005	Introduction to Japanese language	
6	22LS0006	Law for Engineers	
7	22LS0007	Introduction to Painting	
8	22LS0008	Communication Through Sanskrit	
9	22LS0009	Vedic Mathematics	
10	22LS0010	Fundamentals of Critical Thinking	
11	22LS0011	Introduction to Film Studies	
12	22LS0012	Practicing Yoga & Meditation	
13	22LS0013	Cyber Crimes, Policies & Laws	
14	22LS0014	Holistic Medicine	
15	22LS0015	3 D Modelling using Tinkercad	



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Skill Enhancement Course - I			
1	Design Thinking & Ideation		22CT2306
2	Innovative Businesses & Breakthrough Technologies		22CT2307



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IV SEMESTER													
S.N	Course Type	Course Code	Course Name	Teaching Department	Teaching Hours / Week			Examination				Credits	
					Lecture	Tutorial	Practical	Project	Duration in Hours	CIE Marks	SEE Marks		Total Marks
					L	T	P	J					
1	BSC	22CT2401	Probability & Statistics	MAT	3	0	0	0	03	60	40	100	3
2	IPCC	22CT2402	Design and Analysis of Algorithms	CSE	3	0	2	0	03	60	40	100	4
3	PCC	22CT2403	Database Management System	CSE	3	0	2	0	03	60	40	100	4
4	PCC	22CT2404	Product Design & Development	CST	2	0	2	2	02	60	40	100	4
5	IPCC	22CT2405	Computer Organization and Architecture	CSE	3	0	0	0	03	60	40	100	3
6	AEC	22CT24XX	Special Topic	CST	1	0	0	2	--	100		100	2
7	SEC	22CT24XX	Skill Enhancement Course – II	CST	1	0	2	0	--	100	--	100	2
			Total		16	00	08	04	14	500	200	700	22



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Special Topic			
1	Introduction to IPR & Registration		22CT2406
2	Research Paper Writing		22CT2407

Skill Enhancement Course - 1108			
1	Small E-Business Launch		22CT2408
2	Idea Generation and Validation		22CT2409

SEMESTER	I					
YEAR	I					
COURSE CODE	22EN1101					
TITLE OF THE COURSE	LINEAR ALGEBRA & DIFFERENTIAL EQUATIONS					
SCHEME OF INSTRUCTION	Lecture Hours (L)	Tutorial Hours (T)	Practical Hours [P]	Project Hours (J)	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- Understanding basic concepts of linear algebra to illustrate its power and utility through applications to science and Engineering.
- Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
- The course is discussed with algebraic as well as geometric perspectives.
- Solve problems in cryptography, computer graphics and wavelet transforms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
C01	Apply the abstract concepts of matrices and system of linear equations using decomposition methods	L3
CO2	Implement the basic notion of vector spaces and subspaces	L3
CO3	Apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces	L3
C04	Applications of linear transforms in computer graphics and imaging	L3
CO5	Applications of orthogonality in various domains	L3

COURSE CONTENT:	
MODULE 1	8Hrs
Linear algebra: Introduction - The Geometry of Linear Equations - Row reduction and echelon forms- Rank of a matrix - Gaussian Elimination - Solution sets of linear equations - LU decomposition - Inverse of a matrix by Gauss-Jordan method.	
MODULE 2	8Hrs
Vector spaces and subspaces: Linear spaces - Subspaces - Linear independence - Span - Bases and Dimensions -Finite dimensional vector spaces, Fundamental subspaces associated with a matrix.	
MODULE 3	9Hrs
Linear transformations and orthogonality: Linear transformations - Basic properties - Invertible linear transformation - Matrices of linear transformations - Vector space of linear transformations - Inner Product, Orthogonal Vectors - Projections onto Lines - Projections and Least Squares - The Gram-Schmidt Orthogonalization process, QR Factorization.	

MODULE 4	7Hrs
Eigenvalues and eigenvectors: Introduction to Eigenvalues and Eigenvectors - Diagonalization of a Matrix- Diagonalization of symmetric matrices - Quadratic forms.	
MODULE 5	7Hrs
Differential equations: Linear second order ordinary differential equation with constant coefficients - Solutions of homogenous and non-homogenous equations - Method of undetermined coefficients - method of variation of parameters - Solutions of Cauchy-Euler and Cauchy-Legendre differential equations.	

TEXT BOOKS:

1. DC Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4 th Edition, Thomson Brooks/Cole, Second Indian Reprint 2007.
3. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.
4. Thomas' Calculus, George B.Thomas, D.Weir and J. Hass, 2014,13th edition, Pearson.

REFERENCES:

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press (2016).
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003.
5. Practical Linear Algebra, Farin and Hansford, CRC Press (2013).

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1103					
TITLE OF THE COURSE	ENGINEERING CHEMISTRY					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	2	-	39(L)+26(P)= 65	4

COURSE OBJECTIVES:

- To provide chemical concepts most relevant to engineering students and demonstrate them in an applied context.
- To expose to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, phase equilibria nanomaterials and green chemistry and catalysis.
- To emphasize on applications of these concepts to real world problems

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.	L2
CO2	Know construction, working and applications of various energy storage devices such as batteries, fuel cells and supercapacitors.	L2
CO3	Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.	L3
CO4	Know the synthesis, structure -property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world	L3
CO5	Differentiate various instrumental techniques involved in determining chemical reactions	L3

COURSE CONTENT:

MODULE 1	8Hrs
Chemical energy source: Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV&NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol, octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas. Solar energy: Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique.	

MODULE 2	8Hrs
Energy science and technology: Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell- Definition, notation and conventions. Reference electrodes- Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on EMF. Ion-selective electrode- glass electrode Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries-primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries. Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.	
MODULE 3	8Hrs
Corrosion science: Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Corrosion control, Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method. Surface Modification Techniques: Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes, Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.	
MODULE 4	8Hrs
High Polymers: Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber, Conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting polyaniline. Nanotechnology: Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites.	
MODULE 5	7Hrs
Water Technology: Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method, Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment. Instrumental Methods of Analysis: Instrumental methods of analysis, Principles of spectroscopy-Beer's Lamberts law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base).	
List of Laboratory/Practical Experiments activities to be conduct 26Hrs	
Volumetric Analysis and Preparations 1. Evaluation of quality of water in terms of total hardness by Complexometric titration. 2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample. 3. Determination of Alkalinity of the given water sample 4. Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis. 5. Electroless plating of copper (Demo experiment) 6. Preparation of Polyaniline (Demo experiment)	

Instrumental methods of Analysis

1. Potentiometric titration-Estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient, surface tension, density of a given liquid
4. Colorimetric estimation of copper in a given solution
5. Determination of $P_k a$ of given weak acid.
6. Determination of calorific value of coal/oil using Bomb calorimeter (Group experiment)

TEXT BOOKS:

1. Dr. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015

REFERENCES:

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015
 2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015
 3. Dayanada Sagar University laboratory manual
 4. J. Bassett, R.C. Denny, G.H. Jeffery, Vogel's, Text book of quantitative inorganic analysis, 4th edition
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SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1104					
TITLE OF THE COURSE	ELEMENTS OF MECHANICAL ENGINEERING					
SCHEME OF INSTRUCTION	L	T	P	J	TotalHours	Credits
	2	-	2	-	26(L)+26(P) = 52	3

COURSE OBJECTIVES:

The course will enable the students to

- Acquire a basic understanding of renewable energy resources and basic concepts of hydraulic turbines.
- Acquire knowledge of various engineering materials and metal joining techniques.
- Acquire essential knowledge of modern manufacturing tools and techniques.
- Acquire knowledge on basics of refrigeration and air-conditioning.
- Explain about the cooling of electronic devices.
- Acquire knowledge of basic concepts of mechatronics and robotics.
- Explain about the electric and hybrid vehicles.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Describe basic concepts of renewable energy resources and power generation	L2
C02	Distinguish various engineering materials and metal joining techniques	L2
CO3	Demonstrate different modern manufacturing tools and techniques	L3
CO4	Make use of basic concepts of refrigeration and air-conditioning concepts	L3
CO5	Illustrate essential knowledge of basic concepts of mechatronics and robotics	L2
CO 6	Comprehend the important concepts of electric and hybrid vehicles	L2

COURSE CONTENT:	
MODULE 1 Energy Sources and Power Generation	10 Hrs
Review of energy sources: Construction and working of Hydel power plant, Thermal power plant, Nuclear power plant, Solar power plant, Tidal power plant, Wind power plant. Principle and Operation of Hydraulic turbines, Pelton Wheel, Francis Turbine and Kaplan Turbine. Working of Centrifugal Pump & reciprocating pump.	
Thermodynamics: System, boundary, surroundings, types of systems, Zeroth law, First and second laws of thermodynamics, Efficiency, COP, Carnot theorem	
MODULE 2 Engineering Materials and Metal Joining Processes	10 Hrs
Metals-Ferrous: Tool steels and stainless steels. Non-ferrous /metals: aluminum alloys. Ceramics- Glass, optical fiber glass, cermets. Composites- Fiber reinforced composites, Metal matrix Composites.	

Smart materials- Piezoelectric materials, shape memory alloys, semiconductors, and super-insulators. Metal Joining Processes: Fitting, Sheet metal, Soldering, brazing and Welding: Definitions. Classification and methods of soldering, brazing, and welding. Brief description of arc welding, Oxy-acetylene welding, Introduction to TIG welding and MIG welding.	
MODULE 3 Modern Manufacturing Tools and Techniques	12 Hrs
CNC: Introduction, components of CNC, advantages and applications of CNC, CNC Machining centres and Turning Centers Concepts of Smart Manufacturing and Industrial IoT. Additive Manufacturing: Introduction to reverse Engineering, Traditional manufacturing vs Additive Manufacturing, Computer aided design (CAD) and Computer aided manufacturing (CAM) and Additive Manufacturing (AM), Different AM processes, Rapid Prototyping, Rapid Tooling, 3D printing: Introduction, Classification of 3D printing process, Applications to various fields.	
MODULE 4 Thermal Systems and Management	10 Hrs
Heat in Electronic Devices: Modes of Heat Transfer, heat generation in electronics, temperature measurement, heat sink, Cooling of electronic devices: Active, Passive, and Hybrid Cooling. Refrigeration: Principle of refrigeration, Refrigeration effect, Ton of Refrigeration, COP, Refrigerants and their desirable properties. Principles and Operation of Vapor Compression and Vapor absorption refrigeration. Applications of Refrigerator. Air-Conditioning: Classification and Applications of Air Conditioners. Concept and operation of Centralized air conditioning system.	
MODULE 5 Advanced Technologies	10 Hrs
Mechatronics: Introduction, Concept of open-loop and closed-loop systems, Examples of Mechatronic systems and their working principle. Robotics: Introduction, Robot anatomy, Joints & links, common Robot configurations. Applications of Robotics in Material Handling, Processing, Assembly, and Inspection. Electric and Hybrid Vehicles: Introduction, Components of Electric and Hybrid Vehicles, Drives and Transmission. Advantages and disadvantages of EVs and Hybrid vehicles.	

List of Laboratory/Practical Experiments activities to be conduct
Demonstration on Principle and Operation of any one Turbo-machine Demonstration on pumps Visit any one Conventional or Renewable Energy Power Plant and prepare a comprehensive report. One exercises each involving Fitting and Sheet metal. One exercises each involving welding and Soldering. Study oxy-acetylene gas flame structure and its application to gas welding Demonstration on Principle and Operation of CNC machine. Demonstration on Principle and Operation of 3D printing process. Demonstration of anyone Heat transfer application device and prepare a comprehensive report. Demonstration of anyone air conditioning system. Demonstration of the machine consists of Gear Trains. Demonstration of various elements of mechatronic system. Demonstration of any one model of Robot

TEXT BOOKS:

1. Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill 2nd Ed., 2002
2. Non-Conventional Energy Sources, G.D Rai, Khanna Publishers, 2003
3. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010

4. Thermal Management in Electronic Equipment, HCL Technologies, 2010
5. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1

REFERENCES:

1. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012
2. Turbo Machines, M. S. Govindgowda and A. M. Nagaraj, M. M. Publications 7Th Ed, 2012
3. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed., 2003.
4. Thermal Management of Microelectronic Equipment, L. T. Yeh and R. C. Chu, ASME Press, New York, 2002
5. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1105					
TITLE OF THE COURSE	INTRODUCTION TO ELECTRICAL ENGINEERING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

This course enables students:

- To impart basic knowledge of electrical quantities such as current, voltage, power and energy
- To distinguish between passive and active electrical components
- To explain the general structure of electrical power system
- To define basic laws of electric circuit and to solve related problems
- To understand basics of earthing, protective devices and wiring
- To introduce concepts, analogies and laws of magnetic circuits
- To learn the working principle, construction and characteristics of various DC machines
- To study the construction, principle of operation and types of transformers
- To understand the working principles of measuring equipment.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the basic knowledge about the Electric and Magnetic circuits.	L2
CO2	Analyze the working of various Electrical Machines.	L3
CO3	Applying basic laws and determine various circuit parameters in AC and DC Circuits.	L3
CO4	Explain the construction, basic principle of operation, applications and determine performance parameters of various measuring instruments.	L2
CO5	Outline the knowledge of Green Energy, Electrical Safety Rules & standards course.	L3

COURSE CONTENT:	
MODULE 1	8Hrs
ELECTRICAL CIRCUIT CONCEPTS: Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, ohm's law, inductor, and capacitor; types of electrical circuits, voltage and current divider rule, Kirchhoff's laws, Peak, average and rms values of ac quantities; apparent, active and reactive powers; phasor analysis, Power factor, impedance and admittance, power and energy in electrical elements, introduction to 3 phase systems.	

MODULE 2	8Hrs
MAGNETIC CIRCUIT CONCEPTS: Basics of magnetic circuits, laws of magnetism, magnetic field, magnetic lines of force, permeability, Electromagnetic Fields: Relation between field theory and circuit theory; numerical on capacitance calculations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Self and Mutual inductance of simple configurations.	
MODULE 3	8Hrs
DC MACHINES AND TRANSFORMERS: DC Machines: Basic principles of electromagnetic energy conversion, Construction, operation, characteristics, performance, of de generators and motors, testing of de machines, applications, Transformers: Construction, working principle, equivalent circuit, voltage regulation, efficiency, Auto-transformers.	
MODULE 4	8Hrs
SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors. General working principles and construction of indicating instruments. Electro-magnetic Instruments for the measurement of current, voltage, power and energy. Instruments for the measurement of power factor, frequency, Potentiometers. CRO, Calibration of instruments; importance, procedures and standards.	
MODULE 5	7Hrs
POWER STATION PRACTICES, ECONOMICS, AND GREEN ENERGY CONCEPTS: Energy generation-Conventional generation of electrical energy using thermal, hydro, nuclear and, non-conventional sources of energy; overview on green energy technology, load forecasting, electricity tariffs, power factor improvement, power plant economics, Overview on electrical safety standards in industries	

TEXT BOOKS:

1. D.P.Kothari and I J. Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGrawHill, 2010
2. B.L Thereja and A.K Thereja, "A text book of Electrical Technology (Vol III)(Transmission, distribution, and Utilization)", 23rd Edition, S Chand and Company

REFERENCES:

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, 'Introduction to Electrical Engineering', 2nd Edition, McGraw-Hill, 1992
2. P.S. Dhogal, 'Basic Electrical Engineering - Vol. I & IT, 42nd Reprint, McGraw-Hill, 2012.
3. K Sawhney, A course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai & Co. (P) Limited January 2015
4. NPTEL - <https://nptel.ac.in/courses/108/108/108108076/>

SEMESTER	I					
YEAR	I					
COURSE CODE	22EN1102					
TITLE OF THE COURSE	C PROGRAMMING FOR PROBLEM SOLVING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	2	-	2	-	26(L)+26(P) = 52	3

COURSE OBJECTIVES :

- To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Express algorithms learned implicitly in school explicitly in algorithmic form and calculate the number of basic operations (exact or upper bound).	L3
CO2	Trace the execution of short programs/code fragments involving fundamental programming constructs.	L4
CO3	Write a short program/code fragment for a given task using fundamental programming constructs.	L3
CO4	Debug a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools.	L4
CO5	Design a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist.	L3

COURSE CONTENT:

MODULE 1	7 Hrs
Basics and overview of C: Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement.	
MODULE 2	5 Hrs
Arrays: Introduction, declaration & initialization of array, reading and writing array elements, Operations on array: Traversal, searching, sorting. Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using two-dimensional array.	

Strings: definition, declaration, initialization, and representation. String handling functions and character handling functions.	
MODULE 3	6 Hrs
Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers. Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion.	
MODULE 4	4 Hrs
Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures. Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.	
MODULE 5	4 Hrs
Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory. Files: Defining, opening and closing of files. Input and output operations.	

List of Laboratory/Practical Experiments activities to be conducted		
1. Design a C program to Swapping of two numbers. (Simple Expressions].		
2. Design a C program to find the simple interest as per the below conditions (Simple expressions, Integer division issues (data loss], Explicit typecasting, when p, t, r are integers and si is float.		
3. Design a C program to find the largest of 3 numbers. a) Using if and no else. (Conditionals] b) Using nested if. (conditionals and Boolean expressions] c) Using Ladder if else if d) Using Ternary operator.		
4. Design a program that takes three coefficients (a, b, and c] of a Quadratic equation ($ax^2+bx+c=0$] as input and compute all possible roots.		
5.Design a C program to read the vehicle type (Use c or C for car, b or B for bus, t or T for Tempo for vehicle type) and Duration of customer vehicle parked in parking slot. Parking fare is calculated as per the rates given below: print the total parking charges.		
Vehicle	First Rate	Second Rate
Car	Rs 20/hr for first 2hr	Rs 30/hr for next
Bus	Rs 40/hr for first 2hr	Rs 50/hr for next
Tempo	Rs 30 /hr for first 2hr	Rs 40/hr for next
6. a Write a program to calculate the factorial of a given number, b Write a program using four fuctions to check if the given number is a palindrome.		
7.a Sum of natural numbers ($\text{sum}(n) = n + \text{sum}(n-1)$);). b. Write a program to calculate Power of a number ($b^n = b * b^{n-1}$].		
8. a. Write a program to calculate nth fibonacci number given first two numbers in the series.		

Inputs	N	Output
0,1	3	2
1,5	4	11
2,4	7	42
8,1	5	19
3,5	6	34

b. Write a program to calculate GCD of two numbers.

9. Write a program to emulate a calculator with the following operations: Addition, Subtraction, Multiplication, Division - using functions, switch and break.]

10. Write a program using four functions to compute the sine of a value using Taylor's series approximation - pass by value.

11. Write a program to find the sum of n different using four functions and arrays.
Use the following function prototype:
void inputf(int n, int a[n]);
int add(int n, int a[n]);
void output(int n, int a[n], int sum) and main[.]

12. Write a program to add two matrices using separate function for input, add matrices, display matrix and main function.

13. String handling:
a) Write a function to reverse the string in reverse and display it. [Strings]
b) Write a function to concatenate the two strings without using strcat.(Strings)
c) Write a function to find the length of the string.

14. Write a program using Bubble sort technique to sort an array of integer elements (Sorting technique, Const array arguments.)

15. Write a program to search an array of elements of data type requested by the user for a given item using binary search algorithm. (Searching technique, Const array arguments].

16. Write a program with functions to add and multiply two complex numbers. Define a structure Complex to represent a complex number. The main function should call other functions for the purposes of input, computations and display. (Structs as arguments].

17. Define a structure, student, to store the following data about a student: rollno (integer], name (string) and marks (integer] . Your program must contain the following functions: (Array of Structures].

- A function to read the students data.
- A function to display records of each student.
- A function to sort the records of student Rank Wise
- A function print all students details
- A function to search student details by Rollno
- A function to print the names of the students having the highest test score

TEXT BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.
2. ReemaThareja, "Programming in C". Oxford University Press, Second Edition, 2016

REFERENCES :

1. R. S Bichkar, "Programming with C and Data Structure", University Press, 2014
2. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science - A Structured Approach Using C", Cengage Learning, 2007
3. Brian W. Kernigham and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, PHI, 2012
4. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press 2013.

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1106					
TITLE OF THE COURSE	BIOLOGY FOR ENGINEERS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- To introduce students to basics modern biological concepts with an emphasis on how bio-processes are analogous to engineering field, as a multidisciplinary field.
- To make students understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions are arrived citing body functional examples.
- To motivate students of engineering that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
C01	Student appreciates and explains the biological mechanisms of living organisms from the perspective of engineers and find solutions to solve bio-engineering problems with appropriate tools.	L2
C02	Explain optimal designs in engineering that are bio-mechanical in nature and build and use by observing and understanding bio-physiological processes involved in sensing, locomotion, and knowledge application of range of bio-chemicals.	L3
C03	Demonstrate that bio-chemical, bio-sensory, bio-processes could be path-finders to optimise similarities for functional aspects of electronic, computer, mechanical, electrical machines	L3

COURSE CONTENT:	
MODULE 1	8 Hrs
Biomimetics: Biology for Engineers, Body Fluid: Blood- Mechanics of heart, Blood pressure, Life molecules: Water, Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes - engineering analogies	
MODULE 2	8 Hrs
Bioenergy: Unit of life: Human and Plant cell, Metabolism: Enzymes as Bio-catalysts and physiological entities, Development- Bioenergy from Sun-Photosynthesis	
MODULE 3	8 Hrs
Biomechanics (Human Body Movement Mechanics): Normal Human Movement: Force-Vector of Body; Movement Angles; Muscle contraction -Relaxation; Posture - Static & Dynamic; Ideal and abnormal posture, Practical: Stepping-Lifting-Sit-Stand.	

MODULE 4	8 Hrs
Bioelectronics: Brain & Computer: Senso-neural networks, IoT as applied to biology, Bionic Eye: Mechanism of Vision, Electronic Nose: Bio-olfactory mechanisms (Science of smell), Impulses: Cardiac and Nerve, Biological Clock, Circadian rhythm	
MODULE 5	7 Hrs
Biopharma: Metabolic syndromes, Cancer and its diagnostics, Lab on a chip, Bio-Sensors, Drug Discovery	

REFERENCES:

- Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson. "Biology: A global approach",, Global Edition, 10/E, 2014
- David Nelson, Michael Cox. "Lehninger Principles of Biochemistry". W H Freeman & Company, Seventh Edition, 2017.
- Janine M Benvus. "Biomimicry: Innovation inspired by Nature". William Morrow Paperbacks, 2002.
- Lecture Notes, PPT slides by course instructor.

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1107					
TITLE OF THE COURSE	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	1	-	-	-	13	1

COURSE OBJECTIVES:

This course enables students:

- To provide basic information about Indian constitution.
- To identify individual role and ethical responsibility towards society.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand state and central policies, fundamental duties.	L2
CO2	Understand Electoral Process, special provisions.	L2
CO3	Understand powers and functions of Municipalities, Panchayats and Cooperative Societies.	L2
CO4	Understand Engineering ethics and responsibilities of Engineers	L2

COURSE CONTENT:

MODULE 1:	7Hrs
Introduction to the Constitution of India, the making of the constitution and salient features of the constitution. Preamble to the Indian constitution fundamental rights & its limitations. Directive principles of state policy & relevance of directive principles state. Policy fundamental Duties.	
MODULE 2	6Hrs
Union Executives - President, Prime Minister, Parliament, Supreme Court of India. State Executives - Governor Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86 th & 91st amendments. Special provision for SC & ST, special provision for Women, children & backward classes, Emergency provisions. Powers and functions of municipalities, panchyats and co - operative Societies.	

TEXT BOOKS:

1. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) PrenticeHall, 19th / 20th Edn., 2001.

REFERENCES:

1. M.V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1109					
TITLE OF THE COURSE	KANNADA KALI					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	1	-	-	-	13	1

COURSE OBJECTIVES:

This course enables students:

- To introduce Kannada language & culture to Non - Kannada speakers.
- To train them to communicate in colloquial Kannada with confidence.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
C01	The learners can communicate in Kannada & acquaint themselves with Kannada culture.	L2

COURSE CONTENT:

MODULE 1:		7Hrs
Introduction to Karnataka & Kannada Culture, Evolution of Kannada. Introduction to Kannada Alphabets. Introduction to Kannada Numbers.		
MODULE 2		6Hrs
Kannada words, sentences & phrase making for colloquial communication.		

REFERENCES:

1. Kannada Kali -Dr. Lingadevaru Halemane
2. Kannada Paatagalu- Editor: Dr. Chandrashekara Kambara.
3. SLN Sharma & K Shankaranarayana "Basic Grammar", Navakarnataka Publications.
4. Spoken Kannada. Publication: Kannada Sahitya Parishat Bengaluru.

SEMESTER	II					
YEAR	I					
COURSE CODE	22EN1201					
TITLE OF THE COURSE	SINGLE AND MULTI VARIABLE CALCULUS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

- To analyze and solve constrained and unconstrained optimization problems.
- To understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.
- To find volumes of solids by calculating appropriate double integrals in rectangular and polar coordinates.
- To relate rectangular coordinates in 3-space to spherical and cylindrical coordinates.
- To evaluate triple integrals and use them to find volumes in rectangular, cylindrical and spherical coordinates.
- To evaluate line integrals of curves and vector fields and interpret such quantities as work done by a force.
- To use Green's theorem to evaluate line integrals along simple closed contours on the plane.
- To apply Stoke's theorem to compute line integrals along the boundary of a surface.
- To apply Divergence theorem to evaluate surface integral.
- To have a good foundation of Sequences of Bounded, Monotonic and Convergence.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
C01	Understand basic calculus concept such as limit, continuity and derivatives	L2
C02	Compute partial derivatives and use it to give polynomial approximation of functions in several variables	L3
C03	Apply calculus concepts to solve real-world problems such as optimization and related rates problems	L3
C04	Evaluate integrals of functions or vector-related quantities over curves, surfaces, and domains in two- and three-dimensional space	L5
C05	Apply Fundamental Theorem of Line Integrals, Green's Theorem, Stokes' Theorem, or Divergence Theorem to evaluate integrals	L3
C06	Distinguish between the concepts of sequence and series, and determine limits of sequences and convergence and approximate sums of series	L3

COURSE CONTENT:	
MODULE 1	9Hrs
Differential Calculus: Functions of two or more variables: Definition, Region in a plane, Level curves, Level surfaces, Limits, Continuity, Partial derivatives, Differentiability, Gradients, Directional derivatives, Normals to level curves and tangents, Extreme values and saddle points, Lagrange multipliers. Self-Learning Component: Single variable calculus	
MODULE 2	9Hrs
Integral calculus: Double integral and iterated integrals - Cartesian and polar coordinates, Volume of solids of revolution, Triple integral, Change of variables, Multiple integrals in cylindrical and spherical coordinates.	
MODULE 3	9 Hrs
Vector Calculus: Line Integrals, Vector Fields, Work, Circulation and flux, Path independence, Potential functions, and Conservative fields, Green's theorem in the plane, Surface area and surface integrals, Surface area of solid of revolution, Parametrized surfaces, Stokes' theorem, The Divergence theorem.	
MODULE 4	6Hrs
Sequence and Series I: Sequences of real numbers and their convergence criteria, Infinite series, Sequence of partial sums, Tests for convergence/divergence - n^{th} term test, Boundedness and monotonicity, Integral, Condensation, Comparison, Ratio and root tests	
MODULE 5	6Hrs
Sequence And Series II: Alternating series, Absolute and conditional convergence, Rearrangement theorem, Power series, Taylor and Maclaurin series (one and two variables')	

TEXT BOOKS:

1. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCES:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8th edition, Cengage Learning.
4. Engineering Mathematics, K.A. Stroud and Dexter J. Booth, 2013, 7th Edition, Palgrave Macmillan.
5. Basic Multi Variable Calculus, Marsden, Tromba and Weinstein, W.H. Freeman, Third Edition

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1109					
TITLE OF THE COURSE	ENGINEERING PHYSICS					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
	3	-	2	-	39(L)+26(P)=65	4

COURSE OBJECTIVES:

- To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering,
- To understand Band structure of solids, Semiconductors and electrical conductivity of SC's, and their applications.
- To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT.
- To review different types of Engineering materials -Electronic, electrical, mechanical and Magnetic materials and Dielectric material Properties and their applications in Science and Engineering.
- Classify the magnetic materials based on susceptibility and their temperature dependence
- To understand different crystal systems and determine structure by miller-indices
- To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering.
- To learn how to fabricate Nano materials by using Top-down and Bottom-up approach& To review Nano science and technology and its practical applications in biology, engineering and medicine.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimension	LI
CO2	Illustrate Semiconductors, Semiconductor devices like Photo diode, LED, Solar cell and BJT and its applications	L3
C03	Distinguish the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering	L2
CO4	Apply the concept of magnetism to magnetic data storage devices.	L3
C05	Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and its applications in science and engineering.	L2

C06	Interpret Basic concepts of thin films and thin film deposition processes and their applications leads to Sensors and engineering devices	L3
C07	Categorize Nano materials, Properties, and fabrication of Nano materials by using Top-down and Bottom -up approach's - Applications for Science and technology	L2

COURSE CONTENT:	
MODULE 1	8Hrs
Quantum Mechanics: Foundations of quantum theory, wave function and its properties, de-Broglie hypothesis, Heisenberg uncertainty principle, one dimensional time independent Schrodinger wave equation, eigen values and eigen functions, applications: one dimensional motion of an electron in a potential-well. LASER PHYSICS: Introduction to lasers, conditions for laser action, requisite of a laser system principle, construction and working of Nd-YAG and semiconductor laser, application of lasers in defense (LASER range finder), engineering [data storage] and applications of LASERS in medicine.	
MODULE 2	8Hrs
Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valence band (Mention the expression), Intrinsic carrier concentration, Conductivity of semiconductors, Hall effect, Numericals. Semiconducting devices for optoelectronics applications: - Principle and working of LED, photodiode, Solar cell, BJT.	
MODULE 3	8Hrs
Dielectrics: Introduction - Dielectric polarization - Dielectric Polarizability, Susceptibility and Dielectric constant - Types of polarizations: Electronic, Ionic and Orientation polarizations (qualitative) - Lorentz Internal field (Expression only) - Clausius - Mossotti equation (derivation) - Applications of Dielectrics - Numericals. Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials - Engineering applications.	
MODULE 4	8Hrs
Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC, BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals. Mechanical Engineering Materials - mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test.	
MODULE 5	7Hrs
Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films.	

Nano Science technology: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up approach- Ball-milling and Photolithography, Process. Fundamental Principles of Biophysics & Applications of Nano technology in Biology and Engineering.

List of Laboratory/Practical Experiments activities to be conduct

1.1-V characteristics of a Zener Diode

I—V Characteristics of a Zener diode in forward and reverse bias condition (Module 2)

2. Planck's constant

Measurement of Planck's constant using LED (Module 2)

3. Transistor characteristics

Input and output characteristics of a NPN transistor in C-E configuration (Module2]

4. Dielectric constant

Determination of dielectric constant of a dielectric material (Module 2)

5. Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

6. Diffraction grating

Determination of wavelength of a laser light using diffraction grating (Module 4)

7. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit (Module 3)

8. Band gap energy

Determination of energy gap of an intrinsic semiconductor (Module 2)

TEXT BOOKS:

1. S. M. Sze, Semiconductor devices, Physics and Technology, Wiley. Publishing
2. Engineering Physics (2019], DSU Pearson, New Delhi.

REFERENCES:

1. M. Young (1977], Optics & Lasers An Engineering Physics approach, Springer
2. K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
3. S. O. Pillai (2018], Solid State Physics, revised edition, New Age International Publishers, New Delhi
4. MN Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018], A textbook of Engineering Physics, S Chand, New Delhi.

SEMESTER	I/II					
YEAR	I					
COURSE CODE	222EN1110					
TITLE OF THE COURSE	ENGINEERING MECHANICS					
SCHEME OF Instruction	L	T	P	J	TotalHours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

The course will enable the students to

- Explain different types of forces, equilibrium conditions and related theorems
- Illustrate Couples and equivalent force couple system and related problems
- Explain concepts of friction and their relevance in Engineering problems
- Describe centroid, center of gravity, moment of inertia and mass moment of inertia and their relevance in Engineering problems
- Describe Trusses and its classification
- Determine axial forces in members of Planar determinate Truss
- Illustrate various concepts in dynamics and related problems

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
CO1	Understand free body diagrams and principle of statics	L2
CO2	Analyze structures using concept of equilibrium conditions considering effect of frictional forces	L4
CO3	Describe the centroid and moment of inertia of composite geometrical sections	L2
CO4	Calculate axial forces in members of determinate truss	L3
CO5	Demonstrate plane kinematics and kinetics of particles/rigid bodies	L3

COURSE CONTENT:

MODULE 1		9 Hrs
Introduction to Engineering Mechanics: Introduction to Engineering Mechanics, Force Systems Basic concepts, Particle Equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Resultant- Moment of Forces and its Application; Couples and Resultant of force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium.		
MODULE 2		7 Hrs
Friction : Introduction, Types of friction, Limiting friction, Cone of Friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Ladder friction, related problems.		
MODULE 3		8 Hrs
Centroid, Centre and gravity and Moment of inertia: Introduction, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of		

inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder and Prism.	
MODULE 4	7 Hrs
Analysis of Truss: Introduction, Classification of trusses, Equilibrium in two and three dimension; Method of Sections; Method of Joints; To determine if a member is in tension or compression; Simple Trusses; Zero force members.	
MODULE 5	8 Hrs
Dynamics: Introduction, Rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates); Projectile motion, Basic terms, general principles in dynamics; Types of motion, motion and simple problems; D Alembert's principle and its applications in plane motion and connected bodies.	

TEXT BOOKS:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall publications.
2. A Nelson (2009), Engineering Mechanics: Statics and dynamics, Tata McGraw Hill publications.

REFERENCES:

1. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, - Dynamics, 9th Ed, Tata McGraw Hill publications.
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
5. H.J. Sawant, S.P Nitsure(2018), Elements of Civil Engineering and Engineering Mechanics, Technical Publications.

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22EN1111					
TITLE OF THE COURSE	INTRODUCTION TO ELECTRONICS					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	3	-	-	-	39	3

COURSE OBJECTIVES:

This course enables students:

- To introduce the concepts of fundamentals of semiconductor devices with the basic knowledge of the flow of current in semiconductor devices such as diodes and transistors
- To Explain the characteristics of various semiconductor devices and the concept of Integrated circuits
- To understand the principles of electronic circuits for operations of energy conversions from AC to DC, noise removal and building the required power supply
- To understand how a particular electronic device can increase the power of a signal and also to be acquainted with gain calculations
- To implement the Boolean functions and to realize basic logic gate operations and logic functions
- To understand the basics of communication system, to modify the characteristics of carrier signals according to the information signals
- To study the fundamentals of electromagnetic waves
- To identify and understand the different blocks present in transmitter and receiver.
- To describe various parameters of Op-Amp, its characteristics and specifications.
- To understand the various applications of Op-Amp.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the fundamentals of semiconductor devices, analog and digital circuits	L2
CO2	Design and analyze the behavior of analog and digital circuits.	L3
CO3	Outline the overview of communication systems and oscillators. Solve various kinds of numerical problems.	L3
CO4	Develop the analog and digital circuits using simulation tool	L3

COURSE CONTENT:

MODULE 1		8Hrs
Semiconductor Diodes: Semiconductor materials- intrinsic and extrinsic types, Ideal Diode. Terminal characteristics of diodes: p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Zener diode, Series voltage regulator, Rectifier Circuits: Half wave and full wave, Reservoir and smoothing circuits.		

MODULE 2	8Hrs
Transistors: Introduction, Transistor construction, operation and characteristics; Configuration types: Common base and common emitter configuration, Active region operation of transistor, Transistor amplifying action, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Transistor as a switch: cut-off and saturation modes. Field Effect Transistors: Construction and characteristics of n-channel JFET, Types of power amplifiers: Class A operation, Class B operation, Class AB operation.	
MODULE 3	8Hrs
Operation Amplifier: Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non-inverting amplifier, comparator, summing amplifier, integrator, differentiator. The concept of positive feedback, Oscillator circuits using op amps: RC phase shift oscillator, wein bridge oscillator.	
MODULE 4	8Hrs
Communication system: The radio frequency spectrum, electromagnetic waves, A simple CW transmitter and receiver, modulation, demodulation, AM transmitter, FM transmitter, Tuned radio frequency receiver, Superheterodyne receiver. RF amplifiers, AM demodulators.	
MODULE 5	7 Hrs
Digital circuits: Logic functions, Switch and lamp logic, logic gates, combinational, Logic, bistables/flipflops, application of Flip flops, Integrated circuit logic devices: introduction to Microprocessor and microcontrollers [Architecture], Related Problems.	

TEXT BOOKS:

1. Electronic Devices and Circuit Theory: Robert L Boylestad and Louis Nashelsky, Pearson Education, Eleventh Edition, 2013.
2. Electronic Circuits: Fundamentals and applications, Michael Tooley, Elsevier, Third edition, 2006.

REFERENCES:

1. David A Bell, Electronic Devices and Circuits, PHI, 5th edition, 2007.
2. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill, second edition, 2010
3. Modern Digital and Analog Communication Systems by B.P.Lathi. Oxford University Press, Fourth edition, 2010
4. NPTEL- <https://nptel.ac.in/courses/122/106/122106025/>
Virtual Labs- <http://vlabs.iitkgp.ac.in/be/>

SEMESTER	1/n					
YEAR	I					
COURSE CODE	22EN1112					
TITLE OF THE COURSE	ENGINEERING GRAPHICS & DESIGN THINKING					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
	2	-	2	-	26(L)+26(L)	3

COURSE OBJECTIVES:

- To create awareness and emphasize the need for Engineering Graphics & design thinking
- To learn using professional CAD software for construction of geometry
- To understand the concepts of orthographic and isometric projections
- To construct orthographic projection of points, lines, planes and solids
- To construct development of surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components
- To work in a team for creating conceptual design of products
- To learn application of design methods and tools on real world problem

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
C01	Explain usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings	L1
C02	Construct points, lines, planes and solids using orthographic projections principles	L3
C03	Construct & understand development of lateral surfaces of solids	L3
C04	Construct geometries of planes and solids using isometric projection principles	L3
C05	Apply the design thinking principles and recognize the significance of innovation	L3
C06	Design various part models related to engineering field using AutoCAD modelling software	L3

COURSE CONTENT:

MODULE 1		4 Hrs
Introduction to engineering graphics: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling, symbols, dimensioning & tolerances, conventions, Introduction to orthographic projection. Types of projections & their principles - [For CIA only]		
Introduction to computer aided drafting software- Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, coloring, mirror, rotate, trim, extend, break, chamfer, fillet and curves - [For CIA only]		

MODULE 2	12 Hrs
Projection of points and lines- Orthographic projections of points in all the quadrants, Orthographic projections of lines- inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Orthographic projections of planes viz triangle, square, rectangle, pentagon, hexagon and circular laminae.	
MODULE 3	16 Hrs
Projection of solids & development of surfaces: Projection of simple solids like prisms, pyramids, cylinder & cone when the axis is inclined to one or both of the principal planes by change of position method, Development of lateral surfaces of simple solids - Prisms, pyramids cylinders and cones.	
MODULE 4	12 Hrs
Isometric projections: Isometric scale, Isometric projection of hexahedron (cube), regular prisms, pyramids, cylinders, cones and spheres, Isometric projection of combination of two solids Conversion of Isometric Views to Orthographic Views & Conversion of orthographic views to isometric projections.	
MODULE 5	8 Hrs
Introduction to design thinking for innovations: A brief history of Design, Engineering Design process, Product development cycle, creation of models and their presentation in standard 3D view. Theory, Practice & Examples in Design thinking, Storytelling, Creativity and Idea Generation, Concept Development, Testing and Prototyping. (For CIA only)	

List of Laboratory activities to be conducted
• Manual & Computer Sketching problems for all the modules in sketch book and also take print out of the problems. • Problems to be solved in first quadrant system. • Minor Project for Design thinking in a group of students with VIVA- (Examples on Solid Modeling - Using 3D Modelling Software & Physical Model Prototype). Module 1 & 5 - Only For CIA

TEXT BOOKS:

1. "A Textbook of Computer Aided Engineering Drawing", Gopalakrishna, K. R. and Sudheer Gopala Krishna (2017), Subash Publishers, Bangalore, India.
2. "Engineering Design- A Project Based Introduction", C. L. Dym and Patrick Little, John Wiley & Sons (2022)

REFERENCES:

1. "Engineering Drawing", Bhatt N.D., 3rd Edition, Charotar Publishing House, Gujarat, India,(2019)
2. "Engineering Drawing with Introduction to AutoCAD" Dhananjay .A .J, Tata McGraw-Hill Publishing Company Ltd, (2018)
3. "Engineering Design Methods: Strategies for Product Design", N. Cross, John Wiley, 2021.

SEMESTER	I/II					
YEAR	I					
COURSE CODE	22ENN1114					
TITLE OF THE COURSE	ENVIRONMENTAL SCIENCE					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
	1	-	-	-	13	1

COURSE OBJECTIVES:

- To understand the concepts of environment, pollution, energy resources
- To learn water as a resource, rain water harvesting as a method of conservation of water
- To explain solid waste and its management
- To learn environmental Protection Act laws, environmental Impact Analysis and air monitoring

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's TaxonomyLevel
C01	Critically elucidate the basic concepts that govern environmental quality, ambient air quality standards	L2
C02	Compare different Energy resource and their environmental implications	L2
C03	Identify different types of pollution, waste stream	L2
C04	Identify different natural and manmade disasters and prevention	L2
C05	Apply the process of environmental impact assessment and implications of Indian Environment Laws	L2

COURSE CONTENT:

MODULE 1	3 Hrs
Definition of environment; Scope and importance of environmental studies; Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships; 3 T's, Chronic and acute effects.	
MODULE 2	4 Hrs
Pollution: Criteria Air pollutants - Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; Acid Rain Cycle. Water as a resource; Lentic and Lotic Water Systems; Rain Water Harvesting; Water Pollution; Noise pollution-sources and effects of noise; Municipal Solid Waste: Hazardous Waste: Electronic Waste: Biomedical Waste; Solid Waste Management: Landfills, composting Process.	
MODULE 3	2 Hrs
Energy Types of energy: Conventional sources of energy, fossil fuel, Coal, Solar, wind; Non-conventional Sources of Energy, Biofuels - biomass, biogas.	

MODULE 4	2 Hrs
Disasters & Management; Definition, Natural (Earthquakes, landslides, floods), Man-made disasters (biological, chemical, nuclear, radiological explosions) - definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters.	
MODULE 5	2 Hrs
Environmental Impact Assessment (EIA); Air pollution monitoring and Ambient Air Quality Standards (AAQS); Environment Protection Act, 1986.	

TEXT BOOKS:

1. Benny Joseph [2005]. "Environmental Studies", Tata McGraw - Hill Publishing Company Limited, New Delhi.
2. R. J. Ranjit Daniels and Jagadish Krishnaswamy (2014). "Environmental Studies" (2014), Wiley India Pvt Limited, New Delhi.

REFERENCE BOOKS:

1. P. Aarne Vesilind, Susan M. Morgan, Thomson (2008). "Introduction to Environmental Engineering" (2008), Thomson learning, Second Edition, Boston.
2. R. Rajagopalan (2005). "Environmental Studies - From Crisis to Cure" Oxford University Press, New Delhi.

SEMESTER	1/n					
YEAR	I					
COURSE CODE	22EN1114					
TITLE OF THE COURSE	TECHNICAL ENGLISH					
SCHEME OF Instruction	L	T	P	J	Total Hours	Credits
		-	2	-	26	1

COURSE OBJECTIVES:

- To enhance their communicative skills
- To equip students with oral and appropriate written communication skills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To create interest among the students about any topic
- To learn the use of body language and improve verbal message
- To acquire skills for placement
- To help them frame their ideas and thoughts in a proper manner.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Make a complete Group Project: Poster Making, Power Point Presentation, Abstract Writing, Project Paper, Facing Viva	L2
CO2	Skit Performance on any social awareness theme in group.	L2
CO3	Learning how to create a Cover Letter, Job Application and Resume.	L3

COURSE CONTENT:	
MODULE 1	4 Hrs
Group Project: How to create a Poster & do Power Point Presentation. Learn to write an Abstract & Project Paper. Applying the basic etiquettes while facing Viva.	
MODULE 2	12 Hrs
Skit Performance: How to write a script. Use of powerful vocabulary, focus on pronunciation and maintaining the body language.	
MODULE 3	16 Hrs
Cover Letter, Job Application and Resume: Learn to create a resume. How to fill a Job Application form & create a proper Cover letter.	

REFERENCES:

- Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019) Technical Communication, Cengage Learning, New Delhi.
- Other Resources: Language Lab

SEMESTER	II					
YEAR	I					
COURSE CODE	22EN1202					
TITLE OF THE COURSE	PYTHON PROGRAMMING FOR PROBLEM SOLVING					
SCHEME OF INSTRUCTION	L	T	P	J	Total Hours	Credits
	2	-	2	-	26(L)+26(P)	3

COURSE OBJECTIVES:

- To understand basic concepts of computational thinking.
- To introduce python programming for problem solving.
- To introduce different debugging and unit testing tools.
- To solve real world problems using python data structures.
- Learn to handle files and exception handling in python.
- To explore Python's object-oriented features.
- To build Web services and Networked programs in python.
- To train students to design an application as part of the course mini- project using computational thinking with python.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand basic concepts of computational thinking.	L2
C02	Outline basic python programming for problem solving.	L2
CO3	Apply computational thinking to solve real world programs using Python	L3
C04	Build python programs using core data structures like list, dictionaries and tuples	L3
CO5	Implement object oriented concepts using python	L3
C06	Design applications related to web services and network Programming.	L3

COURSE CONTENT:	
MODULE 1	5 Hrs
INTRODUCTION: Values, expressions and statements, Conditional execution, Functions, Iterations	
MODULE 2	6Hrs
PYTHON DATA STRUCTURES: Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries	
MODULE 3	5Hrs
PYTHON OBJECTS: Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.	

MODULE 4	5Hrs
EXCEPTION HANDLING: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions	
MODULE 5	5Hrs
PYTHON FILES & LIBRARIES: Files: File types, modes, File functions, File attributes, File positions, Looping over file. Basics of NumPy and Pandas	

List of Laboratory/Practical Experiments activities to be conduct
- Python program to evaluate Values, expressions, and statements, Conditional execution, and Functions Iterations - prompt the user to enter an integer and reverse it. And print the sum of the reversed integer. - Write a python program to find whether a number (num1) is a factor of 255. - Write a python program to find whether a number (num1) is a factor of 255. - Write a program to find the sum of the following series: $1 + 1/3 + 1/5 + 1/7 + \dots$ up to 'N' terms. $1 + x/1! + x^3/2! + x^5/3! + x^7/4 + \dots x^{2n-1}/n!$ - Python program to evaluate Python Collections - Write a Python Program to demonstrate the inbuilt functions of Strings, List, and sets. - Write a Python program for counting a specific letter 'o' in a given string; the number of times vowel 'o' appears. - Write a Python Program to find the frequency of each word in given strings/strings - Store the following for 'n' countries, using a dictionary: - Name of a country, country's capital, per capita income of the country. - Write a program to display details of the country with the highest and second lowest per capita income. - Write a python program to create two classes "Python" and "Java" having data members "Version" and "name" and a member function "displayO". With the help of the object, print the appropriate messages. - Create a class "Employee" with <code>_init_</code> method to initialize data members: Name, Designation, Ph. No., and a member function display (). Create an instance for the class and display the details of the employee - Write an interactive calculator! User input is assumed to be a formula that consist of a number, an operator (at least + and -), and another number, separated by white space (e.g. 1 + 1). Split user input using <code>str.split()</code>, and check whether the resulting list is valid: - If the input does not consist of 3 elements, raise a <code>FormulaError</code>, which is a custom Exception. - Try to convert the first and third input to a float (like so: <code>float_value = float(str_value)</code>). Catch any <code>Value Error</code> that occurs, and instead raise a <code>Formula Error</code> - If the second input is not '+' or again raise a <code>Formula Error</code> - If the input is valid, perform the calculation and print out the result. The user is then prompted to provide new input, and so on, until the user enters quit.



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TRANSFORMS AND NUMERIAL TECHNIQUES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER-III

Course Code : 22CT2301

Credits : 03

Hours / Week : 03 Hours

Total Hours : 39 Hours

L-T-P-J : 3-Q-0-0

Course Learning Objectives:

This Course will enable students to:

1. **Apply** their knowledge of Laplace transforms and inverse Laplace transforms to proficiently solve linear ordinary differential equations with constant coefficients, facilitating the analysis and modelling of complex systems.
2. **Analyze** periodic functions using Fourier series, assessing the convergence properties and precision of the series expansion, thereby enhancing their ability to understand and manipulate periodic phenomena.
3. **Utilize** complex exponential form, Fourier transforms of basic functions, and Fourier sine and cosine transforms to solve problems involving Fourier integrals, developing proficiency in applying these techniques to various mathematical scenarios.
4. **Employ** numerical methods, including Euler's Method, Runge-Kutta 4th order, Adams-Bashforth, and Adams-Moulton Methods, to solve differential equations and effectively analyze dynamic systems, enabling them to model real-world phenomena and make accurate predictions.
5. **Apply** finite difference methods, including the Crank-Nicolson method and appropriate techniques for hyperbolic PDEs, to effectively solve different types of partial differential equations (PDEs) such as elliptic, parabolic, and hyperbolic equations, enhancing their problem-solving skills in the context of differential equations and their applications.



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Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT -1: Laplace Transform and Inverse Laplace Transform

09 Hours

Laplace Transforms of Elementary functions (without proof),

(Text Book-1: Chapter 6:203 to 207).

Laplace Transforms of $e^{at}f(t)$, $t^n f(t)$ and $\frac{f(t)}{t}$, Periodic functions, Unit step function and impulse functions

(Text Book-1: Chapter 6:208-230).

Inverse Laplace Transforms- By the method of Partial Fractions, Logarithmic and Trigonometric functions, Convolution Theorem, Inverse Laplace transform using Convolution Theorem (Text Book-1: Chapter 6:238).

Solution to Differential Equations by Laplace Transform.

(Text Book-1: Chapter 238-242).

UNIT - II: Fourier Series

09 Hours

Periodic Functions, Trigonometric Series

(Text Book-1: Chapter 11:495).

Fourier series Standard function, Functions of any Period $2L$, Even and Odd functions, Half-range Expansions.

(Text Book-1: Chapter 11:483-492)

Practical Harmonic analysis (calculate average power and RMS values of periodic waveforms)



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UNIT - III: Fourier Transform	06 Hours
Calculation of Fourier integrals using complex exponential form <i>(Text Book-1: Chapter 11: 510).</i> Fourier transform of basic functions <i>(Text Book-1: Chapter 11: 510-516).</i> Fourier sine and cosine transforms. <i>(Text Book-1: Chapter 11:518-522).</i>	
UNIT - IV: Numerical Methods for Solving Ordinary Differential Equations	07 Hours
Euler's Method-Basic principles of Euler's method for solving first-order ODEs <i>(Text Book-1: Chapter 1:10-12).</i> Runge-Kutta 4th order <i>(Text Book-1: Chapter 21:904).</i> Multistep Methods-Explanation of multistep methods (Adams-Bashforth, Adams-Moulton Methods) <i>(Text Book-1: Chapter 21:911-913).</i> Second-Order ODE. Mass-Spring System (Euler Method, Runge-Kutta Methods) <i>(Text Book-1: Chapter 21:916-918).</i>	
UNIT - V: Numerical Methods for Partial Differential Equations	08 Hours
Classification of PDEs (elliptic, parabolic, hyperbolic), <i>(Text Book-1: Chapter 21:922-923).</i> Finite Difference Methods (Laplace and Poisson Equations), Derivation of finite difference approximations <i>(Text Book-1: Chapter 21:923-927).</i> Crank-Nicolson Method <i>(Text Book-1: Chapter 21:938-941).</i> Method for Hyperbolic PDEs <i>(Text Book-1: Chapter 21:943-945).</i>	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply Laplace transforms and inverse Laplace transforms to solve linear ordinary differential equations with constant coefficients, demonstrating proficiency in system analysis and modelling.	L3
2	Analyze periodic functions using Fourier series and evaluate the convergence properties and precision of the series expansion.	L2&L3
3	Solve problems involving Fourier integrals by applying complex exponential form, Fourier transforms of basic functions, and Fourier	L3



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	sine and cosine transforms.	
4	Utilize numerical methods such as Euler's Method, Runge-Kutta 4th order, Adams-Bashforth, and Adams-Moulton Methods to solve differential equations and analyze dynamic systems	L2&L3
5	Apply finite difference methods, including the Crank-Nicolson method and appropriate techniques for hyperbolic PDEs, to solve various types of partial differential equations (PDEs) such as elliptic, parabolic, and hyperbolic equations.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1					1					
CO2	3	2	2						1					
CO3	3	2	2	1					1					
CO4	3	2	2	1					1					
CO5	3	2	2	1					1					

3: Substantial High

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6th Edition, Elsevier Limited.

E-Resources:

1. <https://nptel.ac.in/courses/111106139>
2. <https://nptel.ac.in/courses/111101164>
3. <https://nptel.ac.in/courses/111105038>



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DATASTRUCTURES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER-III

Course Code	: 22CT2302	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th)+13(P) Hours
L-T-P-J:	3-Q-2-0		

Prerequisites:

Proficiency in a C programming language.

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the basic approaches for analysing and designing data structures.
2. **Introduce** dynamic memory allocation and C language concepts required for building data structures
3. **Develop** essential skills to construct data structures to store and retrieve data quickly and efficiently.
4. **Utilize** different data structures that support different sets of operations which are suitable for various applications.
5. **Explore & Implement** how to insert, delete, search and modify data in any data Structure- Stack, Queues, Lists, Trees.
6. **Develop** applications using the available data structure as part of the course for mini-project.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teachers can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture methods, but different *types of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note taking, annotating, and roleplaying.
3. Show **Video/Animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.



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6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT -I

08 Hours

INTRODUCTION:

Introduction to Data Structure, Classification, C Structure and Union, Array Definition, Representation, Operations (Insertion, Deletion, Search and Traversal), Two/Multidimensional Arrays, sparse matrix, C Pointers

TB1: 1.1,1.2,1.3.1-1.3.4; TB2:2.5; RBI: 5.1-5.12,6.4

UNIT - II

09 Hours

INTRODUCTION TO ADT:

Stack: Definition, Array Representation of Stack, Operations on Stacks.

Applications of Stack: Expression evaluation, Conversion of Infix to Postfix, Infix to Prefix Recursion, Tower of Hanoi

Queue: Definition, Representation of Queues, Operations of Queues, Circular Queue.

Applications of Queue: Job Scheduling, A Maze Problem

TB1:2.1, 2.2, 2.3, 3.2, 3.3; TB2:3.3,3.4,3.5

UNIT - III

09 Hours

DYNAMIC DATA STRUCTURES:

Linked List: Types, Representation of Linked Lists in Memory. Traversing, Searching, Insertion & Deletion from Linked List. Circular List, Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal).

Applications: Stack & Queue Implementation using Linked Lists.

Case Study: Josephus problem.

TB1: 4.2,4.3,4.5

UNIT - IV

08 Hours

TREES:

Basic Terminology, Binary Trees and their representation, Complete Binary Trees, Binary Search Trees, Threaded Binary Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal).

Applications: Expression Evaluation

Case Study: Game Tree

TB1: 5.5.3,5.5.4,5.6; TB2:5.1,5.2,5.3,5.5,5.7



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UNIT-V	05 Hours
Efficient Binary Search Trees: Optimal Binary Search Trees, AVL Trees, Red Black Trees, Splay Trees. Case Study: B Trees TB2:10.1,10.2,10.3,10.4,11.2	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Demonstrate the key C programming concepts such as pointers, structures, unions and arrays data structures to perform operations such as insertion, deletion, searching, sorting, and traversing.	L3
2	Utilize the fundamental concepts of stacks and queues to solve the standard applications like tower of Hanoi, conversion and evaluation of expressions, job scheduling and maze.	L3
3	Implement Singly Linked List, Doubly Linked List, Circular Linked Lists, stacks and queues using linked list.	L3
4	Develop critical thinking and problem-solving skills by designing and implementing efficient algorithms for Non-linear tree data structure and perform insertion, deletion, search and traversal operations on it.	L3
5	Apply advanced techniques, such as balancing algorithms for AVL trees, Splay trees and Red-Black trees to maintain the balance and efficiency of binary trees.	L3



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Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3												2	
C02	3		3									2	2	
C03	3		3									2	2	
C04	3	2	3									2	2	
C05	3	2	3									2	2	

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS(TB):

1. A.M. Tannenbaum, Y Langsam, M J Augentien "Data Structures using C", 1st Edition, Pearson, 2019.
2. Ellis Horowitz, Susan Anderson-Freed, and Sartaj Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008.

REFERENCE BOOKS:

1. Brian. W. Kernighan, Dennis. M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall, 1988.
2. Gilbert & Forouzan, "Data Structures: A Pseudo-code approach with C", 2nd Edition, Cengage Learning, 2014.
3. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, McGraw Hill, 2013.
4. R.L. Kruse, B.P. Learly, C.L. Tondo, "Data Structure and Program design in C", 5th Edition, PHI, 2009.

E-Resources:

1. <https://nptel.ac.in/courses/106102064>
2. <https://www.coursera.org/learn/data-structures?specialization=data-structures-algorithms>
3. <https://www.udemy.com/topic/data-structures/free/>
4. <https://www.mygreatlearning.com/academy/learn-for-free/courses/data-structures>



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5. <https://cse01-iiith.vlabs.ac.in/>
6. <https://kremlin.cc/k&r.pdf>

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving using group discussion.
2. Role play E.g., Stack, Queue, etc.,
3. Demonstration of solution to a problem through programming.
4. Flip class activity E.g., arrays, pointers, dynamic memory allocation, etc.,

LABORATORY EXPERIMENTS

Total Contact Hours: 13

Following are experiments to be carried out using either C programming language

1. To Implement C programs with concepts of pointers, structures.
2. To implement multidimensional array Matrix Multiplication.
3. To search elements in data structure with different search methods.
4. To implement stack, queue and their variations using arrays.
5. To implement stack, queue and their variations using singly linked lists
6. To implement conversion & evaluation of expression using stacks.
7. To Implement doubly circular Linked Lists and variations and use them to store data and perform operations on it.
8. To Implement Addition/multiplication of 2 polynomial using linked lists
9. To implement binary tree traversal techniques.

OPEN-ENDED EXPERIMENTS

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the



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computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.

3. Mini-Project on applying suitable data structure to a given real-world problem.



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DIGITAL LOGIC DESIGN [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III			
Course Code	: 22CT2303	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39[Th] + 13 CP] Hours
L-T-P-J	: 3-0-2-0		
Course Learning Objectives: This Course will enable students to: 1. Translate the elements of digital logic functions to digital system abstractions using Verilog. 2. Illustrate simplification of Boolean expressions using Karnaugh 3. Model combinational logic circuits for arithmetic operations and logical operations 4. Analyse and model sequential elements flip-flops, counter, shift registers. 5. Outline the concept of Mealy Model, Moore Model and apply FSM to solve a given design problem.			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
UNIT -1			08 Hours



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INTRODUCTION:

Number System- Binary, Hexa, Decimal, Octal and its conversion. Canonical Notation - SOP & POS forms, Minimization of SOP and POS forms.

(Text Book-1: Chapter 1:1.2 to 1.4, Chapter 2:2.6)

ARITHMETIC CIRCUITS AND VERILOG MODELLING

Adders: Half adder, full adder, Ripple carry adder, parallel adder /subtractor, fast adders-CLA, comparator- 2 bit. Simplification using K-Maps

(Text Book-2: Chapter 5:5.2, 5.3.3, 5.4,5.5.2, 5.5.3)

Introduction to Verilog, Syntax of Verilog coding, Modelling styles in Verilog, Verilog Operators, Test bench for simulation

(Text Book-3: Chapter 1:1.1,1.2.2,1.3.1,1.3.2,1.3.3,1.4.2,1.5.1.2,1.5.2.2,1.5.3.2,1.5.4.2,1.6.2)

UNIT - II

07 Hours

Combinational Circuit Building Multiplexers 4:1, 8:1, decoders 3:8, 2:4, demultiplexers 1:4, encoders 8:3, 4:2, code converters- B to G and G to B- Simplification using K-Maps

Verilog for combinational circuits, if else, case-casex, casez, for loop, generate.

(Text Book-2: Chapter 6: 6.1, 6.2, 6.3, 6.4, 6.6)

UNIT - III

08 Hours

Sequential Circuits-1

Basic Latch, Gated latches, Flip Flops SR, D, JK, T, master-slave flip-flops JK, Characteristic equations, 0's and 1's Catching Problem, Race round condition, Switch debounce, shift registers- SISO, SIPO, PISO, PIPO, Setup time, Hold time, Propagation Delay

(Text Book-2: Chapter 7: 7.1, 7.2,7.3, 7.4,7.5,7.6, 7.8)

UNIT - IV

08 Hours

Sequential Circuits-2

Binary counters - asynchronous and synchronous, mod-n counter, ripple counter- 4 bit.

Verilog blocking and non-blocking,

Mealy Model, Moore Model, State machine notation, Construction of Finite State Machine.

(TextBook-2: Chapter 7: 7.9, 7.11, 7.12.3, 7.12.4, 8.1, 8.2, 8.3, 8.4)

UNIT-V

08 Hours



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Introduction to Electronic Design Automation:

FPGA Design Flow, ASIC Design flow, architectural design, logic design, simulation, verification and testing, 3000 Series FPGA architecture.

Applications:

Design 4 Bit ALU, 7 Segment display, Vending Machine, 3 Pipeline.

(Text Book-4: Chapter 1)

Laboratory Experiments

Experiments are conducted using Verilog tool /Kits

1. Introduction to Xilinx tool, FPGA flow
2. Adder - HA, FA using data flow and behaviour modelling styles
3. Adder - HA, FA using structural modelling style
4. Combinational designs - I (blocking and non-blocking/looping examples)
 - a. Multiplexer: 4:1, 8:1 MUX.
 - b. De Multiplexer: 1:4, 1:8 DEMUX.
5. Combinational designs - II (different types of case statements)
 - c. Encoder with and without Priority: 8:3 and 4:2.
 - d. Decoder: 3:8 and 2:4.
6. Design of 4-bit ALU
7. Flip Flop: D FF, T FF, JK FF
8. Design of Mod - n Up/Down Counter with Synchronous reset
9. Design of Mod - n Up/Down Counter with Asynchronous reset.
10. Design of Universal shift Register using FSM

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Interpret Boolean Expressions of digital design in simplified form	L2
2	Build the various elements of digital logic system with Verilog	L3
3	Construct Combinational and Sequential logic circuits	L3



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4	Analyse the hardware model of a digital system at different levels of abstraction in Verilog	L4
5	Evaluate the functionality of digital design by implementing on FPGA kits	L5
6	Design digital systems using FSM	L3

Table: Mapping Levels of COs to POs / PSOs															
Cos	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	1	2	3	-	-	-	1	-	1	1	2	1	-
CO3	3	2	3	1	2	-	-	1	1	-	1	1	2	1	-
CO4	3	3	2	3	3	1	-	1	-	1	2	1	2	2	1
CO5	3	3	2	3	3	1	-	-	-	1	-	-	2	2	1
CO6	3	3	3	3	3	2	-	1	2	2	2	2	2	1	2
3: Substantial (High)				2: Moderate (Medium)				1: Poor (Low)							

TEXT BOOKS:

1. M. Morris Mano Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", 6th Edition, Pearson Education, 2014.
2. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog design", McGraw Hill, 2014.
3. Nazein M. Botros, "HDL programming (VHDL and Verilog)", Dreamtech Press, 2006.
4. Douglas J Smith, "HDL Chip Design", Doone publications 1996.

REFERENCE BOOKS:

1. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2014.
2. Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2015.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, 2016.

E-Resources:

1. <https://archive.nptel.ac.in/courses/106/105/106105165/>
2. <https://nptel.ac.in/courses/117105080>



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Activity Based Learning (Suggested Activities in Class)

1. Design problem solving and Programming using group discussion. E.g., Traffic light controller, Digital Clock, Elevator.
2. Demonstration of solution to a problem through simulation.



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DISCRETE MATHEMATICS AND GRAPH THEORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER-III

Course Code :	22CT2304	Credits :	03
Hours / Week :	03 Hours	Total Hours :	39 Hours
L-T-P-J :	3-Q-0-0		

Course Learning Objectives:

This Course will enable students to:

1. **Learn** the set theoretic concept and its application in theory of computation.
2. **Illustrate** the association of functions, relations, partial ordered set and lattices with problems related to theoretical computer science and network models.
3. **Discuss** the basics of graph theory and its application in computer networks. Learn the concepts of counting techniques and its application.
4. **Determine** the concepts of mathematical induction, recursive relations and their application.
5. **Design the application** of mathematical logic and methods of proof in problems associated with formal verification, reasoning and decision making.

Teaching-Learning Process (General Instructions)

1. These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.
2. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
3. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, focused listening, and formulating questions.
4. To make **Critical thinking**, ask at least three higher order Thinking questions in the class.
5. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them
7. Discuss how some **concept can be applied to the real world** - and when that's possible.

UNIT-I 08 Hours

SET THEORY: Sets and subsets, Operations on Sets: Basic set operations, algebraic properties of sets, The Addition Principle

RELATIONS AND ITS PROPERTIES: Relations and their properties, N-Ary Relations and their applications, Representing relations.

Textbook - 2:1.1,1.2; Textbook - 1: 7.1., 7.2, 7.3



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UNIT - II	06 Hours
RELATIONS AND ORDER RELATIONS: Closure of relations, Equivalence Relations, Partial Orderings, Functions, The Growth of Functions. Self-Study: Transitive Closure and Warshalfs Algorithm. Textbook - 1: 7.4., 7.5, 7.6, 3.2	
UNIT - III	09 Hours
GRAPH THEORY: Graphs and Graph Models. Graph Terminology and Special Types of Graphs: Basic Terminology, Some Special Simple Graphs, Bipartite Graphs, Complete Bipartite Graphs. Representing Graphs and graph isomorphism: Adjacency lists, Adjacency Matrices, Incidence Matrices, Connectivity: Paths, Connectedness in Undirected and Directed Graphs, Vertex and Edge connectivity and their applications. Textbook-1: 8.1, 8.2, 8.3, 8.4	
UNIT - IV	08 Hours
GRAPHS AND ITS APPLICATIONS: Euler and Hamilton Paths and their applications, Planar Graphs and their Applications, Graph Coloring and its applications. Textbook-1: 8.5, 8.7, 8.8	
UNIT-V	08 Hours
MATHEMATICAL INDUCTION AND RECURSION: Mathematical Induction, Recurrence Relations: Rabbits and the Fibonacci Numbers, The Tower of Hanoi, Code word Enumeration, Solving Linear Recurrence Relations Self-Study: Basic Connectives and Truth Tables Textbook-1: 4.1; 6.1, 6.2; 1.1)	
Course Outcomes: At the end of the course the student will be able to: 1. Determine relation's properties for a given relation and basic set equalities, using algebraic properties of set and Venn diagrams. 2. Evaluate permutation functions for encoding and decoding simple text messages 3. Design different types of graphs and identify their main properties and applications in real time problems 4. Predict the degree of optimization in solving colouring problems, Eulerian, Hamiltonian or Planar and counting problems. 5. Illustrate the concept of Mathematical Induction and create linear recurrence relations for the given data	



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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Determine relation's properties for a given relation and basic set equalities, using algebraic properties of set and Venn diagrams.	L3
2	Evaluate permutation functions for encoding and decoding simple text messages	L4
3	Design different types of graphs and identify their main properties and applications in real time problems	L6
4	Predict the degree of optimization in solving colouring problems, Eulerian, Hamiltonian or Planar and counting problems.	L5
5	Illustrate the concept of Mathematical Induction and create linear recurrence relations for the given data	L4

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												3	
CO2	3	2	1									2	3	
CO3	3	2	1										3	
CO4	3	2	1										3	
CO5	3	2										2	3	

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, 2003.
2. Bernard Kolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structures", 3rd Edition, PHI 2001.

REFERENCE BOOKS:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", IV Edition, Pearson Education, Asia, 2002.



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2. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with applications to computer Science", Tata McGraw Hill, 1987.
3. J K Sharma, "Discrete Mathematics", 3rd edition, 2013, Macmillan India Ltd.

E-Resources:

1. Discrete Mathematics with Algorithms by M. O. Albertson, J. P. Hutchinson - J. 1988, Wiley.
2. Discrete Mathematics for Computer Science, Gary Haggard, John Schlipf, Sue Whitesides, Thomson Brooks/Cole, 2006.
3. <http://ocw.mit.edu/courses/mathematics/>
4. <http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html>
5. <http://cglab.ca/~discmath/notes.html>
6. https://www.cs.odu.edu/~toida/nerzic/content/web_course.html

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem using graph theory.



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FULL STACK DEVELOPMENT	
[As per Choice Based Credit System (CBCS) scheme]	
SEMESTER-III	
Course Code : 22CT2305	Credits : 03
Hours / Week : 03 Hours	Total Hours : 39 Hours
L-T-P-J : 3-Q-0-0	
Course Learning Objectives:	
This Course will enable students to:	
1. Understand the major areas and challenges of web programming. 2. To create websites using HTML5, CSS3, JavaScript 3. Front end framework for developing Interactive WebApp using ReactJS 4. Understand server-side scripting language-Node.JS 5. Latest Framework for fast API development using GraphQL	
Teaching-Learning Process (General Instructions)	
1. These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 2. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 3. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, focused listening, and formulating questions. 4. To make Critical thinking, ask at least three higher order Thinking questions in the class. 5. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them 7. Discuss how some concept can be applied to the real world - and when that's possible.	
UNIT-I	08 Hours
Markup Language (HTML5), CSS3	
Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code - Anchors - Backgrounds - Images - Hyperlinks - Lists - Tables - HTML Forms, Video & Audio tag	
CSS3: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; Background images, Conflict Resolution, CSS box model,CSS3 features: Box Shadow, Opacity, Rounded corners, Attribute selector	
UNIT - II	08 Hours
Client-Side Scripting: JavaScript, JSON	



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JavaScript Basics -Arrays- Functions - JavaScript objects - HTML DOM - DOM methods - Events- Regular Expressions, JSON	
UNIT - III	08 Hours
Node JS Introduction to Node JS, Setup Dev Environment, Node JS Modules, Node Package Manager, File System, Debugging Node JS Application, Events, Express.JS, Database Connectivity, MVC Architecture In Node Js Applications	
UNIT - IV	08 Hours
React JS ReactJS: Introducing React ,Main Principles of React, Building your first react app, Components in React, Transferring properties, Dealing with State, The Component life cycle, Virtual DOM, JSX	
UNIT-V	07 Hours
GraphQL Introduction to GraphQL, GraphQL Vs. REST, GraphQL Vs. SQL, Your First GraphQL Query, Complex Types - Unions, Fragments, Interfaces, Graph Nodes, GraphQL with JavaScript, GraphQL with React, GraphQL Server-Exercise Problems	

Course Outcome	Description	Bloom's Taxonomy Level
1	Use the common HTML5 elements (tags) and CSS3 operations (styling properties) to interpret the fundamental of web page technologies	L2
2	Apply Cascading Style Sheets and HTML5 elements for visual presentation and design well-structured web pages.	L3
3	Implement the JavaScript programming concepts to develop client-side scripts and display the contents dynamically.	L3
4	Develop dynamic server-side applications by employing Node.js event-driven, non-blocking I/O model and its integration with MongoDB to work with dynamic schemas.	L3



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5	Utilize the Node.js framework-Express.js basic concepts , and middleware to construct web applications more efficiently and intelligently, enabling faster development and smarter design	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1		2		2							2	2	
CO2	2		2		2							2	3	
CO3	2		2		2							2	3	
CO4	3		3		2							2	3	
CO5	3		3		2							2	3	

TEXT BOOKS:

1. Robert W. Sebesta, Programming the World Wide Web ,7th Edition, Pearson Education, 2008.
2. Basarat Ali Syed - Beginning Node.js-Apress ,2014.
3. Anthony Accomazzo, Ari Lerner, Clay Allsopp, David Guttman, Tyler McGinnis, Nate Murray, FullStack React - The Complete Guide to ReactJS & Friends, Fullstack.io, 2017

REFERENCES:

1. Lionel Lopez,React Quickstart Step-by-Step Guide to Learning React Javascript Library
2. Kirupa Chinnathambi, JavaScript Absolute Beginner's Guide, 1st Edition, 2017.



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3. Robert W Sebesta, Pearson, Programming the World Wide Web, 7th Edition, 2013.
4. Kirupa Chinnathambi, Learning React, 1 Edition, Addison-Wesley Professional
5. Mark Pilgrim, HTML5Up and Running, O'Reilly, 1st Edition, 2012.

E-Resources:

<https://www.edureka.co/blog/ebook/web-development-ebook>

MOOC:

<https://www.coursera.org/learn/server-side-javascript-with-nodejs>

Activity Based Learning (Suggested Activities in Class)

1. Hands-on Lab exercises
2. Mini Project
3. Freecode camp/OpenSource Online Coding Boot Camp
4. Coding platform Challenges - Hackerrank, CodeChef



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DESIGN THINKING AND IDEATION

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER-III

Course Code :	22CT2306	Credits	:	02
Hours / Week :	01 Hours	Total Hours	:	26 Hours
L-T-P-J	: 1-0-2-0			

Course Learning Objectives:

This Course will enable students to:

1. **Analyze** the historical and cultural context of design thinking.
2. **Generate** innovative ideas using various ideation techniques.
3. **Develop** an empathetic and user-centric mindset.
4. **Analyze** and evaluate case studies and real-world examples of successful design thinking and idea generation projects to extract insights and best practices.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT -I

07 Hours

INTRODUCTION:

Introduction to Design Thinking, Stages, Understanding the Mindsets-Empathy, Optimism, Embrace Ambiguity, Make it, Learn from Failure, Iterate, Create Confidence, Creativity Convergent & Divergent Thinking.



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METHODS AND TOOLS FOR EMPATHIZE PHASE:

Methods of Empathize phase: Ask 5 Why/ 5W +H questions, Stakeholders map, Empathy Map, Peer observation, Trend analysis.

Case study: Apply Empathize tool and create a design for solving real world problems.

UNIT - II

07 Hours

METHODS AND TOOLS FOR DEFINE PHASE:

Methods of Define Phase: Storytelling, Critical items diagram, Define success.

Case study: Apply design thinking for real world applications using define tools.

Methods and Tools for Ideate Phase:

Ideate- Brainstorming, 2x2 matrix, NABC method

Activity: Apply the methods of ideate phase to generate ideas.

UNIT - III

07 Hours

Methods and Tools for Prototype & Test phase:

Prototypes- Types of prototypes, Methods of prototyping- focused experiment, Exploration map, Minimum Viable Product, Methods of testing, Feedback capture grid. A/B testing

Activity: Collect feedback, iterate and improve ideas

UNIT - IV

05 Hours

Create a pitch, plan for scaling up, Road map for implementation. Design Thinking to Business Process modelling.

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Utilize the core concepts of design thinking stages, including Mindsets-Empathy, Optimism, Embrace Ambiguity, Make it, Learn from Failure, Iterate, Create Confidence, Creativity Convergent & Divergent Thinking to showcase the application of empathize phase methods and tools.	L2



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2	Implement define tools to frame the problem statement and Ideate tools to generate idea for solving the problem.	L3
3	Develop proficiency in prototyping and testing as essential steps in creating successful and user-centered products or solutions.	L6
4	Apply effective pitching skills and roadmap for business process modelling.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3							2		3
CO2	3	3	3	3	3	3			3		3	2		3
CO3	3	3	3	3	3	3			3		3	2		3
CO4	3	3	3	3	3	3			3		3	2		3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. IdrisMootee," Design Thinking for Strategic Innovation",2013, John Wiley & Sons Inc

REFERENCE BOOKS:

1. Brenda Laurel, "Design Research methods and perspectives", MIT press 2003
2. Terwiesch, C. & Ulrich, K.T., 2009. "Innovation Tournaments: creating and identifying Exceptional Opportunities", Harvard business press.
3. Ulrich &Eppinger, "Product Design and Development", 3rd Edition, McGraw Hill, 2004



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4. Stuart Pugh, "Total Design: Integrated Methods for Successful Product Engineering, BjarkiHallgrimsson, Prototyping and model making for product design", 2012, Laurence King Publishing Ltd

E-Resources:

1. <https://www.mygreatlearning.com/academy/learn-for-free/courses/design-thinking>
2. <https://www.edx.org/learn/design-thinking>
3. <https://www.coursera.org/learn/design-thinking-innovation>
4. <https://alcorfund.com/insight/ideation-tools-purpose-methods/>
5. https://onlinecourses.swayam2.ac.in/aic19_de04/preview



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INNOVATIVE BUSINESSES & BREAKTHROUGH TECHNOLOGIES [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III			
Course Code	: 22CT2307	Credits	: 02
Hours / Week	: 01 Hours	Total Hours	: 26 Hours
L-T-P-J	: 1-0-2-0		
Course Learning Objectives: This Course will enable students to: 1. To equip students with the skills and knowledge needed to apply breakthrough technologies strategically in business innovation. 2. To enable students to comprehend the nature, impact, and potential of breakthrough technologies			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
CONTENTS			13 HRS



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The User Innovation Paradigm, Going for User Solutions Instead of User Needs - the Lead User Method, How Patents Discourage Innovation
User Innovation Communities, Exploring New Combinations of Customer Needs, Determine Users' Needs Ethnographically and Develop Solutions MIT Media Lab Approach, Design and Manufacture of Mass Customized Products with Toolkits/Platforms for User Innovation

Hands-on Component

13 HRS

1. Brainstorming as a Concept Generation Method
2. Case Studies on Problem-Solving about Analogical Thinking

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Discuss innovative solutions by combining diverse customer needs in producing products or services with unique prepositions.	L2
2	Utilize design product tool kits or platforms to the production of customized products that meet individual user preferences and demands.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	3	3	2						2		3
CO2	2	2	3	3	3	2						2		3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. MIT Open Course Ware - How to Develop Breakthrough Products and Services



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REFERENCE BOOKS:

1. Eric Von Hippel, Democratizing Innovation, The MIT Press, February 2006
2. Eric Von Hippel, Stefan Thomke and Mary Sonnack, Creating Breakthroughs at 3M, Harvard Business Review
3. Glen L. Urban, John R. Hauser, "Listening In" to Find & Explore New Combinations of Customer Needs, Journal of Marketing, Sage Journals, 2004

E-Resources:

1. <https://ocw.mit.edu/courses/sloan-school-of-management/15-356-how-to-develop-breakthrough-products-and-services-spring-2012/index.htm>



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PROBABILITY AND STATISTICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER-IV

Course Code : 22CT2401

Credits : 03

Hours / Week : 03 Hours

Total Hours : 39 Hours

L-T-P-J: 3-Q-0-0

Course Learning Objectives:

This Course will enable students to:

1. **Apply** statistical principles and probability concepts to solve complex problems in real-world scenarios involving uncertainty and randomness.
2. **Evaluate** and select appropriate probability distributions and statistical techniques to analyze and interpret data accurately in various applications.
3. **Justify** the use of estimation methods and hypothesis testing techniques for drawing meaningful inferences about population parameters.
4. **Analyze** and interpret sample test results for different statistical relationships, such as means, variances, correlation coefficients, regression coefficients, goodness of fit, and independence, to make informed decisions.
5. **Identify** sample tests using appropriate statistical procedures to investigate the significance of observed data and communicate findings effectively.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching:** Adopt the **Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.



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6. Adopt Problem Based Learning , which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT -I: Probability	09 Hours
Definitions of Probability, Addition Theorem, Conditional Probability, Multiplication Theorem, Bayes' Theorem of Probability	
UNIT - II: Random Variables and their Properties and Probability Distributions	09 Hours
Discrete Random Variable, Continuous Random Variable, Joint Probability Distributions Their Properties, Probability Distributions: Discrete Distributions: Binomial, Poisson Distributions and their Properties; Continuous Distributions: Exponential, Normal, Distributions and their Properties.	
UNIT - III: Estimation and testing of hypothesis	06 Hours
Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-Biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.	
UNIT-IV: Sample Tests-1	07 Hours
Large Sample Tests Based on Normal Distribution , Small Sample Tests : Testing Equality of Means, Testing Equality of Variances, Test of Correlation Coefficient	
UNIT-V: Sample Tests-2	08 Hours
Test for Regression Coefficient; Coefficient of Association, 2 - Test for Goodness of Fit, Test for Independence.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply the principles of probability to solve complex problems in various real-world scenarios.	L3



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2	Solve and compare different probability distributions, including discrete and continuous random variables, in order to make informed decisions and predictions.	L3
3	Apply statistical estimation techniques, such as maximum likelihood estimation and interval estimation, to draw meaningful inferences about population parameters from sample data.	L3
4	Examine hypothesis testing methods, including large and small sample tests, to assess the significance of observed data and draw valid conclusions.	L4
5	Analyze statistical relationships and perform sample tests to assess the Equality of means in different populations, Correlation coefficients between variables to determine the strength and direction of the relationship. Independence of variables using appropriate statistical tests to assess the absence of any relationship.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3	2	2		2				1					
C02	3	2	2		2				1					
C03	3	2	2						1					
C04	3	2	2		2				1					
C05	3	2	2		2				1					

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.

REFERENCE BOOKS:

1. Probability, Statistics and Random Processes T. Veerarajan Tata McGraw - Hill
2. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999



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E-Resources:

1. <https://nptel.ac.in/courses/106104233>
2. <https://nptel.ac.in/courses/117103067>
3. <https://nptel.ac.in/courses/103106120>
4. <https://www.coursera.Org/learn/probability-intro#syllabus>
5. <https://nptel.ac.in/courses/111104073>

Activity Based Learning (Suggested Activities in Class)

1. Tools like Python programming, R programming can be used which helps student to develop a skill to analyze the problem and providing solution.
2. Regular Chapter wise assignments/ Activity/Case studies can help students to have critical thinking, developing an expert mind set, problem-solving and teamwork.

Following are Assignments/ Activities Can be carried out using either R programming language or Python Programming or excel solver.

1. There are n people gathered in a room. What is the probability that at least 2 of them will have the same birthday? (Use excel solver, R Programming, Python Programming)
 - a. Use simulation to estimate this for various n, and Produce Simulation Graph.
 - b. Find the smallest value of n for which the probability of a match is greater than 0.5.
 - c. Explore how the number of trials in the simulation affects the variability of our estimates.
2. **Case Study 1: Customer Arrivals at a Coffee Shop**
 - a. A coffee shop wants to analyze the number of customer arrivals during its morning rush hour (7:00 AM to 9:00 AM). The shop has been recording the number of customer arrivals every 15 minutes for the past month.
 - b. Data: The data consists of the number of customer arrivals recorded at the coffee shop during each 15-minute interval for the past month.
 - c. Here is a sample of the data:

Time Interval	Customer Arrivals
7:00 AM-7:15 AM	6
7:15 AM-7:30 AM	4
7:30 AM-7:45 AM	9
7:45 AM-8:00 AM	7
8:00 AM-8:15 AM	5
8:15 AM-8:30 AM	8
8:30 AM-8:45 AM	10
8:45 AM-9:00 AM	6

analyze the customer arrivals and determine the probability distribution that best fits the data. Specifically, explore both discrete and continuous probability distributions, including the binomial, Poisson, exponential, and normal distributions.



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3. Case Study 2: Comparing the Performance of Two Groups

- a. Suppose you are a data analyst working for a company that manufactures a new energy drink. The marketing team conducted a promotional campaign in two different cities (City A and City B) to determine the effectiveness of the campaign in increasing sales. The sales data for a random sample of customers in each city was collected over a week. Your task is to compare the average sales between the two cities and test whether there is a significant difference in the variance of sales.

- b. **Data:** Let's assume the following sample data for the number of energy drinks sold in each city:

City A: [30, 28, 32, 29, 31, 33, 34, 28, 30, 32]

City B: [25, 24, 26, 23, 22, 27, 29, 30, 26, 24]

perform a two-sample t-test to test the equality of means and a test for equality of variances using Python's SciPy library.

4. case study 3: testing independence between two categorical variables.

- a. Data: Sample of 100 employees, and each employee is classified as either Male or Female. They were asked to rate their job satisfaction on a scale of 1 to 5, where 1 represents low satisfaction and 5 represents high satisfaction. The data is as follows:

Employee	Gender	Job Satisfaction
1	Male	4
2	Female	3
3	Male	2
4	Female	5
...	...	...
100	Female	4

- b. Test for independence between gender and job satisfaction, use the chi-squared test in R.



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DESIGN AND ANALYSIS OF ALGORITHMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	: 2CT2402	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th)+13(P) Hours
L-T-P-J:	3-Q-2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Analyze** the non-recursive and recursive algorithms and to represent efficiency of these algorithms in terms of the standard Asymptotic notations.
2. **Acquire** the knowledge of Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
3. **Master** the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs.
4. **Learn** Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem.
5. **Understand** the importance of Backtracking and Branch and Bound algorithm design techniques to solve a given problem.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.



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7. Show the *different ways to solve* the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every *concept can be applied to the real world* - and when that's possible, it helps improve the students' understanding.

UNIT - I

08 Hours

INTRODUCTION:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving.

(Text Book-1: Chapter 1:1.1 to 1.2)

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Standard notations and common functions (TextBook-2: Chapter 3:3.1, 3.2),

Mathematical Analysis of Non-recursive and Recursive Algorithms,

(Text Book-1: Chapter 2:2.1, 2.3,2.4,)

UNIT - II

08 Hours

BRUTE FORCE:

Background, Selection Sort, Brute-Force String Matching. TSP

(Text Book-1: Chapter 3:3.1, 3.2)

DIVIDE AND CONQUER:

General method, Recurrences: The substitution method, The recursion-tree method, The master method.

(Text Book-2: Chapter 4:4.4, 4.5),

Merge sort, Quick sort, Binary Search, Multiplication of large integers,

Case study: Strassen's Matrix Multiplication.

(Text Book-1: Chapter 4:4.1 to 4.3, 4.5)

UNIT - III

06 Hours

DECREASE & CONQUER:

General method, Insertion Sort, Graph algorithms: Depth First Search, Breadth First Search, Topological Sorting

TRANSFORM AND CONQUER:

Case study: Heaps and Heap sort.

TIME AND SPACE TRADEOFFS:

Input Enhancement in String Matching: Horspool's algorithm, Hashing: Open and Closed hashing.

(Text Book-1: Chapter 5:5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7: 7.2 to 7.3)

UNIT - IV

9 Hours

GREEDY TECHNIQUE:

General method of Greedy technique, Single-Source Shortest Paths: General method, The Bellman-Ford algorithm, Single-Source Shortest Paths in DAGs, Dijkstra's Algorithm



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(Text Book-2: Chapter 24:24.1 to 24.3).

Minimum Spanning Trees: Prim's Algorithm, Optimal Tree problem: Huffman Trees;

Case study: Kruskal's Algorithm. Fractional Problem

(Text Book-1: Chapter 9: 9.1, 9.2, 9.4).

DYNAMIC PROGRAMMING:

General method, The Floyd-Warshall Algorithm, Johnson's algorithm for sparse graphs (Text Book-2: Chapter 25:25.1 to 25.3),

The Knapsack problem (Text Book-1: Chapter 8:8.4).

UNIT-V

08 Hours

LIMITATIONS OF ALGORITHMIC POWER

P, NP and NP-complete problems (Text Book-1: Chapter 11:11.3)

BACKTRACKING:

General method, N-Queens problem, Subset-sum problem.

(Text Book-1: Chapter 12:12.1)

BRANCH AND BOUND:

General method, Travelling Salesman problem, Approximation algorithms for TSP.

Case study: Knapsack Problem.

(Text Book-1: Chapter 12:12.2,12.3)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Exemplify the algorithm design techniques and standard Asymptotic notations. Analyze non-recursive and recursive algorithms to obtain worst-case running times of algorithms using asymptotic analysis	L3
2	Interpret the brute-force, divide-and-conquer paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	L3
3	Demonstrate the Decrease and Conquer, Transform and Conquer algorithm design techniques and analyze the performance of these algorithms.	L3



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4	Identify and interpret the greedy technique, dynamic-programming paradigm as to when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms and analyze them	L3
5	Illustrate the Backtracking, Branch and Bound algorithm design paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ these paradigms. Summarize the limitations of algorithmic power.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3										2		3
CO2	3	3	2									2		3
CO3	3	3										1		3
CO4	3	3	2									2		3
CO5	3	3										1		3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI, 2014.

REFERENCE BOOKS:

1. Horowitz E., Sahni S., Rajasekaran S, "Computer Algorithms", Galgotia Publications, 2001.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T. Tsai, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", Tata McGraw Hill, 2005.

E-Resources:

1. <https://nptel.ac.in/courses/106/101/106101060/>
2. <http://cse01-iiith.vlabs.ac.in/>



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3. <http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithm>
4. <https://www.coursera.org/specializations/algorithms>

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Cabbage puzzle, Konigsberg bridge puzzle etc.,
2. Demonstration of solution to a problem through programming.

LABORATORY EXPERIMENTS

Total Contact Hours: 13

Following are experiments to be carried out using either C programming language or Object-oriented programming language:

1. Apply divide and conquer method and Design a C program to implementation of Binary Search algorithm.
2. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
4. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method.
5. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
6. Compute the Transitive Closure for a given directed graph using Warshall's algorithm.
7. For a given weighted graph, construct an All-Pairs Shortest Paths problem using Floyd's algorithm and implement this algorithm to find the shortest distance and their shortest paths for every pair of vertices.
8. Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique
9. Find Minimum Cost Spanning Tree for a given weighted graph using Prim's and Kruskal's algorithm.
10. From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm.
11. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

Open ended experiments

1. Implement Fractional Knapsack problem using Greedy Method.
2. Implement N-Queens problem using Backtracking technique.
3. implementation of Travelling Sales man problem using Dynamic programming



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DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV			
Course Code	: 2CT2403	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39(Th)+13(P) Hours
L-T-P-)	: 3-0-2-0		
Course Learning Objectives: This course will enable students to: 1. Acquire the concept of databases, Entity-Relationship Model and relational model for creating and designing databases for the real-world scenario. 2. Develop queries to extract data from the databases using a structured query language. 3. Differentiate SQL and NoSQL. 4. Demonstrate the operations on MongoDB, Database connectivity with front end and Optimize the Database design using Normalization Concepts. 5. Understand the importance of Transaction Management, Concurrency control mechanism and recovery techniques.			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying. 3. Show Video/animation films to explain the functioning of various concepts. 4. Encourage Collaborative (Group Learning] Learning in the class. 5. To make Critical thinking, ask at least three Higher-order Thinking questions in the class. 6. Discuss how every <i>concept can be applied to the real world</i> - and when that's possible, it helps improve the student's understanding.			
UNIT -1			10 Hours
INTRODUCTION TO DATABASE SYSTEMS : Introduction, Characteristics of the Database Approach, Advantages of using DBMS Approach, Data Models,			



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Schemas, Instances and Data Independence, Three Schema Architecture, various components of a DBMS. (Text Book-1: Chapter 1:1.1 to 1.4,1.6, Chapter 2:2.1,2.2,2.4) ENTITY-RELATIONSHIP MODEL: Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Diagrams (Text Book-1: Chapter 7: 7.3, 7.4, 7.5, 7.7).	
UNIT - II	07 Hours
RELATIONAL MODEL: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update operations and Dealing with Constraint Violations. (Text Book-1: Chapter 3:3.1 to 3.3). SQL -THE RELATIONAL DATABASE STANDARD: SQL Data Definition and Data types, Specifying constraints in SQL, Basic Queries in SQL-Data Definition Language in SQL, Data Manipulation Language in SQL; (Text Book-1: Chapter 4:4.1 to 4.4).	
UNIT - III	08 Hours
SQL -THE RELATIONAL DATABASE STANDARD: Additional Features of SQL; Views (Virtual Tables) in SQL; Database Programming Issues and Techniques; (Text Book-1: Chapter 4:4.5; Chapter 5:5.1 to 5.4). SQL AND NOSQL DATA MANAGEMENT: Triggers, Database connectivity using Python, SQL vs NoSQL, Introduction to MongoDB, (Text Book-1: Chapter 5:5.2,5.3](Text Book-2 Chapter 1:1.1 to 1.5]	
UNIT - IV	07 Hours
NOSQL DATA MANAGEMENT: Data Types, Data Modelling, CRUD Operations. (Text Book-2 Chapter 1:1.1 to 1.5] DATABASE DESIGN: Design Guidelines, Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; (Text Book-1: Chapter 14:14.1 to 14.5)	
UNIT - V	07 Hours
TRANSACTION MANAGEMENT The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Concurrency	



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Control Mechanisms; Error recovery methods.

(Text Book-1: Chapter 20:20.1 to 20.5, Chapter 21:21.1 to 21.3, Chapter 22:22.1 to 22.4)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Use the basic concepts of database management system in the design and creating database blueprint using E-R model and relational model.	L3
2	Formulate SQL and NoSQL queries for building structure and unstructured databases	L3
3	Demonstrate database connectivity using vendor specific drivers	L3
4	Apply normalization techniques to design relational database management system	L3
5	Adapt Transaction Management, concurrency control and recovery management techniques in database management system.	L3

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COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
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C02	3	2	1	-	3	-	-	-	2	2	-	2	3	-
C03	2	2	2	-	3	-	-	-	2	2	-	2	3	-
C04	3	1	2	-	1	-	-	-	2	2	-	2	3	-
C05	2	1	-	-	-	-	-	-	2	2	-	2	3	-

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:



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1. Elmasri and Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2011, 2015.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", First Edition, Pearson Education, Inc. 2012.

REFERENCE BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw-Hill, 2003.
2. Silberschatz, Korth and Sudharshan: "Database System Concepts", Seventh Edition, Mc-GrawHill, 2019.
3. C.J. Date, A. Kannan, S. Swamynatham: "An Introduction to Database Systems", Eight Edition, Pearson Education, 2012.

E-Resources:

1. <http://nptel.ac.in/courses/106106093/>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/>
3. <http://agce.sets.edu.in/cse/ebook/DBMS%20BY%20RAGHU%20RAMAKRISHNAN.pdf>
4. <http://iips.icci.edu.iq/images/exam/databases-ramaz.pdf>
5. <https://db-class.org/>
6. <https://www.w3schools.com/mongodb/>

Activity Based Learning (Suggested Activities in Class)

1. Database designing and data extraction using group discussion.
2. Collaborative Activity is minor project development with a team of 4 students.

LABORATORY EXPERIMENTS

Total Contact Hours: 13

Following are experiments to be carried out using either oracle or mysql, Mongo Db .

1. Design any database with at least 3 entities and establish proper relationships between them. Draw suitable ER/EER diagrams for the system. Apply DCL and DDL commands.
2. Design and implement a database and apply at least 10 Different DML Queries for the following task.
 - a. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and like operators for the same. Make use of Boolean and arithmetic operators wherever necessary
3. Write SQL statements to join table and retrieve the combined information from tables.
4. Execute the Aggregate functions count, sum, avg, min, max on a suitable database. Make use of built in functions according to the need of the database chosen.
5. Retrieve the data from the database based on time and date functions like now(), date(), day(), time() etc., Use of group by and having clauses.
6. Write and execute database trigger. Consider row level and statement level triggers.
7. Write and execute program to perform operations on MongoDB Database.



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8. Write and execute program to perform CRUD operations.

Open Ended Experiments

1. Consider the Table "employees", write a SQL query to remove all the duplicate emails of employees keeping the unique email with the lowest employee id, return employee id and unique emails .

table: employees

employeeid	employee_name	email_id
101	Liam Alton	li.al@abc.com
102	Josh Day	jio.da@abc.com
103	Sean Mann	se.ma@abc.com
104	Evan Blake	ev.bl@abc.com
105	Toby Scott	jio.da@abc.com

2. A salesperson is a person whose job is to sell products or services. Consider the table "Sales" [given below]. Write a SQL query to find the top 10 salesperson that have made highest sale. Return their names and total sale amount.

Table: sales

TRANSACTION_ID	SALESMANJD	SALE_AMOUNT
501	18	5200.00
502	50	5566.00
503	38	8400.00
599	24	16745.00
600	12	14900.00

Table: salesman

SALESMANJD	SALESMAN-NAME
11	Jonathan Goodwin
12	Adam Hughes
13	Mark Davenport
59	Cleveland Hart
60	Marion Gregory



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PRODUCT DESIGN & DEVELOPMENT

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	22CT2404	Credits	:	04
Hours / Week	02 Hours	Total Hours	:	52 Hours
L-T-P-S	:	2-0-2-2		

Course Learning Objectives:

This Course will enable students to:

1. **Analyze** and understand customer pain points.
2. **Devise** the best possible solution to build PoC to test in agile way.
3. **Explain** the different roles and responsibilities in product development
4. **Get the idea** of tools and technologies with automation in building product.
5. **Describe** and illustrate the collaborative product development.

Teaching-Learning Process (General Instructions)

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* adopted to develop the course outcomes.
2. **Interactive Teaching: Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, by following Idea to PoC cycle.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT-I

08 Hours

Introduction, product development process & organization, product planning, opportunity identification, identifying customer needs



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<i>(Text Book-1: Chapter 1 - 5)</i>	
UNIT - II	08 Hours
Product specifications, concept - generations, selection, testing, product architecture <i>(Text Book-1: Chapter 6-10)</i>	
UNIT - III	07 Hours
Industrial design, design for environment, design for manufacturing & supply chain <i>(Text Book-1: Chapter 11 -13)</i>	
UNIT - IV	8 Hours
Prototyping, robust design, patents & intellectual property, service design <i>(Text Book-1: Chapter 14-17).</i>	
UNIT - V	08 Hours
Product development economics, project management <i>(Text Book-1: Chapter 18-19)</i>	
Course Outcomes:	
At the end of the course the student will be able to:	
Describe the Product design and development with exposure with a set of tools and methods. Explain on coordination with cross disciplinary teams to achieve a common objective with exposure on collaborative development in team(s). Describe the role of multiple functions (e.g. strategy, marketing, engineering, legal, customer service, finance, supply chain, operations, etc.) in creating a new product. Identify the problem statement and explain the product development life cycle by building PoC.	

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3	3										2		3
C02	3	3	2									2		3



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CO3	3	3										1		3
CO4	3	3	2									2		3
CO5	3	3										1		3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

PROJECT DELIVERABLES 13 hrs

1. Proposal Handout & Presentation
 1. The Problem
 2. Need
 3. Existing Alternatives
 4. Potential Market
2. PoC / Prototype, Target Specifications
 1. Core solution
 2. Resources (Environment, Automation, Time to Market)
 3. Build PoC / Prototype
3. Demonstrate PoC including Workflow automation
4. Plan / Register your business (Optional)

TEXT BOOKS:

1. Ulrich, K. and Eppinger, S.; Product Design and Development | 7th Edition, McGraw Hill; ISBN - 13:978-9390113231
https://pdfhost.io/v/icYs4cRR8_Karl_T_Ulrich_Steven_D_Eppinger_Maria_C_Yang_Product_Design_and_Development_2019_lpdf.pdf

REFERENCE BOOKS:

1. Christensen, C.M.; The Innovator's Dilemma; Harvard Business Review Press; ISBN: 978-1-63-369178-0
2. Chesbrough, H. W.; Open Innovation; Harvard Business Review Press; ISBN: 978-1-42-210283-1

E-Resources:

1. https://onlinecourses.swayam2.ac.in/imbl9_mg01/preview



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Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving as a team building soft skills as well as getting exposure to product development skills and automation as appropriate.
2. Demonstration of PoC

COMPUTER ORGANIZATION AND ARCHITECTURE

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER-IV

Course Code	: 2CT2405	Credits	: 03
Hours / Week	: 03 Hours	Total Hours	: 39 Hours
L-T-P-J	: 3-0-0-0		

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the Architecture and programming of ARM microprocessor.
2. **Develop** program using Arm instruction set and appreciate the advanced features provided in the ARM
3. **Understand** the exception handling techniques.
4. **Study in** detail the concept of instruction level parallelism and concepts of pipelining.
5. **Understand** various cache memory mapping techniques and memory Organization.

Teaching-Learning Process

1. **Lecture method** along with traditional lecture method, different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching**; incorporating brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Showing **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.



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5. To make **Critical thinking**, asking Higher order Thinking questions in the class in the form of Quiz and writing programs with complex solutions.
6. Showing the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.

UNIT -I	05 Hours
An Overview of Computing Systems: History of Computers, The Computing Device, The ARM7TDMI Programmers' Model: Introduction, Data types, Processor Modes, Registers, Program Status Registers, The vector Table. Assembler Rules and Directives: Structure of Assembly Language Modules, Registers, Directives and Macros. Loads, Stores and Addressing: LODS and STORES instructions, Operand Addressing, ENDIANNESS Text Book-1: 1.1 to 1.3; 2.1 to 2.6; 4; 5.3, 5.4, 5.5	
UNIT - II	05 Hours
Constants and Literal Pools: The ARM Rotation Scheme, Loading Constants and address into Registers Logic and Arithmetic: Flags and their Use, Compare instructions, Data Processing Instructions Loops and Branches: Branching, Looping, Conditional Execution, Straight-Line Coding Subroutines and Stacks: Stack, Subroutines, Passing parameters to subroutines, The ARM APCS. (Text Book-1: 6.1 to 6.4; 7.1 to 7.4; 8.2 to 8.6; 10.1 to 10.5	
UNIT - III	05 Hours
Mixing C and Assembly Language: Inline Assembler Embedded Assembler, Calling Between C and Assembly. Exception Handling: Interrupts, Error Conditions, Processor Exception Sequence, The Vector Table, Exception Handlers, Exception Priorities, Procedures for Handling Exceptions. (Text Book-1: 11.1 to 11.8; 14.1 to 14.4	
UNIT - IV	12 Hours
Pipelining: Basic and Intermediate Concepts Introduction, The Major Hurdle of Pipelining, How Pipelining Implemented, What makes Pipelining hard to Implement, Extending the MIPS Pipeline to Handle Multicycle Operations, The MIPS R4000 Pipeline, Crosscutting Issues. Text Book-2: C.1 to C.7	
UNIT-V	12 Hours



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Memory Hierarchy:

Introduction, Cache Performance, Six basic cache Optimizations, Virtual Memory, Protection and examples of Virtual Memory, Fallacies and Pitfalls.

Text Book-2: B.1 to B.6

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply knowledge of the internal architecture and organization of ARM microprocessors to utilize their components and functionalities.	L3
2	Apply the instruction set of ARM Microprocessor by writing Assembly language programs.	L3
3	Analyze and compare the various exception handling techniques.	L4
4	Examine the concept of instruction-level parallelism and analyze the principles of Pipelining techniques.	L4
5	Compare and Contrast memory hierarchy and its impact on computer cost/performance.	L4

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		2										2	
CO2	3		3		1								2	
CO3	3	3	1										2	
CO4	3	3	1										2	
CO5	3	3	1										2	

3: Substantial (High) 2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. William Hohl, "ARM Assembly Language", 2nd Edition, CRC Press, 2009.



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2. John L Hennessy, David A Patterson, “Computer Architecture, A Quantitative Approach”, 5th Edition, Morgan Kaufmann publishers, 2012.

REFERENCE BOOKS:

1. David A Patterson, John L Hennessy, “Computer Organization and Design”, 4th Edition, Morgan Kaufmann publishers, 2010.
2. Steve Furber, “ARM System-on-chip Architecture”, 2nd Edition, Pearson Publications, 2000.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, 5th Edition, Tata McGraw Hill, 2002.

E-Resources:

1. <https://www.udemy.com/topic/arm-cortex-m/>
2. <https://www.edx.org/school/armeducation>
3. https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Activity Based Learning (Suggested Activities in Class)

1. Mini project implementation using Assembly Language Programming.
2. Demonstration of solution to a problem through programming.



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INTRODUCTION TO IPR AND REGISTRATION

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	: 2CT24006	Credits	: 02
Hours / Week	: 01 Hours	Total Hours	: 26 Hours
L-T-P	: 0-0-0-4		

Course Learning Objectives:

This Course will enable students to:

1. To understand the concepts IPR
2. To understand Trademarks, Trade Secretes and GI of goods.
3. To understand Copyrights, Patents and Industrial Designs.
4. To learn about how to manage IP rights and legal aspects.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT -1

1 04 Hours



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INTRODUCTION TO IPR: Introduction to Intellectual Property Rights, types of intellectual property, importance of intellectual property rights, Evolution of IP acts and treaties, Agencies responsible for IPR registrations, Role and value of IP in international commerce, Issues affecting IP internationally. <i>(Text Book-1: Chapter 1).</i>	
UNIT - II	07 Hours
Trade Marks: Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims. <i>(Text Book-1: Chapter 2,3,4).</i> Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. <i>(Text Book-1: Chapter 22).</i>	
UNIT-III	07 Hours
COPYRIGHTS: Fundamentals Of Copyright Law, Originality of Material, Right of Reproduction, Right to Perform the Work Publicly, Copyright Ownership Issues, Notice of Copyright. (Text Book-1: Chapter 10,11). PATENTS: Foundation of Patent Law, Patent Searching Process, Basic Criteria of Patentability Industrial Designs: Kind of Protection Provided in Industrial Design. (Text Book-1: Chapter 17,18). Managing IP Rights: Acquiring IP Rights: letters of instruction, joint collaboration agreement, Protecting IP Rights: non-disclosure agreement, cease and desist letter, settlement memorandum. Transferring IP Rights: Assignment contract, license agreement, deed of assignment. <i>(Text Book-1: Chapter 19).</i>	
UNIT - IV	08 Hours
DESIGN- Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000. <i>(Text Book-2: Chapter 8).</i> BASIC TENENTS OF INFORMATION TECHNOLOGY ACT-2000 - IT Act - Introduction E-Commerce and legal provisions E- Governance and legal provisions Digital signature and Electronic Signature.	



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(Text Book-2: Chapter 12).

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Demonstrate the basic concepts of IPR and their role and value internationally.	L2
2	Interpret trademark, their values and trade secrets for liability and litigations.	L3
3	Devise knowledge on copyrights, patents and how to manage and protect IP.	L3
4	Examine convention on design and basic information technology act.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	3	3	3	3	3							2		3
C02	3	3	3	3	3	3			3		3	2		3
C03	3	3	3	3	3	3			3		3	1		3
C04	3	3	3	3	3	3			3		3	2		3

3: Substantial [High]

2: Moderate [Medium]

1: Poor (Low)



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TEXT BOOKS:

1. Deborah Bouchoux /"Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", 4* Edition, Delmar Cengage Learning.
2. Elizabeth Verkey," Intellectual Property: Law and Practice", 2015 Edition, Eastern Book Company

REFERENCE BOOKS:

1. Kompal Bansal, Parikshit Bansal, "Fundamentals of Intellectual Property for Engineers", 2014, BS Publications.
2. Prabuddha Ganguli," Intellectual property right - Unleashing the knowledge economy", Ganguli, 1st edition (1 July 2017], McGraw Hill Education.

E-Resources:

1. Inventing the Future: An introduction to Patents for small and medium sized Enterprises; WIPO publication No. 917. URL: www.wipo.int/ebookshop.
2. Looking Good : An Introduction to Industrial Designs for Small and Medium-sized Enterprises; WIPO publication No.498. URL: www.wipo.int/ebookshop.
3. Creative Expression: An Introduction to Copyright and Related Rights for Small and Medium-sized Enterprises; WIPO publication No. 918. URL: www.wipo.int/ebookshop
4. Making a Mark: An Introduction to Trademarks for Small and Medium-sized Enterprises; WIPO publication No. 900. URL: www.wipo.int/ebookshop



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RESEARCH PAPER WRITING			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER-IV			
Course Code	: 2CT2407	Credits	: 02
Hours / Week	: 01 Hours	Total Hours	: 26 Hours
L-T-P-J	: 0-0-0-4		
Course Learning Objectives: This Course will enable students to: 1. Teach how to improve writing skills and level of readability 2. Tell about what to write in each section 3. Summarize the skills needed when writing a Title 4. Infer the skills needed when writing the Conclusion 5. Ensure the quality of paper at very first-time submission			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. <i>Lecture method</i> means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 1. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 2. Show Video/animation films to explain functioning of various concepts. 3. Encourage Collaborative (Group Learning) Learning in the class. 4. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 5. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
UNIT -1			6 Hours
INTRODUCTION TO RESEARCH PAPER WRITING: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness			



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UNIT - II	5 Hours
PRESENTATION SKILLS: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	
UNIT - III	5 Hours
TITLE WRITING SKILLS: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	
UNIT - IV	5 Hours
RESULT WRITING SKILLS: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	
UNIT-V	5 Hours
VERIFICATION SKILLS: Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Understand that how to improve your writing skills and level of readability	L2
2	Learn about what to write in each section	L2
3	Understand the skills needed when writing a Title	L2
4	Understand the skills needed when writing the Conclusion	L2
5	Ensure the good quality of paper at very first-time submission	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2



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CO1	2	2	2	2	2							2	2	
CO2	2	2	2	2	2							2	2	
CO3	2	2	2	2	2							2	2	
CO4	2	2	2	2	2							2	2	
CO5	2	2	2	2	2							2	2	

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

REFERENCE BOOKS:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011



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SMALL E- BUSINESS LAUNCH

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV

Course Code	:	22CT2408	Credits	:	02
Hours / Week	:	03 Hours	Total Hours	:	26 Hours
L-T-P-S	:	1-0-2-0			

Course Learning Objectives:

This Course will enable students to:

1. **Experience** with a set of tools and methods for setting up an online service.
2. **Knowledge** of the role of multiple functions in creating a small business.
3. **Ability** to coordinate multiple, interdisciplinary tasks to achieve a common objective.
4. **Emphasis** of specific knowledge from other courses through practice and reflection in an action-oriented setting.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt the Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the students' understanding.

UNIT -1

06 Hours

INTRODUCTION:

Introduction, Identifying Customer Needs, Opportunity Identification & Planning, Idea Generation and Validation, Entrepreneurial Culture, Digital Business Opportunity

(Text Book-1: Chapter 1: 1.1, 1.4 to 1.9, 1.11 to 1.17, 1.22 to 1.28)



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UNIT-II		06 Hours
Business Plan & its Components, Business Model and Strategies, Selection of Appropriate Business Model, Business Model Canvas, Feasibility (Text Book-1: Chapter 3:3.1 to 3.18)		
UNIT - III		06 Hours
Lean thinking, Specifications, Wireframe Generation and Validation. (Text Book-1: Chapter 5:5.1 to 5.4, Chapter 5:5.11 to 5.19)		
UNIT - IV		08 Hours
Service-Market Fit, legal Aspects & Entrepreneurial Law, Logistics of goods delivery, Virtual Trade Shows (Text Book-1: Chapter 7: 7.2 to 7.17)		
Course Outcomes: At the end of the course the student will be able to: 1. Identify customer needs and pain points. 2. Generate concept and validate idea. 3. Use design thinking to create a wire frame of your online service. 4. Launch your app/website. 5. Register your small business.		
List of Laboratory/Practical Experiments activities to be conducted (if any):		13 Hrs
Building of Business Models and seminars on deployment tools		

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	2	3										2		3
C02	3	2	2									1		2
C03	2	2	2									1		2



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C04	3	2	2									2		3
C05	3	2										1		3
3: Substantial (High)				2: Moderate (Medium)				1: Poor (Low)						

TEXT BOOKS:

1. Fisher, Steven, Duane, Ja-Nae (2016). Start-up Equation - A Visual Guidebook for Building your Start-up, New Delhi: Tata McGraw-Hill
2. Ulrich, K. T. (2019). Product design and development. Tata McGraw-Hill Education, 7th edition

REFERENCE BOOKS:

1. Holt H., David (2017). Entrepreneurship: New Venture Creation, New Delhi: Pearson Education
2. Zimmerer, W. Thomas and Scarborough, M. Norman and Doug Wilson (2009). Essentials of Entrepreneurship and Small Business Management, 5/e; New Delhi: Prentice Hall India

Activity Based Learning (Suggested Activities in Class)

1. Proposal Handout & Presentation
 - a. The Problem
 - b. Need
 - c. Existing Alternatives
 - d. Potential Market
2. Wireframe Sketches, Target Specifications
 - a. List Critical Customer Needs
 - b. For a., Prepare a List of Target Specifications
 - c. Prepare Wireframe



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IDEA GENERATION & VALIDATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER-IV	
Course Code : 22CT2409	Credits : 02
Hours / Week : 01 Hours	Total Hours : 26 Hours
L-T-P-J : 1-0-2-0	
Course Learning Objectives: This Course will enable students to: 1. Generate, develop, and pitch innovative new venture ideas 2. Evaluate the attractiveness and feasibility of new venture opportunities 3. Analyze industries, markets, and competitors	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 1. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 2. Show Video/animation films to explain functioning of various concepts. 3. Encourage Collaborative (Group Learning) Learning in the class. 4. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 5. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
CONTENT	13 Hours



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Process of Idea Generation; Problem Identification, Idea formation, Idea Generation Techniques:
Brainstorming, Mind Mapping, Story Boarding, Attribute Listing, Idea Validation and Risk Assessment

List of Laboratory/Practical Experiments activities to be conducted (if any): **13 HRS**

1. Get out of the Building Exercise - Meet at least 20 persons in your targeted segment and understand their pain points and propose ideas that may solve their problems.
2. Discuss with mentors and zero in on one idea.
3. Make a hand drawn functional sketch of the proposed solution
4. Idea Validation with potential customers - Meet at least 20 customers and validate the proposed idea with them.
5. Prepare a comprehensive report, highlighting the learnings and the implications on the proposed solution and pivots (if any).

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Classify idea generation techniques to validate ideas.	L2
2	Interpret to pitch innovations on new venture ideas.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
C01	2	2	3	3	3							2		3
C02	2	2	3	3	3							2		3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXT BOOKS:

5. Kotter, J.P. and Whitehead, L.A. (2010). Buy-In: Saving Your Good Idea from Getting Shot Down.

REFERENCE BOOKS:



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1. Belsky, S. [2010]. Making Ideas Happen: Overcoming the Obstacles between Vision and Reality.

LIBERAL STUDIES LIST - B.TECH PROGRAMME - 2022-23 Batch

Sl. No.	Course Code	Course Title	Offering dept
1	22LS0001	Introduction to Drama	Any department
2	22LS0002	Introduction to Dance	
3	22LS0003	Introduction to Music	
4	22LS0004	Introduction to Photography	
5	22LS0005	Introduction to Japanese language	
6	22LS0006	Law for Engineers	
7	22LS0007	Introduction to Painting	
8	22LS0008	Communication Through Sanskrit	
9	22LS0009	Vedic Mathematics	
10	22LS0010	Fundamentals of Critical Thinking	
11	22LS0011	Introduction to Film Studies	
12	22LS0012	Practicing Yoga & Meditation	
13	22LS0013	Cyber Crimes, Policies & Laws	
14	22LS0014	Holistic Medicine	
15	22LS0015	3 D Modelling using Tinkercad	

INTRODUCTION TO DRAMA [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0001	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. Students will learn about theatre and performing arts and transform simple stories into wonderful scripts. 2. Students will be equipped with key critical thinking skills, performance skills, speaking and writing skills.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT -1: Introduction to Drama	03 Hours
Drama, as an artistic medium, has the power to transcend boundaries and ignite conversations that delve deep into the core of human existence. In the realm of liberal studies, drama serves as a transformative tool, challenging societal norms and exploring various perspectives on critical issues. By harnessing the raw emotions, complex characters, and thought-provoking narratives, drama enriches the study of liberal arts by encouraging active engagement, fostering empathy, and promoting a nuanced understanding of the world we inhabit.	
UNIT - II: Embracing Critical Thinking	03 Hours
Drama within the framework of liberal studies provides a platform for critical thinking. Through the portrayal of multifaceted characters and intricate storylines, students are exposed to a multitude of viewpoints, forcing them to question their own beliefs and biases. The analysis of themes, subtext, and dramatic techniques encourages students to think	

critically about social, political, and moral dilemmas presented in the performances. This process nurtures an intellectual curiosity that transcends the boundaries of the stage and expands into the wider world.

UNIT - III: Fostering Empathy and Understanding

03 Hours

One of the fundamental tenets of liberal studies is to cultivate empathy and understanding. Drama achieves this by allowing students to embody diverse characters and experience life through their perspectives. By engaging in improvisation, role-playing, and character analysis, students gain a deeper understanding of different cultural, historical, and social contexts. This immersive experience fosters empathy by bridging the gap between personal experiences and the experiences of others, cultivating a sense of shared humanity and interconnectedness.

UNIT - IV: Social Commentary and Advocacy

02 Hours

Drama within liberal studies serves as a vehicle for social commentary and advocacy. By exploring social issues such as discrimination, inequality, and justice, drama becomes a powerful tool for initiating conversations and inspiring action. Through the examination of theatrical texts and the creation of original performances, students develop the skills to articulate their perspectives and communicate their ideas effectively. This process empowers them to become advocates for change and contribute to a more inclusive and just society.

UNIT - V: Collaboration and Communication Skills

02 Hours

Drama requires collaborative efforts and effective communication among actors, directors, designers, and technicians. In the context of liberal studies, drama serves as a microcosm of the real world, where teamwork and effective communication are essential. Students learn to listen actively, express their ideas clearly, and negotiate differing opinions to achieve a common goal. These skills are transferable to various aspects of life, empowering students to become effective collaborators, leaders, and active participants in their communities.

Course Outcome	Description
At the end of the course the student will be able to:	
1	Understand the elements of drama performance.
2	Analyse the structure, form, and conceptual ideas of drama techniques.
3	Express drama as a means of creating and communicating meaning.

TEXT BOOKS:

1. Sohini Roychowdhury, Indian Stage Stories Connecting Civilizations (A Telling of the Story of Indian Stage and how it connects to the World), SHUBHI PUBLICATIONS, GURGAON 2023.

INTRODUCTION TO DANCE [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0002	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To understand the elements of dance performance. 2. To interpret the elements of dance movement music, and conceptual ideas that together compose dance performances. 3. To analyse the structure, form, and conceptual ideas of dance techniques. 4. To understand and perform the basic Modern Dance concepts. 5. To gain knowledge in Classic/Semi Classic/Western Dance and various dance forms. 6. To Understand intermediate level dance technique. 7. To gain a critical understanding of dance as a form of human cultural expression. 8. To express dance as a means of creating and communicating meaning.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 2. Show Video/animation films to explain functioning of various concepts. 3. Encourage Collaborative (Group Learning) Learning in the class.	
UNIT - I: Introduction to Dance & Elements of dance performance.	02 Hours
UNIT - II: Composing dance	02 Hours
UNIT - III: Dance Techniques with dance movement music & understanding the modern dance	03 Hours
UNIT - IV: Dance Formation & Knowledge on Classic/Semi Classic/Western Dance and various dance forms.	03 Hours
UNIT - V: Choreographic Principles & Understanding dance as the important skill of creating and communicating meaning	03 Hours

Course Outcome	Description
At the end of the course the student will be able to:	
1	An introduction to the history and cultural context of different dance styles, helping students appreciate the cultural significance of dance forms.
2	Develop a fundamental understanding of dance techniques, including posture, alignment, balance, and coordination.
3	Increased self-confidence and self-esteem through the mastery of dance movements and the ability to perform in front of others.

INTRODUCTION TO MUSIC [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0003	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To understand the basic terminologies of Music 2. Appreciate the importance of Music in Engineers Life. 3. Apply Music knowledge in carrying out projects related to signal processing.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
Module-1: Basic Terminologies of Music	07 Hours
Define Music, Types of Music, Types Musical Instruments, Music Terminologies: Raag, Taal, Shruthi, Swara, Vaadi Swara, Samvaadi Swara, Varjitha Swara, Shudha/Komala/ Teevra Swara, Aaroha, Avaroha, Pakkad, Lakshana Geethe, Swara Geethe, Chota Khyal.	
Module-2: Raag	05 Hours
Raag Bhoop: Introduction to raag bhoop, Swara geethe, Chotha Khyal Raag Saranga: Introduction to Raag Saranga, Swarageethe. Lakshanageethe	
Module-3: Taal	01 Hours
Introduction to Taal: Teentai and Ektal with details	

Course Outcome	Description
	At the end of the course the student will be able to:
1	Classify types of Music
2	Rephrase the Terminologies of Music
3	Take part in performances in Music by involving in Singing, Helping Singers, organizing the event.

INTRODUCTION TO PHOTOGRAPHY [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0004	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. Understanding Camera Basics: Teach students the fundamental components of a camera, including its settings, modes, and functions, helping them become comfortable with their equipment. 2. Mastering Technical Skills: Provide comprehensive knowledge about exposure (aperture, shutter speed, ISO), focus, white balance, and other technical aspects to ensure students can control the outcome of their photographs effectively. 3. Lighting Mastery: Cover the principles of natural and artificial lighting, including how to manipulate and control light for different effects, moods, and subjects. 4. Visual Storytelling: Train students to use photography as a means of storytelling by capturing a series of images that convey a narrative, emotion, or theme. 5. Genre Exploration: Introduce students to various photography genres such as portrait, landscape, macro, street, wildlife, and more, allowing them to discover their interests and strengths.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT -I	07 Hours
Basics of photography and its scope relating to their career opportunities.	
UNIT - II	06 Hours
A detailed introduction about camera, lens, types of photography, essentiality of natural light.	

Course Outcome	Description
At the end of the course the student will be able to:	

1	Demonstrate a solid understanding of camera settings, exposure (aperture, shutter speed, ISO), focus, and other technical aspects of photography.
2	Ability to work with different lighting conditions and manipulate light effectively to achieve desired effects.
3	Demonstrate competence in a specific photography genre (portrait, landscape, macro, etc.).

INTRODUCTION TO THE JAPANESE LANGUAGE [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0005	Credits : 01
Hours /Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To learn the hiragana and katakana writing systems. 2. To learn and understand the culture of Japanese society. 3. To understand simple sentences and basic Japanese grammar. 4. To acquire the ability to communicate in Japanese.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
UNIT -1: Basics of the Japanese language	13 Hours
<u>Hiragana/Katakana:</u> Reading and writing hiragana and katakana. <u>Kanji Characters:</u> understanding the idea of a Dictogram as opposed to a phonogram, reading and writing the kun- and on- readings of some commonly used kanji: Days of the week characters, numbers and a few others. <u>Verbs, particles and sentence structure:</u> Sentence structure, particles. combining multiple particles, question and answer form, polite vs standard form. Vocabulary: Asking for directions, making purchases at shops, asking for something to be done and other phrases useful during travel to Japan as well as other basic phrases. Basics of Japanese culture: 1. Basics of Japanese standards for politeness and societal norms. 2. Formal introductions, awareness of different social situations and the norms followed in such situations, formalities such as exchanging business cards and senpai-kouhai relationships. 3. Formal, polite form of self-introduction, common greetings and responses.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Demonstrate a basic understanding of the Japanese language.
2	Demonstrate an understanding of basic Japanese cultural norms.
3	Apply the Japanese language in simple, polite tongue.
4	Demonstrate the ability to read Hiragana and Katakana characters, as well as a few Kanji characters.

TEXT BOOKS:

1. Japanese for busy people - I, revised 3rd edition, The Association for Japanese-Language Teaching (AJALT), Kodansha USA, 2020.

LAW FOR ENGINEERS [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0006	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. The aim of the course is providing general exposure to the students about the elementary knowledge of law that would be of utility in their profession; to enable the students to appreciate the importance of law and its impact on business and society.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
Module I: Introduction to Law	02 Hours
Define Law, Need for law, objects & Branches of law, Constitutional Law with emphasis on Fundamental Rights, Directive Principles of State Policy and Fundamental Duties	
Module II: General Principles of Contract under Indian Contract Act, 1872	03 Hours
Indian Contract Act 1872, Essentials of valid contract act (Sec 10), Kinds of contracts ; types of offer, acceptance, free consent, coercion, undue influence, Breach of contract, remedies of breach of contract.	
Module III: Law Relating to Intellectual Property	04 Hours
Concept of Property, Types of Property; Introduction to IPR; Types of IPR: Copyrights, Patents, Trademarks, Designs, Trade Secrets, Infringement of IPRs.	
Module IV: Privacy in Governance and Transparency Confidentiality in Government	04 Hours
Right to Information Act, 2005, Offences and penalties under the Information Technology Act 2000, Industrial Disputes Act, 1947; The Employees' State insurance act, 1948, Payment of Wages Act, 1936.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	To present a problem oriented in depth knowledge of Laws for Engineers.
2	To address the underlying concepts and methods behind Laws for Engineers.
3	Understand the Indian Legal System and Basics of different laws
4	Understand, explore, and acquire practical insight of legal system and its application in engineering profession

TEXT BOOKS:

1. M.P. Jain (2005), Indian Constitutional Law, Wadhwa & Co.
2. Agarwal H.O. (2008), International Law and Human Rights, Central Law Publications.
3. S.K. Kapur (2001), Human Rights under International Law and Indian Law, Central Law Agency.
4. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing.

REFERENCE BOOKS:

1. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
2. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
3. K.M. Desai (1946), The Industrial Employment (Standing Orders) Act
4. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House

INTRODUCTION TO PAINTING [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0007	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. Introduction to canvas. 2. Acrylica colour and water colour. 3. Opaque colour and transparent colour. 4. Painting on canvas.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 2. Show Video/animation films to explain functioning of various concepts. 3. Encourage Collaborative (Group Learning) Learning in the class.	
UNIT -I:	07 Hours
Introduction to canvas, Study water, Transparent -painting method, Wet paper spreading method, Basic study about "Opaque Colour" painting, Painting on canvas, Simple landscape painting, Indian traditional painting using opaque colours.	
UNIT - II:	06 Hours
Study of difference between opaque colour and transparent painting, use different materials on canvas like Sponge, Hard brush, Plastic etc., Creative art on canvas, Study of Acrylic paint, Indian -Tribe art (Warli art), Semimodern painting on canvas.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Canvas introduction, study of water colour, wet paper spreading, Painting on canvas, simple landscape painting.
2	Difference between transparent colour and opaque colour, Indian tribe art, semimodern painting, use of different method and Materials on canvas.

Importance of Painting and Benefits of learning:

1. Increases creativity.
2. Helps reduce stress.
3. Subtly impact on subconscious mind and helps to get clarity.
4. Activate right brain.
5. Improves communication and management skills.

COMMUNICATION THROUGH SANSKRIT [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III			
Course Code	:	22LS0008	Credits : 01
Hours/Week	:	01 Hours	Total Hours : 13 Hours
L-T-P-J	:	1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To understand the basics of a new language like Sanskrit 2. To understand the basic characters, words, sentences etc 3. To understand the grammar to some extent with terminologies like shabda, vachana, vibhakti etc 4. To understand the process of formation of simple sentences. 5. To translate from English to Sanskrit and vice-versa for better communication 6. To practice speaking in Sanskrit.			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.			
UNIT 1: Introduction to Sanskrit language			03 Hours
Introduction to Sanskrit, characters, formation of words, learning numbers, 'a' karanta, 'aa' karanta, 'i' karanta, 'ee' karanta and 'u' karanta, pullinga (masculine) and streelinga (feminine) words.			
UNIT 2: Various shabdaha			03 Hours
Running different anta shabdaha for eight vibhaktis and three vachanas.			
UNIT 3: Basic lessons from Text book			03 Hours
Basic words, formation of sentences, translation to English from Sanskrit and vice versa. The sentence formation with vibhakti and vachana. Exercises and activities.			
UNIT 4: Simple sentence formation			02 Hours
Formation of sentences in Sanskrit, Strike conversation with friends, parents, seniors, bus conductor, auto river, vegetable vendor etc.			

UNIT 5: Practice communication in Sanskrit	02 Hours
Initiation of communication in Sanskrit, translation between languages.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Know a new language	
2	Understands the characters, words and sentences	
3	Learns grammatical / syntax rules and regulations	
4	Gets information on shabda, vachana, vibhakti etc	
5	Communicate in Sanskrit	

TEXT BOOKS:

1. "Sanskrit Bharati" - 'Sanskritam Vadatu', Gandhi Vidya Sansthanam, Rajghat, Varanasi
2. Infant Reader, "Sanskrita Baladarshaha" Published by R S Vidyadhar & Sons, Book sellers and Publishers, Kalpathi, Palakkad -678003.

REFERENCE BOOKS:

1. Sabda Manjari, Published by R S Vidyadhar & Sons, Book sellers and Publishers, Kalpathi, Palakkad -678003.

VEDIC MATHEMATICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III			
Course Code	: 22LS0009	Credits	: 01
Hours /Week	: 01 Hours	Total Hours	: 13 Hours
L-T-P-J	: 1-0-0-0		
Course Learning Objectives: This Course will enable students to: 1. Remembering (Knowledge): identify key numerical patterns and properties in Vedic Mathematics. 2. Understanding (Comprehension): interpret the relationship between conventional arithmetic and Vedic methods. 3. Applying (Application): Utilize Vedic techniques to perform rapid mental calculations for addition, subtraction, multiplication, and division and apply Vedic methods to solve real-life mathematical problems and puzzles. 4. Analyzing (Analysis): Analyse the advantages and limitations of Vedic Mathematics in comparison to traditional methods, differentiate between various Vedic sutras and their specific applications. 5. Creating (Synthesis): Design innovative approaches by combining multiple Vedic sutras to solve complex mathematical problems.			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.			
UNIT 1: Basic Operations of Mathematics			07 Hours
Basic addition and subtraction, Addition of 1,11, 111, 1111,1111,, Addition of 0.1, 0.11, 0.111, 0.1111, 0.11111,, Multiplication of two numbers near the base & sub-base, Multiplication of two numbers whose sum of digits in unit place is 10 and sum of the digits in ten's place is 10, Multiplication of a number by 9,99,999,9999,99999,999999, Division of a number by 9,99,999,9999,99999,999999, Multiplication of two numbers by vertically and crosswise method.			

UNIT 2: Square & Cube of a Number	06 Hours
Square of a number ending with '5', Square of 1,11, 111, 1111,.....,Square of a number near the base, Square of a number near sub-base, Cube of a number, Square root of a perfect square, Cube root of a perfect cubic number.	

Course Outcome	Description
	At the end of the course the student will be able to:
1	Develop enhanced mental calculation abilities. They will learn techniques to perform calculations like addition, subtraction, multiplication, and division mentally and quickly.
2	Understanding of Ancient Mathematical Concepts: Provides insight into the mathematical knowledge and practices of ancient India.
3	Stimulate mental agility and improve cognitive skills, as participants engage in exercises that require mental gymnastics.

TEXT BOOKS:

1. "Vedic Mathematics" by Bharati Krishna Tirthaji, Motilal Banarsidass Publishers, ISBN: 978-8120801646.

REFERENCE BOOKS:

1. Magical World of Mathematics, V G Unkalkar, Vandana Publishers, 2017, ISBN:819026608.
2. The Teaching of Vedic Mathematics- Dr. S. K. Kapur, Lotus Press, 2016, ISBN: 9788183820431.
3. Vedic Mathematics Made Easy" by Dhaval Bathia, ISBN: 978-8129116116.

FUNDAMENTALS OF CRITICAL THINKING [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0010	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To enable framework to think critically about core subjects for better decisions with fewer mistakes. 2. To motivate and inculcate transformational learning in an ongoing basis towards inclination to shift their thinking of project work in a research framework with effective team work.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT - I: Etymology and Definitions, Needs, enablement of knowledge and methods	03 Hours
UNIT - II: Common denominators	02 Hours
UNIT - III: Tests and values	02 Hours
UNIT - IV: Process of identifying key findings from research survey in problem solving	02 Hours
UNIT -V: Problem-solving approaches	02 Hours
UNIT - VI: Case study - Scenario Presentations in Jigsaw learning method	02 Hours

Course Outcome	Description
At the end of the course the student will be able to:	
1	Recognize relevant definitions of knowledge and methods to articulation of ideas and identify diverting Arguments.
2	To develop a systematic approach for to enable quality of thinking and what they design and produce in articulating assumptions, selecting appropriate hypothesis and methods of experiments through critical thinking dispositions

REFERENCE BOOKS:

1. ID2_W Baytiyeh, H. and M.K. Naja. 2017. "Students' Perceptions of the Flipped Classroom Model in an Engineering Course: A Case Study." *European Journal of Engineering Education* 42 (6): 1048-1061. doi: 10.1080/03043797.2016.1252905.
2. ID9 Chang, P. and D. Wang. 2011. "Cultivating Engineering Ethics and Critical Thinking: A Systematic and Cross-Cultural Education Approach Using Problem-Based Learning". *European Journal of Engineering Education* 36 (4): 370-390. doi: 10.1080/03043797.2011.596928
3. Godfrey, P., R. Deakin Crick and S. Huang. 2014. "Systems Thinking, Systems Design and Learning Power in Engineering Education." *International Journal of Engineering Education* 30 (1): 112-127.
4. *Conducting Research Literature Reviews: From the Internet to Paper: Arlene Fink - UCLA, Los Angeles, USA: 5th edition:*

INTRODUCTION TO FILM STUDIES [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0011	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. Acquire fundamental knowledge of the principles of critical analysis of film as a text (With the overview of Indian cinema after Independence] 2. Develop analytical and interpretative minds, and transform them into spoken and written modes of expression i.e., Debates, group discussions, writing, reviews, and scripts 3. Apply the writing strategies for writing film reviews.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning] Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
Module -I	07 Hours
History and Scope of Indian Cinema- the Beginnings (1896-1912]-The Silent Era (1913-1930], Growth of the Industry (1931-1947]-Post-Independence- Indian Cinema-Film aesthetics: Realism, Authorship, Language of the Film (Film, Language & Montage], Narrative Comprehension - Representations and Debates -Film and other arts- Career Prospects in Indian Cinema.	
Module - II	06 Hours
Basic Frame- Shot-Scene-Sequence-Visual Grammar- Pioneers of film, Silent to audio era- The language of Cinema-Camera- Cinematography - Important functions and terms of Cinematography. -Science and Art of Lighting- Different Lightings-Cinematographic tools- Editing- What is a script? - Thinking process- Theatre Directions- Creating and Developing a script- Adapting a script- Character spin-off- Creating a sequel- Characterization- Qualities of a scriptwriter- Themes and social Obligations- Hands-on Experience.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Acquire fundamental knowledge of the principles of critical analysis of film as a text (With the overview of Indian cinema after Independence)
2	Develop analytical and interpretative minds, and translate them into spoken and written modes of expression i.e. Debates, group discussions, writing, reviews, and scripts
3	Develop communicative competence - Competence in speaking and writing from different domains and applying an interdisciplinary approach in perception and expression.

TEXT BOOKS:

1. Saran, Renu. "History of Indian Cinema". Diamond Books, 2012. Print.
2. Valicha, Kishore. "The Moving Image: A study of Indian Cinema". Orient Longman Limited, 1988. Print.
3. Vasudevan, Ravi. "The Melodramatic Public: Film form and Spectatorship in Indian Cinema". Orient Black Swan, 2012. Print.
4. Jain, Manju. "Narratives of Indian cinema". Primus Books, 2009. Print.

REFERENCE BOOKS:

1. Dwyer, Rachel. "Cinema India: The Visual Culture of Hindi film". Rutgers University Press, 2002. Print.
2. Corrigan, Timothy. "A Short Guide to Writing About Film". 9th Edition, Pearson Global Edition. Print.
3. Joseph M. Boggs and Dennis W. Petrie. "The Art of Watching Films". Boston: McGraw-Hill, 2008. Print.
4. Richard, Barsam. "Looking at movies: An introduction to film". New York: W.W. Norton & Co., 2007. Print.
5. James, Monaco. "How to read a film: Movies, Media and Multimedia: Language, History, Theory". New York: Oxford University Press, 2000. Print.

YOGA AND MEDITATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0012	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. Promoting positive health and holistic wellness. 2. Imparting skills to introduce Yoga awareness for health among general public. 3. To enable students to become competent and committed professionals willing to perform as Yoga performer. 4. To make student to use competencies and skills needed for becoming effective Yoga individual. 5. To enable student to understand the type of Yoga.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT -1: Introduction to Yoga and Yogic Practices	02 Hours
Yoga: Etymology, definitions, aim, objectives and misconceptions, Yoga: Its Origin, history and development, Rules and regulations to be followed by Yoga Practitioners, Introduction to major schools of Yoga (Jnana, Bhakti, Karma, Patanjali, Hatha), Introduction to Yoga practices, Introduction to Surya Namaskar.	
UNIT - II: Foundation of Yoga and Meditation	02 Hours
Yoga, Diet and Nutrition Practical -1 (Yogasana and Meditation I) Practical II (Shatkarma, Pranayam and Meditation II)	
UNIT - III: Types & techniques of Meditation II	02 Hours
Meditation • Meditation- Introduction, definition • Concentration and meditation • OM Meditation Types of Meditation • Tantra: Yantra and Mantra for meditation	

• Japa (chanting) meditation • Ajapajapa Meditation • Shoonya Meditation • Yoga Nidra	
UNIT - IV: Relationship between Meditation & Yoga (Mental Health Aspects)	02 Hours
Yoga and Mental Health • Define mental health, Holistic health, Medical & Yogic perspective Mental Hygiene • Mental Hygiene and roll of yoga in mental hygiene • Relationship between mind and body Meditation - Yoga • Swara yoga - the balance of life • The mind and personality Yoga & Stress Management • Human Psyche: Yogic and modern concept, Behaviour and consciousness frustration, Conflicts. • Concept of stress according to modern science and yoga • Stress and Personality • Role of yoga in life management	
UNIT - V: Yogasana, Pranayam and Meditation Practical's	3+2 Hours

Yogasanas

- **Standing Asana:** Tadasana, Trikonasana, Urdhahastotanasana, Vrikshasana, Ardchakrasna, Padhastanasana, Ashwasthasana.
- **Sitting Asana:** Padmasana, Vakrasana, Ardhamatsyendrasana, Janusirsasana, Paschimottanasana, Vajrasana, Ushtrasana, Shasankasana, Gomukhasana, Mandukasana, Bhadrasana, Singhasana.
- **Prone Lying Asana:** Bhujangasana, Shalabhasana, Dhanurasana, Makarasana
- **Supine Lying Asana:** Pawanmuktasana and its variation, setubandhasana, sarvangasana, Ardhalasana, Uttanpadasana, Halasana, Naukasana, Cakrasana, Markatasana, Shavasana.

Surya Namaskar

- Surya Namaskara.

Pranayama

- Breath Awareness.
- Yogic Breathing.
- Nadishodhan Pranayama.
- Suryabhedhi.
- Ujjayi.
- Shitali.
- Sitkari.
- Bhastrika.
- Bhramari.

Bandha and Mudra

- JalandharaBandha, UddiyanaBandha, MulaBandha, Tri Bandha.
- Yoga Mudra, Shanmukhi Mudra, shambhavi mudra, VipareetKarni Mudra.

Course Outcome	Description
At the end of the course the student will be able to:	
1	Development of relaxation techniques.
2	Improved concentration and cognitive function.
3	Promotion of overall health and well-being.

Text Book and Reference Book:

1. Concentration and Meditation by swami SivanandaSaraswati
2. Yoga and Kriya by Swami SatyanandaSaraswati
3. Yoga & Mental Health by R. S. Bhogal
4. Yoga & Modern Psychology by KaivalyadhamAsharam
5. Yoga for Stress Management by Sri Venkatkrishnan
6. Yoga for Stress Relief by Swami Shivapramananda
7. Yoga Nidra by Swami StyanandaSaraswati
8. Certification of Yoga Professionals - Official Guid book

CYBER CRIME, POLICIES, LAWS [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III			
Course Code	: 22LS0013	Credits	: 01
Hours/Week	: 01 Hour	Total Hours	: 13 Hours
L-T-P-J	: 1-0-0-0		
Course Learning Objectives: This Course will enable students to: 1. Understand Cybercrime Fundamentals. 2. Explore Cybercrime Investigation Techniques. 3. Discuss Cybersecurity Incident Response.			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
UNIT -1: Introduction to Cyber Security			02 Hours
Basic Cyber Security fundamentals, Types of Cyber Attacks, The 7 layers of Cyber Security, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, types of active attacks, passive Attacks, Software attacks, hardware attacks, Cyber Threats-, Cyber Crime, Cyber terrorism, Cyber Espionage.			
UNIT - II: Cyberspace and the Law & Cyber Forensics			04 Hours
Introduction, Cyber Security Regulations, Roles of International Law, Cyber forensics, Digital forensics lifecycle: Types of forensics investigation, challenges in computer forensics.			
UNIT - III: Cybercrime: Mobile and Wireless Devices			03 Hours
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era.			

UNIT - IV: Cyber Security: Organizational Implications	04 Hours
Drama within liberal studies serves as a vehicle for social commentary and advocacy. By exploring social issues such as discrimination, inequality, and justice, drama becomes a powerful tool for initiating conversations and inspiring action. Through the examination of theatrical texts and the creation of original performances, students develop the skills to articulate their perspectives and communicate their ideas effectively. This process empowers them to become advocates for change and contribute to a more inclusive and just society.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Analyse cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
2	Interpret and forensically investigate security incidents.
3	Apply policies and procedures to manage Privacy issues.

TEXT BOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes,Computer Forensics and Legal Perspectives, Wiley
2. B.B.Gupta,D.P. Agrawal, Haoxiang Wang, Computer and CyberSecurity: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
 2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&FGroup.
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Holistic Medicine [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0014	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. To develop an understanding of the principles and philosophies that underpin holistic medicine. 2. To develop an understanding about the theories behind these therapies and their potential benefits and risks. 3. Explore the role of nutrition, exercise, sleep, stress management, and other lifestyle factors in promoting health and preventing illness. 4. Promote an understanding of how cultural and social factors can influence health beliefs and practices.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
UNIT 1: Understanding our immune system, importance of nutrients and minerals	03 Hours
Understanding Immunity, types of immunity, keys organs involved in immune system, key cells of immune system, about vitamin and nutrients, essential nutrients required for our body, natural ways to boost immunity.	
UNIT 2: Detoxification and Gut Health	03 Hours
About detoxification and its importance, colon cleansing, about good bacteria and bad bacteria, why gut health is important, how gut health is related to many diseases, how to improve gut health.	
UNIT 3: Power of fasting	03 Hours
About fasting, types of fasting, benefits of fasting, power of forgiveness and meditation.	
UNIT 4: Health starts from your kitchen	02 Hours

About home remedies, food as medicine, healthy food and drinks, life style changes, why exercise is important?	
UNIT 5: Acupressure	02 Hours
About acupressure, various pressure points of body, benefits and uses of acupressure.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Describe the collective factors of health and their impact on holistic health and wellness.
2	Understand existing research to examine the use and effectiveness of holistic health practices.
3	Apply health and wellness practices to enhance one's own personal well-being.

TEXT BOOK:

1. Back to the Roots: Celebrating Indian Wisdom and Wellness by Luke Coutinho.
2. Eat Smart Move More Sleep Right Paperback - 1 January 2011 by Luke Coutinho
3. Nimma Kaigalalli Arogya - Vol 1 & Vol2 by Devendra Vora.

REFERENCES:

1. <https://www.youtube.com/c/LukeCoutinho>

3 D MODELLING USING TINKERCAD [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0015	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Objectives:</u> This Course will enable students to: - To understand the basic concepts and functions of 3D view. - To understand the modelling of 3 D objects - To analyze modelling of designs and animation.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. - Show Video/animation films to explain functioning of various concepts. - Encourage Collaborative (Group Learning) Learning in the class. - To make Critical thinking, ask at least three Higher order Thinking questions in the class. - Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. - Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. - Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT -1: Introduction of 3D modelling & Design, TinkerCAD Basics	02 Hours
Read the Class Introduction Presentation, Create a TinkerCAD Account, "Place It" "View It" "Move It" "Rotate It" "Size It Up" "Group It" "Align It"	
UNIT - II: Review and More Basics, First Projects	02 Hours
"Learning the Moves" "Camera Controls" "Scale, Copy, and Paste" "Creating Holes" Tutorial, Read Assignment Descriptions and Rubric, Key Ring Project, Dice Project, Dice from Scratch Project	

UNIT - III: Hands on Project & Designs on case study	03 Hours
# case study project on designing a living room, setting up of virtual classroom & building a fort structure	
UNIT - IV: Creating Portfolio in TinkerCad	03 Hours
Project, Read Portfolio Information Presentation, Complete Portfolio	
UNIT - V: Intrdocution to Arduino & mini Circuots using Circuit design TinkerCad	03 Hours
Android Circuit design using tinker cad, Introduction to circuit designing, Android Song Teller - Project, Android smart notice board	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Understand the basics of 3 D design.	L2
2	Designing and drafting in Tinkercad software.	L2
3	Acquire the knowledge & study about various additive manufacturing techniques (3D File setup).	L2
4	Understand about design technology and innovation.	L3
5	Design some basics Arduino circuits.	L3

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Oultcomes (P(Ds)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1					1					
CO2	3	2	2						1					
CO3	3	2	2	1					1					
C04	3	2	2	1					1					
CO5	3	2	2	1					1					

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

Text Book:

1. 3D Printing with Autodesk 123D, Tinkercad, and MakerBot, 1st Edition, 0071833471 • 9780071833479, By Lydia Sloan Cline © 2015 | Published: November 6, 2014

Reference Book:

1. The 2020-2025 World Outlook for 3D Mapping and 3D Modeling, Philip M. Parker Ph.D

2. Blender 3D By Example A project-based guide to learning the latest Blender 3D, EEVEE rendering engine, and Grease Pencil, 2nd Edition Oscar Baechler, Xury Greer-2020

E-Resources:

1. www.tinkercad.com

LIBERAL STUDIES LIST - B.TECH PROGRAMME - 2022-23 Batch

Sl. No.	Course Code	Course Title	Offering dept
1	22LS0001	Introduction to Drama	Any department
2	22LS0002	Introduction to Dance	
3	22LS0003	Introduction to Music	
4	22LS0004	Introduction to Photography	
5	22LS0005	Introduction to Japanese language	
6	22LS0006	Law for Engineers	
7	22LS0007	Introduction to Painting	
8	22LS0008	Communication Through Sanskrit	
9	22LS0009	Vedic Mathematics	
10	22LS0010	Fundamentals of Critical Thinking	
11	22LS0011	Introduction to Film Studies	
12	22LS0012	Practicing Yoga & Meditation	
13	22LS0013	Cyber Crimes, Policies & Laws	
14	22LS0014	Holistic Medicine	
15	22LS0015	3 D Modelling using Tinkercad	

INTRODUCTION TO DRAMA [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0001	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. Students will learn about theatre and performing arts and transform simple stories into wonderful scripts. 2. Students will be equipped with key critical thinking skills, performance skills, speaking and writing skills.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT - I: Introduction to Drama	03 Hours
Drama, as an artistic medium, has the power to transcend boundaries and ignite conversations that delve deep into the core of human existence. In the realm of liberal studies, drama serves as a transformative tool, challenging societal norms and exploring various perspectives on critical issues. By harnessing the raw emotions, complex characters, and thought-provoking narratives, drama enriches the study of liberal arts by encouraging active engagement, fostering empathy, and promoting a nuanced understanding of the world we inhabit.	
UNIT - II: Embracing Critical Thinking	03 Hours
Drama within the framework of liberal studies provides a platform for critical thinking. Through the portrayal of multifaceted characters and intricate storylines, students are exposed to a multitude of viewpoints, forcing them to question their own beliefs and biases. The analysis of themes, subtext, and dramatic techniques encourages students to think	

critically about social, political, and moral dilemmas presented in the performances. This process nurtures an intellectual curiosity that transcends the boundaries of the stage and expands into the wider world.

UNIT - III: Fostering Empathy and Understanding

03 Hours

One of the fundamental tenets of liberal studies is to cultivate empathy and understanding. Drama achieves this by allowing students to embody diverse characters and experience life through their perspectives. By engaging in improvisation, role-playing, and character analysis, students gain a deeper understanding of different cultural, historical, and social contexts. This immersive experience fosters empathy by bridging the gap between personal experiences and the experiences of others, cultivating a sense of shared humanity and interconnectedness.

UNIT - IV: Social Commentary and Advocacy

02 Hours

Drama within liberal studies serves as a vehicle for social commentary and advocacy. By exploring social issues such as discrimination, inequality, and justice, drama becomes a powerful tool for initiating conversations and inspiring action. Through the examination of theatrical texts and the creation of original performances, students develop the skills to articulate their perspectives and communicate their ideas effectively. This process empowers them to become advocates for change and contribute to a more inclusive and just society.

UNIT - V: Collaboration and Communication Skills

02 Hours

Drama requires collaborative efforts and effective communication among actors, directors, designers, and technicians. In the context of liberal studies, drama serves as a microcosm of the real world, where teamwork and effective communication are essential. Students learn to listen actively, express their ideas clearly, and negotiate differing opinions to achieve a common goal. These skills are transferable to various aspects of life, empowering students to become effective collaborators, leaders, and active participants in their communities.

Course Outcome	Description
At the end of the course the student will be able to:	
1	Understand the elements of drama performance.
2	Analyse the structure, form, and conceptual ideas of drama techniques.
3	Express drama as a means of creating and communicating meaning.

TEXT BOOKS:

1. Sohini Roychowdhury, Indian Stage Stories Connecting Civilizations (A Telling of the Story of Indian Stage and how it connects to the World), SHUBHI PUBLICATIONS, GURGAON 2023.

INTRODUCTION TO DANCE [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0002	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To understand the elements of dance performance. 2. To interpret the elements of dance movement music, and conceptual ideas that together compose dance performances. 3. To analyse the structure, form, and conceptual ideas of dance techniques. 4. To understand and perform the basic Modern Dance concepts. 5. To gain knowledge in Classic/Semi Classic/Western Dance and various dance forms. 6. To Understand intermediate level dance technique. 7. To gain a critical understanding of dance as a form of human cultural expression. 8. To express dance as a means of creating and communicating meaning.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 2. Show Video/animation films to explain functioning of various concepts. 3. Encourage Collaborative (Group Learning) Learning in the class.	
UNIT - I: Introduction to Dance & Elements of dance performance.	02 Hours
UNIT - II: Composing dance	02 Hours
UNIT - III: Dance Techniques with dance movement music & understanding the modern dance	03 Hours
UNIT - IV: Dance Formation & Knowledge on Classic/Semi Classic/Western Dance and various dance forms.	03 Hours
UNIT - V: Choreographic Principles & Understanding dance as the important skill of creating and communicating meaning	03 Hours

Course Outcome	Description
At the end of the course the student will be able to:	
1	An introduction to the history and cultural context of different dance styles, helping students appreciate the cultural significance of dance forms.
2	Develop a fundamental understanding of dance techniques, including posture, alignment, balance, and coordination.
3	Increased self-confidence and self-esteem through the mastery of dance movements and the ability to perform in front of others.

INTRODUCTION TO MUSIC [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0003	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To understand the basic terminologies of Music 2. Appreciate the importance of Music in Engineers Life. 3. Apply Music knowledge in carrying out projects related to signal processing.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
Module-1: Basic Terminologies of Music	07 Hours
Define Music, Types of Music, Types Musical Instruments, Music Terminologies: Raag, Taal, Shruthi, Swara, Vaadi Swara, Samvaadi Swara, Varjitha Swara, Shudha/Komala/ Teevra Swara, Aaroha, Avaroha, Pakkad, Lakshana Geethe, Swara Geethe, Chota Khyal.	
Module-2: Raag	05 Hours
Raag Bhoop: Introduction to raag bhoop, Swara geethe, Chotha Khyal Raag Saranga: Introduction to Raag Saranga, Swarageethe. Lakshanageethe	
Module-3: Taal	01 Hours
Introduction to Taal: Teentai and Ektal with details	

Course Outcome	Description
	At the end of the course the student will be able to:
1	Classify types of Music
2	Rephrase the Terminologies of Music
3	Take part in performances in Music by involving in Singing, Helping Singers, organizing the event.

INTRODUCTION TO PHOTOGRAPHY [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0004	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. Understanding Camera Basics: Teach students the fundamental components of a camera, including its settings, modes, and functions, helping them become comfortable with their equipment. 2. Mastering Technical Skills: Provide comprehensive knowledge about exposure (aperture, shutter speed, ISO), focus, white balance, and other technical aspects to ensure students can control the outcome of their photographs effectively. 3. Lighting Mastery: Cover the principles of natural and artificial lighting, including how to manipulate and control light for different effects, moods, and subjects. 4. Visual Storytelling: Train students to use photography as a means of storytelling by capturing a series of images that convey a narrative, emotion, or theme. 5. Genre Exploration: Introduce students to various photography genres such as portrait, landscape, macro, street, wildlife, and more, allowing them to discover their interests and strengths.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT -I	07 Hours
Basics of photography and its scope relating to their career opportunities.	
UNIT - II	06 Hours
A detailed introduction about camera, lens, types of photography, essentiality of natural light.	

Course Outcome	Description
At the end of the course the student will be able to:	

1	Demonstrate a solid understanding of camera settings, exposure (aperture, shutter speed, ISO], focus, and other technical aspects of photography.
2	Ability to work with different lighting conditions and manipulate light effectively to achieve desired effects.
3	Demonstrate competence in a specific photography genre (portrait, landscape, macro, etc.).

INTRODUCTION TO THE JAPANESE LANGUAGE [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0005	Credits : 01
Hours /Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To learn the hiragana and katakana writing systems. 2. To learn and understand the culture of Japanese society. 3. To understand simple sentences and basic Japanese grammar. 4. To acquire the ability to communicate in Japanese.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
UNIT - I: Basics of the Japanese language	13 Hours
<u>Hiragana/Katakana:</u> Reading and writing hiragana and katakana. <u>Kanji Characters:</u> understanding the idea of a pictogram as opposed to a phonogram, reading and writing the kun- and on- readings of some commonly used kanji: Days of the week characters, numbers and a few others. <u>Verbs, particles and sentence structure:</u> Sentence structure, particles, combining multiple particles, question and answer form, polite vs standard form. Vocabulary: Asking for directions, making purchases at shops, asking for something to be done and other phrases useful during travel to Japan as well as other basic phrases. Basics of Japanese culture: 1. Basics of Japanese standards for politeness and societal norms. 2. Formal introductions, awareness of different social situations and the norms followed in such situations, formalities such as exchanging business cards and senpai-kouhai relationships. 3. Formal, polite form of self-introduction, common greetings and responses.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Demonstrate a basic understanding of the Japanese language.
2	Demonstrate an understanding of basic Japanese cultural norms.
3	Apply the Japanese language in simple, polite tongue.
4	Demonstrate the ability to read Hiragana and Katakana characters, as well as a few Kanji characters.

TEXT BOOKS:

1. Japanese for busy people - I, revised 3rd edition, The Association for Japanese-Language Teaching (AJALT), Kodansha USA, 2020.

LAW FOR ENGINEERS [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0006	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. The aim of the course is providing general exposure to the students about the elementary knowledge of law that would be of utility in their profession; to enable the students to appreciate the importance of law and its impact on business and society.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
Module I: Introduction to Law	02 Hours
Define Law, Need for law, objects & Branches of law, Constitutional Law with emphasis on Fundamental Rights, Directive Principles of State Policy and Fundamental Duties	
Module II: General Principles of Contract under Indian Contract Act, 1872	03 Hours
Indian Contract Act 1872, Essentials of valid contract act (Sec 10), Kinds of contracts ; types of offer, acceptance, free consent, coercion, undue influence, Breach of contract, remedies of breach of contract.	
Module III: Law Relating to Intellectual Property	04 Hours
Concept of Property, Types of Property; Introduction to IPR; Types of IPR: Copyrights, Patents, Trademarks, Designs, Trade Secrets, Infringement of IPRs.	
Module IV: Privacy in Governance and Transparency Confidentiality in Government	04 Hours
Right to Information Act, 2005, Offences and penalties under the Information Technology Act 2000, Industrial Disputes Act, 1947; The Employees' State insurance act, 1948, Payment of Wages Act, 1936.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	To present a problem oriented in depth knowledge of Laws for Engineers.
2	To address the underlying concepts and methods behind Laws for Engineers.
3	Understand the Indian Legal System and Basics of different laws
4	Understand, explore, and acquire practical insight of legal system and its application in engineering profession

TEXT BOOKS:

1. M.P. Jain (2005), Indian Constitutional Law, Wadhwa & Co.
2. Agarwal H.O. (2008), International Law and Human Rights, Central Law Publications.
3. S.K. Kapur (2001), Human Rights under International Law and Indian Law, Central Law Agency.
4. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing.

REFERENCE BOOKS:

1. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
2. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
3. K.M. Desai (1946), The Industrial Employment (Standing Orders) Act
4. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House

INTRODUCTION TO PAINTING [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0007	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. Introduction to canvas. 2. Acrylica colour and water colour. 3. Opaque colour and transparent colour. 4. Painting on canvas.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 2. Show Video/animation films to explain functioning of various concepts. 3. Encourage Collaborative (Group Learning) Learning in the class.	
UNIT -I:	07 Hours
Introduction to canvas, Study water, Transparent -painting method, Wet paper spreading method, Basic study about "Opaque Colour" painting, Painting on canvas, Simple landscape painting, Indian traditional painting using opaque colours.	
UNIT - II:	06 Hours
Study of difference between opaque colour and transparent painting, use different materials on canvas like Sponge, Hard brush, Plastic etc., Creative art on canvas, Study of Acrylic paint, Indian -Tribe art (Warli art), Semimodern painting on canvas.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Canvas introduction, study of water colour, wet paper spreading, Painting on canvas, simple landscape painting.
2	Difference between transparent colour and opaque colour, Indian tribe art, semimodern painting, use of different method and Materials on canvas.

Importance of Painting and Benefits of learning:

1. Increases creativity.
2. Helps reduce stress.
3. Subtly impact on subconscious mind and helps to get clarity.
4. Activate right brain.
5. Improves communication and management skills.

COMMUNICATION THROUGH SANSKRIT [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0008	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To understand the basics of a new language like Sanskrit 2. To understand the basic characters, words, sentences etc 3. To understand the grammar to some extent with terminologies like shabda, vachana, vibhakti etc 4. To understand the process of formation of simple sentences. 5. To translate from English to Sanskrit and vice-versa for better communication 6. To practice speaking in Sanskrit.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
UNIT 1: Introduction to Sanskrit language	03 Hours
Introduction to Sanskrit, characters, formation of words, learning numbers, 'a' karanta, 'aa' karanta, 'i' karanta, 'ee' karanta and 'u' karanta, pullinga (masculine) and streelinga (feminine) words.	
UNIT 2: Various shabdaha	03 Hours
Running different anta shabdaha for eight vibhaktis and three vachanas.	
UNIT 3: Basic lessons from Text book	03 Hours
Basic words, formation of sentences, translation to English from Sanskrit and vice versa. The sentence formation with vibhakti and vachana. Exercises and activities.	
UNIT 4: Simple sentence formation	02 Hours
Formation of sentences in Sanskrit, Strike conversation with friends, parents, seniors, bus conductor, auto river, vegetable vendor etc.	

UNIT 5: Practice communication in Sanskrit		02 Hours
Initiation of communication in Sanskrit, translation between languages.		

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Know a new language	
2	Understands the characters, words and sentences	
3	Learns grammatical / syntax rules and regulations	
4	Gets information on shabda, vachana, vibhakti etc	
5	Communicate in Sanskrit	

TEXT BOOKS:

1. "Sanskrit Bharati" - 'Sanskritam Vadatu', Gandhi Vidya Sansthanam, Rajghat, Varanasi
2. Infant Reader, "Sanskrita Baladarshaha" Published by R S Vidyadhar & Sons, Book sellers and Publishers, Kalpathi, Palakkad -678003.

REFERENCE BOOKS:

1. Sabda Manjari, Published by R S Vidyadhar & Sons, Book sellers and Publishers, Kalpathi, Palakkad -678003.

VEDIC MATHEMATICS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER - III			
Course Code	: 22LS0009	Credits	: 01
Hours /Week	: 01 Hours	Total Hours	: 13 Hours
L-T-P-J	: 1-0-0-0		
<u>Course Learning Objectives:</u>			
This Course will enable students to:			
1. Remembering (Knowledge): identify key numerical patterns and properties in Vedic Mathematics. 2. Understanding (Comprehension): interpret the relationship between conventional arithmetic and Vedic methods. 3. Applying (Application): Utilize Vedic techniques to perform rapid mental calculations for addition, subtraction, multiplication, and division and apply Vedic methods to solve real-life mathematical problems and puzzles. 4. Analyzing (Analysis): Analyse the advantages and limitations of Vedic Mathematics in comparison to traditional methods, differentiate between various Vedic sutras and their specific applications. 5. Creating (Synthesis): Design innovative approaches by combining multiple Vedic <u>sutras to solve complex mathematical problems.</u>			
Teaching-Learning Process (General Instructions)			
These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.			
1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.			
UNIT 1: Basic Operations of Mathematics			07 Hours
Basic addition and subtraction, Addition of 1,11, 111, 1111,1111,, Addition of 0.1, 0.11, 0.111, 0.1111, 0.11111,, Multiplication of two numbers near the base & sub-base, Multiplication of two numbers whose sum of digits in unit place is 10 and sum of the digits in ten's place is 10, Multiplication of a number by 9,99,999,9999,99999,999999, Division of a number by 9,99,999,9999,99999,999999, Multiplication of two numbers by vertically and crosswise method.			

UNIT 2: Square & Cube of a Number	06 Hours
Square of a number ending with '5', Square of 1,11, 111, 1111,.....,Square of a number near the base, Square of a number near sub-base, Cube of a number, Square root of a perfect square, Cube root of a perfect cubic number.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Develop enhanced mental calculation abilities. They will learn techniques to perform calculations like addition, subtraction, multiplication, and division mentally and quickly.
2	Understanding of Ancient Mathematical Concepts: Provides insight into the mathematical knowledge and practices of ancient India.
3	Stimulate mental agility and improve cognitive skills, as participants engage in exercises that require mental gymnastics.

TEXT BOOKS:

1. "Vedic Mathematics" by Bharati Krishna Tirthaji, Motilal Banarsidass Publishers, ISBN: 978-8120801646.

REFERENCE BOOKS:

1. Magical World of Mathematics, V G Unkalkar, Vandana Publishers, 2017, ISBN:819026608.
2. The Teaching of Vedic Mathematics- Dr. S. K. Kapur, Lotus Press, 2016, ISBN: 9788183820431.
3. Vedic Mathematics Made Easy" by Dhaval Bathia, ISBN: 978-8129116116.

FUNDAMENTALS OF CRITICAL THINKING [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0010	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
<u>Course Learning Objectives:</u> This Course will enable students to: 1. To enable framework to think critically about core subjects for better decisions with fewer mistakes. 2. To motivate and inculcate transformational learning in an ongoing basis towards inclination to shift their thinking of project work in a research framework with effective team work.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT - I: Etymology and Definitions, Needs, enablement of knowledge and methods	03 Hours
UNIT - II: Common denominators	02 Hours
UNIT - III: Tests and values	02 Hours
UNIT - IV: Process of identifying key findings from research survey in problem solving	02 Hours
UNIT - V: Problem-solving approaches	02 Hours
UNIT - VI: Case study - Scenario Presentations in Jigsaw learning method	02 Hours

Course Outcome	Description
At the end of the course the student will be able to:	
1	Recognize relevant definitions of knowledge and methods to articulation of ideas and identify diverting Arguments.
2	To develop a systematic approach for to enable quality of thinking and what they design and produce in articulating assumptions, selecting appropriate hypothesis and methods of experiments through critical thinking dispositions

REFERENCE BOOKS:

1. ID2_W Baytiyeh, H. and M.K. Naja. 2017. "Students' Perceptions of the Flipped Classroom Model in an Engineering Course: A Case Study." *European Journal of Engineering Education* 42 (6): 1048-1061. doi: 10.1080/03043797.2016.1252905.
2. ID9 Chang, P. and D. Wang. 2011. "Cultivating Engineering Ethics and Critical Thinking: A Systematic and Cross-Cultural Education Approach Using Problem-Based Learning". *European Journal of Engineering Education* 36 (4): 370-390. doi: 10.1080/03043797.2011.596928
3. Godfrey, P., R. Deakin Crick and S. Huang. 2014. "Systems Thinking, Systems Design and Learning Power in Engineering Education." *International Journal of Engineering Education* 30 (1): 112-127.
4. *Conducting Research Literature Reviews: From the Internet to Paper: Arlene Fink - UCLA, Los Angeles, USA: 5th edition:*

INTRODUCTION TO FILM STUDIES [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0011	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. Acquire fundamental knowledge of the principles of critical analysis of film as a text (With the overview of Indian cinema after Independence] 2. Develop analytical and interpretative minds, and transform them into spoken and written modes of expression i.e., Debates, group discussions, writing, reviews, and scripts 3. Apply the writing strategies for writing film reviews.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning] Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
Module -I	07 Hours
History and Scope of Indian Cinema- the Beginnings (1896-1912]-The Silent Era (1913-1930], Growth of the Industry (1931-1947]-Post-Independence- Indian Cinema-Film aesthetics: Realism, Authorship, Language of the Film (Film, Language & Montage], Narrative Comprehension - Representations and Debates -Film and other arts- Career Prospects in Indian Cinema.	
Module - II	06 Hours
Basic Frame- Shot-Scene-Sequence-Visual Grammar- Pioneers of film, Silent to audio era- The language of Cinema-Camera- Cinematography - Important functions and terms of Cinematography. -Science and Art of Lighting- Different Lightings-Cinematographic tools- Editing- What is a script? - Thinking process- Theatre Directions- Creating and Developing a script- Adapting a script- Character spin-off- Creating a sequel- Characterization- Qualities of a scriptwriter- Themes and social Obligations- Hands-on Experience.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Acquire fundamental knowledge of the principles of critical analysis of film as a text (With the overview of Indian cinema after Independence)
2	Develop analytical and interpretative minds, and translate them into spoken and written modes of expression i.e. Debates, group discussions, writing, reviews, and scripts
3	Develop communicative competence - Competence in speaking and writing from different domains and applying an interdisciplinary approach in perception and expression.

TEXT BOOKS:

1. Saran, Renu. "History of Indian Cinema". Diamond Books, 2012. Print.
2. Valicha, Kishore. "The Moving Image: A study of Indian Cinema". Orient Longman Limited, 1988. Print.
3. Vasudevan, Ravi. "The Melodramatic Public: Film form and Spectatorship in Indian Cinema". Orient Black Swan, 2012. Print.
4. Jain, Manju. "Narratives of Indian cinema". Primus Books, 2009. Print.

REFERENCE BOOKS:

1. Dwyer, Rachel. "Cinema India: The Visual Culture of Hindi film". Rutgers University Press, 2002. Print.
2. Corrigan, Timothy. "A Short Guide to Writing About Film". 9th Edition, Pearson Global Edition. Print.
3. Joseph M. Boggs and Dennis W. Petrie. "The Art of Watching Films". Boston: McGraw-Hill, 2008. Print.
4. Richard, Barsam. "Looking at movies: An introduction to film". New York: W.W. Norton & Co., 2007. Print.
5. James, Monaco. "How to read a film: Movies, Media and Multimedia: Language, History, Theory". New York: Oxford University Press, 2000. Print.

YOGA AND MEDITATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0012	Credits : 01
Hours/Week : 01 Hour	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. Promoting positive health and holistic wellness. 2. Imparting skills to introduce Yoga awareness for health among general public. 3. To enable students to become competent and committed professionals willing to perform as Yoga performer. 4. To make student to use competencies and skills needed for becoming effective Yoga individual. 5. To enable student to understand the type of Yoga.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.	
UNIT - I: Introduction to Yoga and Yogic Practices	02 Hours
Yoga: Etymology, definitions, aim, objectives and misconceptions, Yoga: Its Origin, history and development, Rules and regulations to be followed by Yoga Practitioners, Introduction to major schools of Yoga (Jnana, Bhakti, Karma, Patanjali, Hatha), Introduction to Yoga practices, Introduction to Surya Namaskar.	
UNIT - II: Foundation of Yoga and Meditation	02 Hours
Yoga, Diet and Nutrition Practical - 1 (Yogasana and Meditation I) Practical 11 (Shatkarma, Pranayam and Meditation II)	
UNIT - III: Types & techniques of Meditation II	02 Hours
Meditation • Meditation- Introduction, definition • Concentration and meditation • OM Meditation Types of Meditation • Tantra: Yantra and Mantra for meditation	

• Japa (chanting) meditation • Ajapajapa Meditation • Shoonya Meditation • Yoga Nidra	
UNIT - IV: Relationship between Meditation & Yoga (Mental Health Aspects)	02 Hours
Yoga and Mental Health • Define mental health, Holistic health, Medical & Yogic perspective Mental Hygiene • Mental Hygiene and roll of yoga in mental hygiene • Relationship between mind and body Meditation - Yoga • Swara yoga - the balance of life • The mind and personality Yoga & Stress Management • Human Psyche: Yogic and modern concept, Behaviour and consciousness frustration, Conflicts. • Concept of stress according to modern science and yoga • Stress and Personality • Role of yoga in life management	
UNIT - V: Yogasana, Pranayam and Meditation Practical's	3+2 Hours

Yogasanas

- **Standing Asana:** Tadasana, Trikonasana, Urdhahastotanasana, Vrikshasana, ArdhaChakrasana, Padhastanasana, Ashwasthasana.
- **Sitting Asana:** Padmasana, Vakrasana, Ardhamatsyendrasana, Janusirsasana, Paschimottanasana, Vajrasana, Ushtrasana, Shasankasana, Gomukhasana, Mandukasana, Bhadrasana, Singhasana.
- **Prone Lying Asana:** Bhujangasana, Shalabhasana, Dhanurasana, Makarasana
- **Supine Lying Asana:** Pawanmuktasana and its variation, setubandhasana, sarvangasana, ArdhaHalasana, Uttanpadasana, Halasana, Naukasana, Cakrasana, Markatasana, Shavasana.

Surya Namaskar

- Surya Namaskara.

Pranayama

- Breath Awareness.
- Yogic Breathing.
- Nadishodhan Pranayama.
- Suryabhedhi.
- Ujjayi.
- Shitali.
- Sitkari.
- Bhastrika.
- Bhramari.

Bandha and Mudra

- JalandharaBandha, UddiyanaBandha, MulaBandha, Tri Bandha.
- Yoga Mudra, Shanmukhi Mudra, shambhavi mudra, VipareetKarni Mudra.

Course Outcome	Description
At the end of the course the student will be able to:	
1	Development of relaxation techniques.
2	Improved concentration and cognitive function.
3	Promotion of overall health and well-being.

Text Book and Reference Book:

1. Concentration and Meditation by swami SivanandaSaraswati
2. Yoga and Kriya by Swami SatyanandaSaraswati
3. Yoga & Mental Health by R. S. Bhogal
4. Yoga & Modern Psychology by KaivalyadhamAsharam
5. Yoga for Stress Management by Sri Venkatkrishnan
6. Yoga for Stress Relief by Swami Shivapramananda
7. Yoga Nidra by Swami StyanandaSaraswati
8. Certification of Yoga Professionals - Official Guid book

CYBER CRIME, POLICIES, LAWS [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III			
Course Code	: 22LS0013	Credits	: 01
Hours/Week	: 01 Hour	Total Hours	: 13 Hours
L-T-P-J	: 1-0-0-0		
Course Learning Objectives: This Course will enable students to: 1. Understand Cybercrime Fundamentals. 2. Explore Cybercrime Investigation Techniques. 3. Discuss Cybersecurity Incident Response.			
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class. 6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
UNIT - I: Introduction to Cyber Security			02 Hours
Basic Cyber Security fundamentals, Types of Cyber Attacks, The 7 layers of Cyber Security, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, types of active attacks, passive Attacks, Software attacks, hardware attacks, Cyber Threats-, Cyber Crime, Cyber terrorism, Cyber Espionage.			
UNIT - II: Cyberspace and the Law & Cyber Forensics			04 Hours
Introduction, Cyber Security Regulations, Roles of International Law, Cyber forensics, Digital forensics lifecycle: Types of forensics investigation, challenges in computer forensics.			
UNIT - III: Cybercrime: Mobile and Wireless Devices			03 Hours
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era.			

UNIT - IV: Cyber Security: Organizational Implications	04 Hours
Drama within liberal studies serves as a vehicle for social commentary and advocacy. By exploring social issues such as discrimination, inequality, and justice, drama becomes a powerful tool for initiating conversations and inspiring action. Through the examination of theatrical texts and the creation of original performances, students develop the skills to articulate their perspectives and communicate their ideas effectively. This process empowers them to become advocates for change and contribute to a more inclusive and just society.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Analyse cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
2	Interpret and forensically investigate security incidents.
3	Apply policies and procedures to manage Privacy issues.

TEXT BOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes,Computer Forensics and Legal Perspectives, Wiley
2. B.B.Gupta,D.P. Agrawal, Haoxiang Wang, Computer and CyberSecurity: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
 2. Introduction to Cyber Security, Chwan-HwaQohn] WuJ. David Irwin, CRC Press T&FGroup.
-

Holistic Medicine [As per Choice Based Credit System (CBCS) scheme] SEMESTER-III	
Course Code : 22LS0014	Credits : 01
Hours/Week : 01 Hours	Total Hours : 13 Hours
L-T-P-J : 1-0-0-0	
Course Learning Objectives: This Course will enable students to: 1. To develop an understanding of the principles and philosophies that underpin holistic medicine. 2. To develop an understanding about the theories behind these therapies and their potential benefits and risks. 3. Explore the role of nutrition, exercise, sleep, stress management, and other lifestyle factors in promoting health and preventing illness. 4. Promote an understanding of how cultural and social factors can influence health beliefs and practices.	
Teaching-Learning Process (General Instructions) These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes. 1. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes. 2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying. 3. Show Video/animation films to explain functioning of various concepts. 4. Encourage Collaborative (Group Learning) Learning in the class. 5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.	
UNIT 1: Understanding our immune system, importance of nutrients and minerals	03 Hours
Understanding Immunity, types of immunity, keys organs involved in immune system, key cells of immune system, about vitamin and nutrients, essential nutrients required for our body, natural ways to boost immunity.	
UNIT 2: Detoxification and Gut Health	03 Hours
About detoxification and its importance, colon cleansing, about good bacteria and bad bacteria, why gut health is important, how gut health is related to many diseases, how to improve gut health.	
UNIT 3: Power of fasting	03 Hours
About fasting, types of fasting, benefits of fasting, power of forgiveness and meditation.	
UNIT 4: Health starts from your kitchen	02 Hours

About home remedies, food as medicine, healthy food and drinks, life style changes, why exercise is important?	
UNIT 5: Acupressure	02 Hours
About acupressure, various pressure points of body, benefits and uses of acupressure.	

Course Outcome	Description
At the end of the course the student will be able to:	
1	Describe the collective factors of health and their impact on holistic health and wellness.
2	Understand existing research to examine the use and effectiveness of holistic health practices.
3	Apply health and wellness practices to enhance one's own personal well-being.

TEXT BOOK:

1. Back to the Roots: Celebrating Indian Wisdom and Wellness by Luke Coutinho.
2. Eat Smart Move More Sleep Right Paperback - 1 January 2011 by Luke Coutinho
3. Nimma Kaigalalli Arogya - Vol 1 & Vol2 by Devendra Vora.

REFERENCES:

1. <https://www.youtube.com/c/LukeCoutinho>

3 D MODELLING USING TINKERCAD			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER-III			
Course Code	: 22LS0015	Credits	: 01
Hours/ Week	: 01 Hours	Total Hours	: 13 Hours
L-T-P-J	: 1-0-0-0		
Course Objectives:			
This Course will enable students to:			
7. To understand the basic concepts and functions of 3D view.			
8. To understand the modelling of 3 D objects			
9. To analyze modelling of designs and animation.			
Teaching-Learning Process (General Instructions)			
These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.			
6. Lecture method means it includes not only traditional lecture method, but different <i>type of teaching methods</i> may be adopted to develop the course outcomes.			
7. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.			
8. Show Video/animation films to explain functioning of various concepts.			
9. Encourage Collaborative (Group Learning) Learning in the class.			
10. To make Critical thinking , ask at least three Higher order Thinking questions in the class.			
11. Adopt Problem Based Learning , which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.			
12. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.			
13. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
UNIT - I: Introduction of 3D modelling & Design, TinkerCAD Basics			02 Hours
Read the Class Introduction Presentation, Create a TinkerCAD Account, "Place It" "View It" "Move It" "Rotate It" "Size It Up" "Group It" "Align It"			
UNIT - II: Review and More Basics, First Projects			02 Hours
"Learning the Moves" "Camera Controls" "Scale, Copy, and Paste" "Creating Holes" Tutorial, Read Assignment Descriptions and Rubric, Key Ring Project, Dice Project, Dice from Scratch Project			

UNIT - III: Hands on Project & Designs on case study	03 Hours
# case study project on designing a living room, setting up of virtual classroom & building a fort structure	
UNIT - IV: Creating Portfolio in TinkerCad	03 Hours
Project, Read Portfolio Information Presentation, Complete Portfolio	
UNIT - V: Intrdocution to Arduino & mini Circuots using Circuit design TinkerCad	03 Hours
Android Circuit design using tinker cad, Introduction to circuit designing, Android Song Teller - Project, Android smart notice board	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Understand the basics of 3 D design.	L2
2	Designing and drafting in Tinkercad software.	L2
3	Acquire the knowledge & study about various additive manufacturing techniques (3D File setup).	L2
4	Understand about design technology and innovation.	L3
5	Design some basics Arduino circuits.	L3

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Oultcomes (P(Ds)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1					1					
CO2	3	2	2						1					
CO3	3	2	2	1					1					
CO4	3	2	2	1					1					
CO5	3	2	2	1					1					

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

Text Book:

1. 3D Printing with Autodesk 123D, Tinkercad, and MakerBot, 1st Edition, 0071833471 • 9780071833479, By Lydia Sloan Cline © 2015 | Published: November 6, 2014

Reference Book:

1. The 2020-2025 World Outlook for 3D Mapping and 3D Modeling, Philip M. Parker Ph.D

2. Blender 3D By Example A project-based guide to learning the latest Blender 3D, EEVEE rendering engine, and Grease Pencil, 2nd Edition Oscar Baechler, Xury Greer-2020

E-Resources:

1. www.tinkercad.com

DAYANANDA SAGAR UNIVERSITY
SHAVIGE MALLESHWARA HILLS, KUMARASWAMY
LAYOUT BENGALURU-560 111, KARNATAKA.

SCHOOL OF ENGINEERING



SCHEME & SYLLABUS
FOR
BACHELOR OF TECHNOLOGY (B. Tech.) -2020
COMPUTER SCIENCE & TECHNOLOGY
(CST)
(WITH EFFECT FROM 2020-21)

SCHEME - B.TECH - 2020-21 ONWARDS**I SEM - CHEMISTRY CYCLE**

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1101	ENGINEERING MATHEMATICS -1	CR	03	01	-	--	04	*	***
2	101-105 & 121-123	20EN1102	ENGINEERING CHEMISTRY	CR	03	-	02	--	04	*	***
3	101-105 & 121-123	20EN1103	FUNDAMENTALS OF PROGRAMMING	CR	03	-	04	--	05	*	***
4	101-105 & 121-123	20EN1104	BASIC ELECTRICAL ENGINEERING	CR	03	-	-	--	03	*	***
5	101-105 & 121-123	20EN1105	ENVIRONMENTAL STUDIES	CR	02	-	-	--	02	*	***
6	101-105 & 121-123	20EN1106	ELEMENTS OF MECHANICAL ENGINEERING	CR	02	-	02	--	03	*	***
					16	01	08	--	21		
7	101-105 & 121-123	20AU0004	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AU	02	--	--	--	--	*	***

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2020-21 ONWARDS
ISEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1101	ENGINEERING MATHEMATICS -I	CR	03	01	--	-	04	*	***
2	101-105 & 121-123	20EN1107	ENGINEERING PHYSICS	CR	03	-	02	--	04	*	***
3	101-105 & 121-123	20EN1108	BASIC ELECTRONICS	CR	03	-	02	--	04	*	***
4	101-105 & 121-123	20EN1109	BIOLOGICAL SCIENCES	CR	02	--	--	--	02	*	***
5	101-105 & 121-123	20EN1110	TECHNICAL COMMUNICATION	CR	02	-	02	--	03	*	***
6	101-105 & 121-123	20EN1111	ENGINEERING GRAPHICS & DESIGN	CR	01	-	04	--	03	*	***
7	101-105 & 121-123	20EN1112	DESIGN THINKING & INNOVATION	CR	-	-	02	--	01	*	***
					14	01	12	-	21		
8	101-105 & 121-123	20AU0021	KANNADA KALI - II	AU	02	--	--	--	--	*	***
		20AU0025	KANNADA MANASU - II	AU	02	--	--	--	--	*	***

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2020-21 ONWARDS
IISEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	20EN1201	ENGINEERING MATHEMATICS - II	CR	03	01	--	-	04	*	***
2	101-105 & 121-123	20EN1107	ENGINEERING PHYSICS	CR	03	-	02	--	04	*	***
3	101-105 & 121-123	20EN1108	BASIC ELECTRONICS	CR	03	-	02	--	04	*	***
4	101-105 & 121-123	20EN1109	BIOLOGICAL SCIENCES	CR	02	--	--	--	02	*	***
5	101-105 & 121-123	20EN1110	TECHNICAL COMMUNICATION	CR	02	-	02	--	03	*	***
6	101-105 & 121-123	20EN1111	ENGINEERING GRAPHICS & DESIGN	CR	01	-	04	--	03	*	***
7	101-105 & 121-123	20EN1112	DESIGN THINKING & INNOVATION	CR	-	-	02	--	01	*	***
					14	01	12	-	21		
9	101-105 & 121-123	20AU0021	KANNADA KALI	AU	02	--	--	--	--	*	***
		20AU0025	KANNADA MANASU	AU	02	--	--	--	--	*	***

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2019 -20 ONWARDS

II SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	p	s/ P	c	SEM	COURSE CODE
1	101-105 & 121-123	20EN1201	ENGINEERING MATHEMATICS - II	CR	03	01	-	--	04	*	***
2	101-105 & 121-123	20EN1102	ENGINEERING CHEMISTRY	CR	03	-	02	--	04	*	***
3	101-105 & 121-123	20EN1103	FUNDAMENTALS OF PROGRAMMING	CR	03	-	04	--	05	*	***
4	101-105 & 121-123	20EN1104	BASIC ELECTRICAL ENGINEERING	CR	03	-	-	--	03	*	***
5	101-105 & 121-123	20EN1105	ENVIRONMENTAL STUDIES	CR	02	-	-	--	02	*	***
6	101-105 & 121-123	20EN1106	ELEMENTS OF MECHANICAL ENGINEERING	CR	02	-	02	--	03	*	***
					16	01	08	-	21		
7	101-105 & 121-123	20AU0004	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AU	02	--	--	--	--	*	***

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH —2020-21 ONWARDS

SEM - COMPUTER SCIENCE & TECHNOLOGY

III

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR /AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	104	20CS2301	DISCRETE MATHEMATICAL STRUCTURES	CR	3	-	-	-	3	*	***
2	104	20CS2302	DATA STRUCTURES	CR	3	-	-	-	3	I/II	20EN1103
3	104	20CS2303	DIGITAL ELECTRONICS & LOGIC DESIGN	CR	3	-	-	2	4	*	***
4	104	20CS2304	DATABASE MANAGEMENT SYSTEMS	CR	3	-	-	-	3	*	***
5	104	20CS2305	COMPUTATIONAL THINKING WITH PYTHON	CR	3	-	-	-	3	*	***
6	104	20CS2306	AGILE SOFTWARE ENGINEERING	CR	2	-	-	2	3	*	***
7	104	20CS2307	DATA STRUCTURES LAB	CR	-	-	2	-	1	*	***
8	104	20CS2308	DATABASE MANAGEMENT SYSTEMS LAB	CR	-	-	2	-	1	*	***
9	104	20CT2301	DESIGN TECHNOLOGY	CR	-	-	2	2	2	*	***
10	104	20CT2302	INNOVATIVE BUSINESSES & BREAKTHROUGH TECHNOLOGIES	CR	-	-	-	2	1	*	***
					17	-	06	08	24		

CR-CREDIT, AU-AUDIT, L-LECTURE, T-TUTORIAL, P-PRACTICAL, S/P-SEMINAR/PROJECT, C-NO. OF CREDITS

SCHEME - B.TECH —2020-21 ONWARDS

IV

SEM - COMPUTER SCIENCE & TECNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR /AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	104	20CS2401	PROBABILITY AND STATISTICS	CR	3	-	-	-	3	*	***
2	104	20CS2402	OBJECT ORIENTED DESIGN AND PROGRAMMING	CR	3	-	-	-	3	*	***
3	104	20CS2403	PRINCIPLES OF MICROPROCESSORS AND COMPUTER ORGANIZATION	CR	4	-	-	-	4	*	***
4	104	20CS2404	FINITE AUTOMATA & FORMAL LANGUAGES	CR	3	-	-	2	4	*	***
5	104	20CS2405	INTRODUCTION TO NETWORKS & CYBERSECURITY	CR	3	-	-	-	3	*	***
6	104	20CS2406	FULL STACK DEVELOPMENT	CR	2	-	-	2	3	*	***
7	104	20CS2407	OBJECT ORIENTED PROGRAMMING LAB	CR	-	-	2	-	1	*	***
8	104	20CS2408	MICROPROCESSORS LABORATORY	CR	-	-	2	-	1	*	***
9	104	20CT2401	SMALL E-BUSINESS LAUNCH	CR	-	-	-	4	2	*	***
10	104	20CT2402	TREE ELECTIVE-1	CR	-	-	-	2	1	*	***
					18	-	04	10	25		

CR - CREDIT, AU - AUDIT, L- LECTURE, T-TUTORIAL, P - PRACTICAL, S/P- SEMINAR/PROJECT, C - NO. OF CREDITS

TREE ELECTIVE

Students may take a course in the field of your choice or investigate any other area of interest.
Students should consult your department academic advisor before the commencement of the semester to discuss how your choice of free electives fit into your overall curriculum and get prior approval.

V

SEM - COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR /AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	104	20CS3501	COMPUTER NETWORKS	CR	3	-	2	-	4		***
2	104	20CS3502	DESIGN AND ANALYSIS OF ALGORITHMS	CR	3	-	-	-	3		***
3	104	20CS3503	OPERATING SYSTEMS	CR	3	1	-	-	4		***
4	104	20CS3504	MACHINE LEARNING	CR	3	-	2	-	4		***
5	104	20CT3501	PRODUCT ENGINEERING & ENTREPRENEURSHIP	CR	2	-	-	2	3		***
6	104	20CT35XX	TECHNOLOGY ELECTIVE-1	CR	2	-	-	2	3		***
7	104	20CS3505	DESIGN AND ANALYSIS OF ALGORITHMS LAB	CR	-	-	2	-	1		***
8	104	20CS3506	OPERATING SYSTEMS LAB	CR	-	-	2	-	1		***
9	104	20CT3502	MOOC	CR	1	-	-	-	1		***
					17	1	8	4	24		

CR-CREDIT, AU-AUDIT, L-LECTURE, T-TUTORIAL, P-PRACTICAL, S/P-SEMINAR/PROJECT, C-NO. OF CREDITS

VSEM - TECHNOLOGY ELECTIVES-I

SL	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					SCHEME OF EVALUATION		PREREQUISITE	
				L	T	P	J	C	CIA	SEE	SEM	COURSE CODE
1	20CT3503	VRand Game-theoretic Simulation	CR	2	-	-	-	2	60	40	*	***
2	20CT3504	Creative Coding	CR	2	-	-	2	2	60	40	*	***
3	20CT3505	Cloud Security Services	CR	2	-	-	2	2	60	40	*	***

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR /AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	104	20CS3601	COMPILER DESIGN AND SYSTEM SOFTWARE	CR	3	1	-	-	4	*	***
2	104	20CS3602	SECURE PROGRAMMING	CR	2	-	2	-	3	*	***
3	104	20CS3603	CLOUD APPLICATION DEVELOPMENT	CR	3	-	-	-	3	*	***
4	104	20CT36XX	TECHNOLOGY ELECTIVE - 2	CR	3	-	-	-	3	*	***
5	104	20CT3601	LEAN STARTUP METHODOLOGY	CR	2	-	-	2	2	*	***
6	104	20CT3602	SPECIAL TOPICS-I	CR	-	-	2	-	1	*	***
7	104	20OE00XX	OPEN ELECTIVES -I	CR	3	-	-	-	3	*	***
8	104	20CS3604	COMPILER DESIGN AND SYSTEM SOFTWARE LAB	CR	-	-	2	-	1	*	***
9	104	20CS3605	CLOUD APPLICATION DEVELOPMENT LAB	CR	-	■	2	-	1	*	***
					16	1	8	2	21		

VI SEM - TECHNOLOGY ELECTIVES-II

SL	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING				SCHEME OF EVALUATION			PREREQUISITE	
				L	T	P	J	C	CIA	SEE	SEM	COURSE CODE
1	20CT3603	Data-Driven Decision Making	CR	2	-	2	-	3	60	40	*	***
2	20CT3604	Human-Computer Interaction	CR	2	-	2	-	3	60	40	*	***
3	20CT3605	Blockchain & Crypto currency	CR	2	-	2	-	3	60	40	*	***
				6	0	6	0	9	180	120		

SCHEME - B. TECH - 2020-21 ONWARDS
VII SEM - COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	J	C	SEM	COURSE CODE
1	104	20CT4701	PRODUCT ANALYTICS	CR	01	-	-	02	02	*	***
		20CT4702	IPR & ART OF RAISING CAPITAL								
3	104	20CT4703	BIG DATA ANALYSIS AND DEEP LEARNING	CR	02	-	-	02	03	*	***
4	104	20CT47XX	TECHNOLOGY ELECTIVE - III	CR	02	-	-	02	03	*	AS INDICATED IN THE ELECTIVE LIST
5	104	20OEXXXX	OPEN ELECTIVE -II	CR	03	-	-	-	03	*	AS INDICATED IN THE ELECTIVE LIST
6	104	20CT4704	PROJECT PHASE-I	CR	-	-	-	06	03	*	***
					08	-	-	12	14		

CR - CREDIT, AU - AUDIT, L - LECTURE, T - TUTORIAL, P - PRACTICAL, J - SEMINAR/PROJECT, C - NO. OF CREDITS

VII SEM - TECHNOLOGY ELECTIVE-III

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	C	SEM	COURSE CODE
1	20CT4705	AUGMENTED & MIXED REALITY	02	-	-	02	03	-	-
2	20CT4706	EDGE COMPUTING WITH IOT	02	-	-	02	03	-	-
3	20CT4707	AWS WEB SERVICES	02	-	-	02	03	-	-

VII SEM - OPEN ELECTIVE - II

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	c	SEM	COURSE CODE
1	200E0035	LEARN STARTUP METHODOLOGY	03	-	-	-	03	-	-

SCHEME - B. TECH - 2020-21 ONWARDS
VIII SEM - COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	J	C	SEM	COURSE CODE
1	104	20CT4801	TECHNOLOGY STRATEGY	CR	01	-	-	02	02	*	***
2	104	20CT48XX	TECHNOLOGY ELECTIVE - IV	CR	02	-	-	02	03	*	AS INDICATED IN ELECTIVE LIST
3	104	20CT4802	PROJECT PHASE-II/VENTURE	CR	-	-	-	12	06	*	***
					03	-	-	16	11		

CR - CREDIT, AU - AUDIT, L - LECTURE, T - TUTORIAL, P - PRACTICAL, J - SEMINAR/PROJECT, C - NO. OF CREDITS

VIII SEM-TECHNOLOGY ELECTIVE - IV

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	C	SEM	COURSE CODE
1	20CT4803	AI AS A SERVICE	02	-	-	02	03	*	***
2	20CT4804	QUANTUM CRYPTOGRAPHY	02	-	-	02	03	*	***
3	20CT4805	INDUSTRIAL INTERNET OF THINGS	02	-	-	02	03	*	***

SEMESTER/YEAR : I SEM
COURSE CODE : 20EN1101
TITLE OF THE COURSE : ENGINEERING MATHEMATICS - I
L:T/A:P:C :3: 1:0:4

Course Objectives

1. Understanding basic concepts of linear algebra to illustrate its power and utility through applications to science and Engineering.
2. Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. The course is discussed with algebraic as well as geometric perspectives.
4. Solve problems in cryptography, computer graphics and wavelet transforms.

Expected Course Outcomes

At the end of this course the students are expected to learn

1. the abstract concepts of matrices and system of linear equations using decomposition methods
2. the basic notion of vector spaces and subspaces
3. apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces
4. applications of inner product spaces in cryptography

Student Learning Outcomes

1. Having an ability to apply knowledge or Mathematics in Science and Engineering
2. Having a clear understanding of the subject related concepts and of contemporary issues.
3. Having computational thinking

Module: 1 LINEAR EQUATIONS

8 hours

Introduction - The Geometry of Linear Equations - Row reduction and echelon forms- Gaussian Elimination - Solution sets of linear equations - LU decomposition - Inverse of a matrix by Gauss Jordan method.

Self Learning Component: Algebra of Matrices.

Module: 2 VECTOR SPACES AND SUBSPACES

8 hours

Linear spaces - Subspaces - Linear independence - Span - Bases and Dimensions -Finite dimensional vector space.

Self Learning Component: Examples of vector spaces and subspaces, Rank of a matrix.

Module3 LINEAR TRANSFORMATIONS AND ORTHOGONALITY

8 hours

Linear transformations - Basic properties - Invertible linear transformation - Matrices of linear transformations - Vector space of linear transformations - change of bases - Orthogonal Vectors - Projections onto Lines - Projections and Least Squares - The Gram-Schmidt Orthogonalization process.

Self Learning Component: Inner Products

Module 4 EIGEN VALUES AND EIGEN VECTORS**10 hours**

Introduction to Eigen values and Eigen vectors - Diagonalization of a Matrix- Diagonalization of symmetric matrices - Quadratic forms - Singular Value Decomposition - QR factorization.

Self Learning Component: Determinant and Properties of Eigen values and Eigenvectors

Module 5 APPLICATIONS OF LINEAR EQUATIONS**6 hours**

An Introduction to coding - Classical Cryptosystems -Plain Text, Cipher Text, Encryption, Decryption and Introduction to Wavelets from Raw data - curve fitting

Contemporary Issues

Industry Expert Lecture

Tutorial • Variety of minimum 10 problems to be worked out by students in every Tutorial Class

12 hours

- Another set of 5 problems per Tutorial Class to be given for self solving.

Text Book(s)

1. DC Lay, S R Lay and JMcDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4 th Edition, Thomson Brooks/ Cole, Second Indian Reprint 2007.
3. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.

Reference Books

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press(2016)
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003

SCILAB components

There will be a computational component to the course, using a mix of computational packages like SCILAB to solve engineering problems using the mathematical concepts developed in the course :

1. Gaussian Elimination
2. The LU Decomposition
3. Inverse of a Matrix by the Gauss- Jordan Method, curve fitting
4. The Span of Column Space of a Matrix
5. Fundamental Subspaces
6. Projections by Least Squares
7. The Gram-Schmidt Orthogonalization

8. Eigen values and Eigen Vectors of a Matrix
9. The Largest Eigen Value of a Matrix by the Power Method
10. Singular value decomposition

SEMESTER/YEAR : II SEM
COURSE CODE : 20EN1201
TITLE OF THE COURSE : ENGINEERING MATHEMATICS - II
L:T/A:P:C :3: 1:0:4

Course Objectives

1. To provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists.
2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus etc.
3. To impart the knowledge of Laplace transform, an important transform technique for Engineers which requires knowledge of integration

Expected Course Outcomes

At the end of this course the students should be able to

1. apply single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions
2. evaluate partial derivatives, limits, total differentials, Jacobians, Taylor series and optimization problems involving several variables with or without constraints
3. evaluate multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates.
4. understand gradient, directional derivatives, divergence, curl and Greens', Stokes, Gauss theorems

Student Learning Outcomes

1. Having an ability to apply mathematics and science in engineering applications
2. Having a clear understanding of the subject related concepts and of contemporary issues
3. Having problem solving ability- solving social issues and engineering problems

Module: 1 Application of Single Variable Differential Calculus

8 hours

Differentiation- Extrema on an Interval-Rolle's Theorem and the Mean Value Theorem - Increasing and Decreasing functions and First derivative test-Second derivative test- Maxima and Minima-Concavity.

Integration-Average function value - Area between curves - Volumes of solids of revolution - Beta and Gamma functions

Module: 2 MULTI VARIABLE DIFFERENTIAL CALCULUS

8 hours

Functions of two or more real variables, Partial derivatives of second and higher order, Euler's theorem on homogenous function, Total derivatives, Differentiation of composite and implicit functions, Change of variable, Jacobians, Maxima and minima of functions of two or more variable, Lagrange's method of undetermined multipliers, Taylor's formula for two variables

Module 3 MULTI VARIABLE INTEGRAL CALCULUS**8 hours**

Double integrals, Triple integrals, Change of order of integration in a double integral, Change of variables in double and triple integrals, Area as a double integral, Volume as a triple integral, Line integrals, Vector Fields and Line integrals.

Module 4 VECTOR CALCULUS**10 hours**

Scalar and vector valued functions - gradient, tangent plane-directional derivative-divergence and curl-scalar and vector potentials-Simple problems
Line integral- Surface integral - Volume integral - Path independence- Green's theorem-Stoke's Theorem- Divergence Theorem

Module 5 LAPLACE TRANSFORM**6 hours**

Basic concepts, Linearity and First shifting theorem, Laplace transforms of derivatives and integrals, Second shifting theorem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differential equations.

Tutorial • Variety of minimum 10 problems to be worked out by students in every Tutorial Class

12 hours

- Another set of 5 problems per Tutorial Class to be given for self solving.

Text Book(s)

1. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

Reference Books

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8th edition, Cengage Learning.
4. Engineering Mathematics, K.A. Stroud and Dexter J. Booth, 2013, 7th Edition, Palgrave Macmillan.

SCILAB components

There will be a computational component to the course, using a mix of computational packages like SCILAB to solve engineering problems using the mathematical concepts developed in the course :

1. Plotting and visualizing curves
2. Plotting and visualizing surfaces
3. Evaluating Extremum of a single variable function
4. Evaluating maxima and minima of functions of several variables
5. Tracing of curves
6. Applying Lagrange multiplier optimization method
7. Line integral

8. Surface integral
9. Volume integral
10. Solving Differential equation using Laplace transform

SEMESTER/YEAR	: I/ISEM
COURSE CODE	:20EN1102
TITLE OF THE COURSE	: ENGINEERING CHEMISTRY
L:T/A:P:C	:3:0:2:4

Course learning objectives:

The Theory Course intends to provide chemical concepts most relevant to engineering students and demonstrate them in an applied context. The student is exposed to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, phase equilibria nanomaterials and green chemistry and catalysis. The underlying theme is to emphasize on applications of these concepts to real world problems

Course outcome:

- Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.
- Know construction, working and applications of various energy storage devices such as batteries, fuel cells and supercapacitors.
- Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.
- Understand and interpret phase equilibria of one and two-component systems.
- Know the synthesis, structure -property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world.

Engineering Chemistry (Theory -Syllabus)

Total: 52 Hrs

Module 1

Chemical Energy Source:

- Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV&NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol, octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas-Dry gas harvesting and its efficiency.

Note: Video lecture on

- Fractional distillation of crude petroleum
- Biogas
- Biodiesel

Solar Energy:

- Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photovoltaics, doping of silicon by diffusion technique.

Module 2**Energy Science and Technology**

- Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell- Definition, notation and conventions. Reference electrodes- Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on electrode potentials and EMF. Ion-selective electrode- glass electrode- Derivation electrode potential of glass electrode
- Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries- primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries.
Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.

Module 3**Corrosion Science:**

- Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Inorganic coatings-Anodization. Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method.

Surface Modification Techniques:

- Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroplating of Chromium. Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.
Note: Video lecture on surface modification using polymer

Module: 4

- **High Polymers:** Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber, Conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting Polyaniline.
- **Nanotechnology:** Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites-metal oxide-polymer nano-composite

Note: Video lecture on metal oxide-polymer nano-composite.

- **Advances in engineering chemistry:** Synthesis of carbon and sulphur containing compounds.

Module: 5

- **Water Technology:** Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method. Alkalinity. Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment, problems on quantity of flocculent required in sewage treatment. Principle and applications of green chemistry
- **Instrumental Methods of Analysis:**
Instrumental methods of analysis, Principles of spectroscopy-Beer's Lambert's law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base) and viscometer.

Text Books

1. Dr. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017,
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015

Reference Books

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

ENGINEERING CHEMISTRY- LABORATORY

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by Complexometric titration.
2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
3. Determination of Alkalinity of the given water sample
4. Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis.
5. Electroless plating of copper (Demo experiment)
6. Preparation of Polyaniline (Demo experiment)

Instrumental methods of Analysis

1. Potentiometric titration-Estimation of FAS using standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution.
2. Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient, surface tension, density of a given liquid
4. Colorimetric estimation of copper in a given solution
5. Determination of Pka of given weak acid.
6. Determination of calorific value of coal/oil using Bomb calorimeter (Group experiment)

Reference books:

1. Dayanada Sagar University laboratory manual.
2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.

SEMESTER/YEAR : I/II SEM
COURSE CODE :20EN1103
TITLE OF THE COURSE : FUNDAMENTALS OF PROGRAMMING
L:T/A:P:C : 3: 0:4: 5

Course objective: To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.

Course outcomes: After completing this course, students will be able to:

- **Express** algorithms learned implicitly in school explicitly in algorithmic form and **calculate** the number of basic operations (exact or upper bound)
- **Trace** the execution of short programs/code fragments involving fundamental programming constructs
- **Explain** what a short program/code fragment involving fundamental programming constructs does
- **Determine** whether code meets consistent documentation and programming style standards, and **make changes** to improve the readability and maintainability of software using a modern IDE
- **Write** a short program/code fragment for a given task using fundamental programming constructs
- **Rewrite** a short program/code fragment with fundamental programming constructs using more appropriate programming constructs
- **Debug** a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools
- **Add/modify** functionality and decompose monolithic code into smaller pieces
- **Design** a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist
- **Use** appropriate tools to build source code for testing and deployment
- **Identify** potential computing ethics issues in a given programming task and **suggest** ways to address these issues

Course Content:

Module 1. The primary focus is on code comprehension. Simple expressions, operator precedence, integer issues (overflow, integer division), floating point issues, implicit and explicit typecasting, conditionals, Boolean expressions, lazy evaluation. 14 Hours

Module 2. The primary focus will be on debugging (gdb) and code rewriting. Simple recursion (factorial and GCD), functions with variables, functions with loops (e.g., Taylor series), switch statements, command line arguments. 14 Hours

Module 3. The primary focus is on writing code for given specifications. Functions with const array arguments (e.g., linear search, binary search), arrays and pointers, library functions (especially strings), functions with side-effects (non-const arrays, pointers), structs as arguments and return value, global variables. 14 Hours

Module 4. The primary focus is on managing heap memory (malloc, free, realloc), memory leaks (valgrind). 14 Hours

Module 5. Header files and multiple implementations (e.g., using dictionary ADT and array-based implementations), file I/O. 14 Hours

Note: The hours include 4 Hours of Lab per week.

Textbook:

Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.

SEMESTER/YEAR	: I/II SEM
COURSE CODE	:20EN1108
TITLE OF THE COURSE	: BASIC ELECTRONICS
L:T/A:P:C	: 3: 0:2: 4

COURSE OBJECTIVE:

1. Imparting knowledge of fundamentals of semiconductor devices
2. Understanding electronic circuits

COURSE OUTCOME:

1. Analyze and design the basic electronic circuits containing semiconductor devices
2. Identify the need of Integrated Circuits and use them in realizing circuit applications.
3. Analyze and implement basic Digital Electronic circuits for a given application.
4. Identify the applications and significance of electronics in interdisciplinary engineering domains.

Module 1: Semiconductors

Semiconductor diodes, Diode types, Bipolar junction transistors BJT, FET characteristics, Packages and coding, Integrated circuits

Power supplies: Rectifiers, Reservoir and smoothing circuits, improved ripple filters Full-wave rectifiers, Voltage regulators, Practical power supply circuits, Related Problems.

Module 2: Amplifiers

Types of amplifier, Gain, Class of operation, Input and output resistance, Frequency response, Bandwidth, Phase shift, Negative feedback, Transistor amplifiers Bias, Predicting amplifier performance, Practical amplifier circuits

Oscillators: Positive feedback, conditions for oscillation, types of oscillators, practical oscillator circuits., Related Problems.

Module 3: Operational Amplifiers

Symbols and connections, Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier applications, Related Problems Circuit simulation: Introduction, types of analysis, net lists and component models.

Module 4: Logic Circuits

Logic functions, Switch and lamp logic, logic gates, combinational logic, bistables/flipflops, Integrated circuit logic devices, Logic simulation using SPICE

Microprocessors: Microprocessor and microcontrollers, Microprocessor systems, architecture, operation, microcontroller systems, Related Problems.

Module 5: Radio

The radio frequency spectrum, Electromagnetic waves, a simple CW transmitter and receiver, Modulation, Demodulation, Types of transmitters and receivers, aerials, Related Problems.

Text book(s)

1. Electronic Circuits: Fundamentals and Applications by Michael Tooley BA Elsevier Ltd., Third Edition, 2006.
2. Electronic Devices and Circuits, Allan Mottershed, PHI.

Reference book(s)

1. Robert. L. Boylestad and L.Nashelsky, Electronic Devices and circuit Theory, Pearson Education,9th edition, 2005.
2. David A Bell, Electronic Devices and Circuits, PHI, 5th edition 2007.
3. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1112
TITLE OF THE COURSE : DESIGN THINKING & INNOVATION
L: T/A: P: C : 1: 0: 0: 1

Course Summary

The course 'Design Thinking and Innovation' gives an overview of design thinking to help students in understanding design thinking as a problem-solving approach. Ideas are developed through these processes and then applied to a basic approach to understand their value in the market place.

This course integrates the laboratory component into the theory enabling students to understand different phases of Design thinking by creating models using various workbenches from Autodesk Fusion 360 platform.

This course also aims at developing skillsets by using different design approaches to create components that can provide solutions to various engineering problems. It also enables students to use the tool proficiently to create their engineering models independently.

Course Objectives

Theory Component:

The objectives of the Course are to:

- Introduce students to a discipline of design thinking that enhances innovation activities in terms of value creation, speed, and sustainability
- Understand the importance and phases of design thinking and innovation
- Discuss key concepts and principles related to design process
- Examine approaches to innovation practiced by various organizations
- Explain the fundamental principles that guide design thinking
- Explain design thinking practices, their applications and importance.
- Enable students to use basic presentation techniques.
- Come up with new ideas and potential innovations.
- Understand the significance of Team Work and roles of individuals within a team.

Lab Component:

- To impart knowledge and skills to use various workbenches in Autodesk Fusion 360.
- To provide hands-on training on different commands to create part models in Autodesk Fusion 360.

Course Outcomes (CO):

After undergoing this course students will be able to:

- **Apply** the design thinking principles and recognize the significance of innovation

- **Explain** the importance of approaching innovation projects with concept development
- **Discuss** both individual and contextual factors that are linked to creativity
- **Discuss** the need for and significance of adopting a design thinking mind set
- **Develop** creative ideas through design criteria & brainstorming sessions
- **Design** various part models related to engineering field using Autodesk Fusion 360

Module 1: Introduction to Design Thinking & Innovation

Design Thinking Phases, Scoping, and Importance of storytelling. Design brief and visualization, Creativity and Idea Generation.

Module 2: Scope of Design Process

Introduction, Steps of Design Process, Design Components, Product and Process design, Ethnography and Identifying Insights, Requirements of a good product, Customer Satisfaction and Profitability

Module 3: Morphology of Design Process

Establishing design criteria, Design Morphology, Creative Design & Engineering Design, Product life cycle, Concept Development, Testing and Prototyping, Brainstorming & decision making.

Module 4: Analysis of Design Problem

Design inputs and outputs, Constraints in Design, Tools for Preliminary Design- Prescriptive and Descriptive Design, Market & Technology driven process.

Module 5: Communication & Presentation

Types of design communications, Qualities of a Good Poster & Presenter, Barriers & Difficulties in Communication, Effective Communication, Presentation Skills, Professional Ethics in Engineering.

Text Book(s)

1. C. L. Dym and Patrick Little, Engineering Design- A Project Based Introduction, John Wiley, 1995.
2. N. Cross, Engineering Design Methods: Strategies for Product Design, John Wiley, 1995.

References(s)

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (Harper Business, 2009]
2. Bruce Hannington and Bella Martin, Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions (Rockport Publishers, 2012]

3. Ian C. Wright, Design Methods in Engineering & Product Design, McGraw-Hill, 1998.
4. M. A. Parameswaran, an Introduction to Design Engineering, Narosa, 2004.

SEMESTER/YEAR	: I/II SEM
COURSE CODE	:20EN1106
TITLE OF THE COURSE	: ELEMENTS OF MECHANICAL ENGINEERING
L:T/A:P:C	: 2: 0:2: 3

Course Summary

The course 'Elements of Mechanical Engineering' aims at introducing principles of energy resources, thermodynamics, prime movers, pumps, materials science & composites, mechanical design, power transmission, manufacturing techniques (metal cutting, joining & foundry), mechatronics, 3D printing, robotics, electric mobility and applications.

This course integrates the laboratory component into the theory enabling students to understand the working and application of various mechanical systems. Students belonging to all branches of engineering are introduced to fundamental topics related to mechanical engineering.

This course also aims at developing skills by using workshop tools, equipment's and materials to create various physical models. The course deals with basic manufacturing processes like fitting, sheet metal work, welding, soldering, machining, carpentry, casting and smithy useful for industries.

Course Objectives:

Theory Component:

The objectives of the Course are to:

- Explain the basic concepts of renewable & non-renewable energy resources
- State first and second laws of thermodynamics
- Describe Carnot, Otto, diesel, Brayton, Rankine & refrigeration cycles
- Discuss 4 stroke petrol & diesel engines, turbines and pumps
- Study materials types, properties and stress- strain diagram
- Explain simple stresses, strains, elastic constants and power trains
- Discuss the operations of lathe, drilling, shaper, milling, and grinding machines
- Describe Joining Processes and foundry
- Explain mechatronics, PLC, instrumentation & control systems
- Explain robot anatomy, configurations, sensors and applications
- Discuss rapid prototyping, 3D printing and electric mobility

Lab Component:

- To impart knowledge and skills to use tools, machines, equipment, and measuring instruments
- To cultivate safety aspects in handling of tools and equipments
- To provide hands-on training on fitting, sheet metal, carpentry, casting , smithy, machining operations
- To provide hands-on training on soldering and welding processes

Course Outcomes (CO):

- Explain various energy resources, laws of thermodynamics, gas and vapour cycles, prime movers and pumps
- Discuss fundamentals of materials and mechanical design aspects
- Describe basics of machine tools, joining processes and foundry
- Explain advanced topics in mechanical engineering
- Construct different types of fitting, welding, sheet metal, turning models
- Demonstrate working of engines, turbines, pumps, 3D printing; wood working, foundry & smithy operations

Course content**Module 1: Energy Conversion**

Renewable & Nonrenewable energy resources - Introduction to Steam, Hydro & Nuclear power plants, solar, wind and biomass energy based power plants, Effect of power generation on environment

Thermodynamics- First and second laws of thermodynamics, Efficiency, COP, Carnot theorem, Numericals

Module 2: Prime Movers & Pumps

Gas and Vapour cycles -Carnot, Otto, Diesel, Brayton, Rankine & Refrigeration cycles
Prime movers- 4 stroke- petrol and Diesel engines, Gas turbines-open and closed Cycle, steam turbines-Impulse and reaction, Numericals.

Introduction to pumps-working of centrifugal and reciprocating

Module 3: Materials & Mechanical Design

Materials- Introduction to ferrous, non-ferrous & composites, Stress-strain diagrams, Mechanical Properties for materials.

Mechanical Design-Introduction, Simple Stresses and strains, Elastic constants.

Power Transmission- Gear & Belt Drives, Numerical problems.

Module 4: Manufacturing Processes

Metal cutting: Introduction, classification of machine tools, basic operations on lathe, drilling, shaper, milling, grinding, introduction to CNC machining.

Joining Processes- Welding- classification, gas, arc, laser & friction welding, brazing and soldering

Foundry- Basic terminology, Types of patterns, sand moulding.

Module 5: Advanced Technologies in Mechanical Engineering

Mechatronics - Introduction, Mechatronics, PLC, Instrumentation & control systems

Robotics- Introduction, Robot anatomy, configurations, Sensors, applications.

Rapid prototyping & 3D Printing- Introduction & applications, powder-based additive manufacturing processes.

Electric Mobility -Introduction, electric, hybrid and autonomous vehicles

Lab Component

1. Fitting Shop- Simple exercises involving fitting work-Dove tail.
2. Welding Shop- Simple butt and Lap welded joints using arc welding
3. Sheet-metal Shop- Fabrication of tray, Making Funnel complete with soldering
4. Lathe machining on plain and step turning

Demonstration of

1. Pelton wheel, and Francis turbine
2. 4 stroke petrol and diesel engines
3. Lathe, milling, drilling, grinding & CNC milling machines and wood turning lathe
4. Foundry and smithy operations
5. 3D printing

Text book(s)

1. Nag P K, Basics and applied thermodynamics, Second edition, Tata McGraw Hill, New Delhi-2017.
2. P.N. Rao-Manufacturing Technology-Foundry, Forming and Welding, Volume 1, 4 Edition, Tata McGraw Hill Publishing Co Ltd, 2018.
3. P.N. Rao-Manufacturing Technology- Metal Cutting and Machine Tools, Volume 2, 4 Edition, Tata McGraw Hill Publishing Co Ltd, 2018.

Reference(s)

1. El-Wakil M M, Power plant technology, Tata McGraw Hill edition, New Delhi -2017. Larminie J, Lowry J, Electric vehicle technology explained, John Wiley and & sons Ltd. USA
2. William D. Callister and David G. Rethwisch-Fundamentals of Materials Science and Engineering: An Integrated Approach, John Wiley & Sons; 4th Edition edition, 2011

SEMESTER/YEAR	: I/II SEM
COURSE CODE	:20EN1107
TITLE OF THE COURSE	: ENGINEERING PHYSICS
L:T/A:P:C	: 3: 0:2: 4

Course learning objectives:

This course will enable students to learn the basic concepts in Physics which are very much essential in understanding and solving problems in engineering.

Course Aim and Summary:

The course ‘**Engineering Physics**’ aims at introducing principles of physics to understand the working and behaviour of engineering systems. To begin with, the course emphasises upon the basics of Classical mechanics, principles of Quantum mechanics, and subsequently deals with engineering materials such as Electrical-Electronics and Mechanical properties of materials. Semiconductor Physics, devices like , LED, photodiode, Solar cell and BJT. The course also covers topics like Laser Physics and Crystallography. Finally the course concludes with Thin-Film deposition techniques and Nano science & technology. During the course virtual lab and physical tools/models will be used to demonstrate the behaviour of different engineering systems.

Course Objectives

The Objectives of the Course are:

- To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering.
- To review different types of Engineering materials -Electronic, electrical, mechanical and Magnetic materials Properties and their applications in Science and Engineering.
- To understand Band structure of solids, Semiconductors and electrical conductivity of SC’s, and their applications.
- To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT.
- To learn how to find Lattice parameters of different crystalline solids by using X-ray diffraction methods
- To explain Principle and working of LASERS, Different types of Lasers, and Applications of Lasers in defence, engineering and medicine.
- To introduce Polar and non-polar dielectrics, dielectric constant, electronic, ionic and orientation polarization mechanisms.

- Lorentz field in cubic materials, Clausius-Mossotti equation, Ferro, Piezo and Pyro electric materials and their applications in engineering.
- To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering.
- To learn how to fabricate Nano materials by using Top-down and Bottom -up approach

To review Nano science and technology and its practical applications in science and engineering.

Course Outcomes (CO's):

On completion of the Course the Students are able to

- Describe the concepts of Quantum mechanics, basics of Quantum computing and select for solving problems in engineering.
- Discuss the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering
- Illustrate Semiconductors , Semiconductor devices like Photo diode, LED, Solar cell and BJT and its applications
- Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and Summarize theoretical background of laser, construction and working of different types of lasers and its applications in science and engineering
- Interpret Basic concepts of Thin films and Thin film deposition processes and their applications leads to Sensors and engineering devices
- Discuss Nano materials properties and fabrication of Nano materials by using Top-down and Bottom -up approach's-Applications for Science and technology

Module 1: Introduction to Basics of Classical mechanics

Quantum Mechanics 1: Foundations of quantum theory, Wave function and its properties, One dimensional time independent Schrodinger wave equation, Eigenvalues and Eigen functions, Uncertainty principle, Applications: one dimensional motion of an electron in a potential-well.

Quantum Mechanics 2: Matrix formulation: Linear & matrix algebra, Dirac's bra & ket notation, matrix representation of vectors & operators, Expectation values, Basics of quantum computing - Concepts of Superposition, entanglement, Interference and Qubit

Module 2:

Introduction to Engineering materials: Introduction to Principles of Electromagnetic theory (Maxwell's Equations). Classification of Engineering Materials such as Conductors, Semiconductors, Insulators and Magnetic materials ; Electrical conductivity of metals and Semiconductors. Effect of temperature, composition on resistivity/conductivity

of materials.

Mechanical Engineering materials - mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Malleability, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell, Rockwell and Vickers hardness test-Numericals

Dielectrics: polar and non-polar dielectrics, internal fields in a solid, Different Polarization techniques. Clausius-Mossotti equation, applications of dielectrics. Ferro, Piezo and Pyro electric materials and their applications.

Module 3:

Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valence band (Mention the expression), Intrinsic carrier concentration Conductivity of semiconductors, Measurement of Electrical resistivity using 4 probe method.

Semiconducting devices of interest for optoelectronics applications: Principle and working of LED, photodiode, and solar cell. BJT, FET-JFET and MOSFET

Module 4:

LASER PHYSICS: Einstein's coefficients (expression for energy density). Requisites of a Laser system. Conditions for laser action. Principle, Construction and working of Nd-YAG, Semiconductor Laser and CO₂ Lasers. Application of Lasers in Defense (Laser range finder), Engineering (Data storage) and Applications of Lasers in medicine [6 hours]

Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. X-ray diffraction, Bragg's law and Powder method.

Module 5:

Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin film.

Nano Science & technology: Introduction to Nano materials, Classification of nano materials, Scaling laws in miniaturization electrical systems, Size dependent properties of materials, Top-down and Bottom-up approach- Ball milling, self-assembly process. Fundamental Principles of Bio-Physics and Applications of Nano technology in Biology and Engineering.

Introduction to Micro machining techniques: Silicon micromachining techniques- Etching (isotropic and anisotropic etching)-Numericals

Lab component

1.1-V characteristics of a Zener Diode

I-V Characteristics of a Zener diode in forward and reverse bias condition

2. Four probe technique

Measurement of resistivity of a semiconductor using Four probe technique

3. Newton's Rings

Measurement of radius of curvature of a plano-convex lens using Newton's Rings

4. Dielectric constant

Determination of dielectric constant of a dielectric material

5. Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

6. Band gap energy

Determination of energy gap of an intrinsic semiconductor

7. Diffraction grating

Determination of wavelength of a laser light using diffraction grating

8. Planck's constant

Measurement of Planck's constant using LED

9. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit

10. Transistor characteristics

Input and output characteristics of a NPN transistor in C-E configuration

Text Book(s)

1. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.
2. Materials Science and Engineering by V S Raghavan
3. Engineering Physics (2019), DSU Pearson, New Delhi
4. Engineering Physics (2017), DSU WILEY Publications
5. Engineering Physics Laboratory manual, DSU

Reference Book(s)

1. M. Young (1977), Optics & Lasers an Engineering Physics approach, Springer, Verlag
2. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi.
3. Thin-Films Phenomena-K L Chopra, McGraw -Hill Publishing
4. K. Thyagarajan, A.K. Ghatak (1981), Lasers: Theory & Applications, Plenum Press, New York.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1104
TITLE OF THE COURSE : BASIC ELECTRICAL ENGINEERING
L:T/A:P:C : 3: 0:0: 3

COURSE OBJECTIVE:

1. Imparting Knowledge of basic circuits.
2. Understanding analysis of circuits.
3. Basics of electric and magnetic fields.
4. Working principles of machines, measuring equipments.

COURSE OUTCOME:

1. Able to get the basic knowledge about the Electric and Magnetic circuits.
2. Able to understand the AC fundamentals.
3. Able to understand the working of various Electrical Machines.
4. Able to get the knowledge about various measuring instruments and house wiring.

Course content

Module 1: INTRODUCTION TO ELECTRICAL ENGINEERING

Introduction to Electrical Engineering: General structure of electrical power systems, Electric current, ohm's law, Resistance, Inductance and capacitance parameter, Kirchoff's laws, node voltage and mesh current methods, Series and parallel combinations, current division, voltage division rule, Electrical power and energy. Related Numerical problems. Domestic Wiring: Earthing-significance and types, two way & three way control of lamps, basic protective devices like MCB's and Fuses.

Module 2: Magnetic Circuits

Faradays laws of electromagnetic induction, Lenz's law, Magnetic circuit- concept and analogies, Force on a current carrying conductor placed in a magnetic field, Dynamically induced emf, Fleming's rules and its applications. Self and mutual inductance. Related Numerical Problems.

Module 3: Alternating Quantities

Average and effective values of periodic functions, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, instantaneous and average power, power factor, power in complex notation, response of series, parallel and series - parallel circuits. Related numerical problems.

Necessity and advantages of Three phase supply, delta and Y - connections, line and phase quantities, solution of balanced three phase circuits, phasor diagram, Three phase three wire and four wire circuits.

Module 4: DC Machines

Construction, Working principle and analysis of DC motor and generator, EMF and Torque equations, Connections and working of DC generators and motors- series and shunt, back emf. Related numerical problems.

Module 5: Transformers

Principle of operation, Construction, Equivalent circuit, EMF equation, ratings, losses, Efficiency and voltage regulation, related simple problems.

Induction motors: brief idea about construction, concept of rotating magnetic field. Slip and its significance, Ratings and applications, Problems on slip calculation

Text Book(s)

1. M. Maria Louis, Elements of Electrical Engineering, fifth edition, PHI Publications, 2014.
2. D.P.Kothari and I.J. Nagrath, Basic Electrical Engineering, TataMcGraw Hill.

Reference book(s)

1. S.S. Parker Smith and NN Parker Smith, Problems in Electrical Engineering.
2. Rajendra Prasad, "Fundamentals of Electrical, PHI Publications, 3RD Edition.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1109
TITLE OF THE COURSE : BIOLOGICAL SCIENCES
L:T/A:P:C : 2: 0:0:2

Biology in the 21st century: The new world in the post genome era. Past, present and future of our society, industry and life style: Impact of discoveries and technological innovations in biology. Challenges and excitement of research in biology and bioengineering. Bioengineering as an emerging science at the intersection of biology, engineering, physics and chemistry.

Carrier opportunities in biotechnology, biomedical engineering, pharmaceutical industry, agro-biotechnology and in the diverse areas of basic science and medical research. Emerging trends of collaboration between industry and academia for development of entrepreneurship in biotechnology.

Quantitative views of modern biology. Importance of illustrations and building quantitative/qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems - a glimpse.

Management and transformation of energy in cells. Mathematical view - binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication.

Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity. Systems biology and illustrative examples of applications of Engineering in Biology

Text Book(s)

1. R. Phillips, J. Kondev and J. Theriot, Physical biology of the cell, Garland Science Publisher, 2008, 1st Edition.
2. J.B. Reece, L.A. Urry, M.L. Cain, S.A. Wasserman, P.V. Minorsky and R.B. Jackson. Campbell Biology, Benjamin Cummings Publishers, 2010, 9th Edition.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1110
TITLE OF THE COURSE : TECHNICAL COMMUNICATION
L:T/A:P:C : 2: 0:2:3

Course Aim and Summary

The course 'Technical Communication Skills' aims at enhancing Communication skills of the students in dimensions of - Listening, Speaking, Reading, Writing, Grammar and Vocabulary. The course introduces Communication and types of Communication and deals in detail the listening, referencing, report writing and group discussions. The course covers team, team building skills and effective leadership skills. The course also deals with resume writing, covering letter, job application and e-mail etiquettes. The practical course is designed to acquire correct pronunciation and to enable students to get rid of stage fear and become a good orator.

Course Objectives

The objectives of the Course are:

- To improve students lexical, grammatical competence
- To enhance their communicative skills
- To equip students with oral and appropriate written communication skills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To Develop professional communication skills
- To create interest among the students about a topic by exploring thoughts and ideas
- To enable students with good use of tenses
- To learn the use of body language and improve verbal message
- To equip with Types of Teams and Leadership styles -to develop managing skills in corporate world.
- To Acquire skills for placement

Course Outcomes

After undergoing this course students will be able to:

- Explain communication and types of Communication: Managerial, Corporate, Technical & Organizational Communication.
- Distinguish Listening and hearing. Demonstrate various aspects of speaking. Discuss Word formation and types.
- Write a report, essay. Minutes of Meeting. Evaluate current issues and debate
- Use Leadership skills and Team building. Solve Tense exercise.
- Write a job application and CV.

- Discuss E-Mail etiquettes.
- Discuss topic and speak on the spot. Interpret data

Course content

1. Communication; Types of Communication: Managerial, Corporate, Technical & Organizational Communication.

Listening: Types & its Importance. Difference between hearing & listening.

Speaking: Different aspects of Effective Speaking

Word Formation and Types of Word Formation, Word Family.

2. Referencing Skills: Academic Writing: Definition & Tips for writing

Report Writing: Importance. Steps for Report Writing.

Group Discussion: Definition, How GD helps in Student Life & Corporate Life.

Minutes of Meeting: Importance; Steps for writing MOM in Organizations.

3. TEAM & TEAM BUILDING: Definition, Importance, Types of Team; Team Building & Team Dynamics.

Leadership: Styles of Leadership; Characteristics of a good leader, Influence of different forces on leadership.

4. JOB Application, Covering Letter; Resume/CV Writing; Difference between Job Application & Resume.

5. E-mail Etiquettes: Definition, Rules for e-mail etiquettes, Business E-mail etiquettes, Tips for perfecting e-mail etiquettes.

6. ICE Breaking activity and JAM sessions

7. Situational Dialogues/ Role Play (Greetings, enquiring, complaining)

8. Tenses and Subject Verb Concord

9. Extempore, Public Speaking, Debates.

10. Data Interpretation.

Reference(s)

1. Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019) Technical Communication, Cengage Learning, New Delhi

SEMESTER/YEAR	: I/II SEM
COURSE CODE	:20EN1111
TITLE OF THE COURSE	: ENGINEERING GRAPHICS & DESIGN
L:T/A:P:C	: 1: 0:4:3

Course Aim & Summary:

The course aims at introducing engineering graphics as a language of engineers for universal communication. This course covers orthographic projections of points, lines, planes and solids. It also deals with development of surfaces and isometric projections of planes and solids. Students solve problems using manual sketching and professional CAD software for modelling and assembly of simple engineering components from various engineering domains. They work in teams to develop conceptual designs for an identified need.

Course Objectives**The objectives of the Course are:**

- To create awareness and emphasize the need for Engineering Graphics
- To follow basic drawing standards and conventions
- To Introduce free hand sketching as a tool for technical Communication
- To understand the principles of geometrical curves and construct manually
- To learn using professional CAD software for construction of geometry
- To understand the concepts of orthographic and isometric projections
- To construct orthographic projection of points, lines, planes and solids
- To develop the lateral surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components and assembly
- To work in a team for creating conceptual design of products

Course Outcomes

After undergoing this course students will be able to:

- Explain usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings
- Construct points, lines, planes and solids using orthographic projections principles
- Construct geometries of planes and solids using isometric projection principles
- Prepare the lateral surfaces of the given solid by applying the basic concepts
- Construct lateral surfaces of solids using geometry development principles

- Create associative models at the component and assembly levels for product design

Course content

Module 1:

Introduction: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling of figures, symbols and drawing instruments, Introduction to orthographic & perspective projection. Types of projections, Principles of Orthographic projection

Plain & Miscellaneous Curves: Construction of ellipse, parabola, hyperbola, Construction of Tangent and Normal at any point on these curves. Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Construction of Tangent and Normal at any point on these curves.

Module 2:

Projection of Points and Lines: Projections of points located in same quadrant and different quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.

Projection of planes: Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by change of position method.

Module 3:

Projection of Solids: Projection of solids such as prisms, pyramids, cone, cylinder, tetrahedron, Projections of solids with axis perpendicular and parallel to HP and VP, solids with axis inclined to one or both the planes, suspension of solids.

Module 4:

Sections of Solids: Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other, obtaining true shape of section.

Development of Surfaces: Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.

Module 5:

Isometric Projection: Principles of isometric projection, isometric scale, Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions, Conversion of orthographic views into isometric projection and vice versa

Module 6:

Computer Aided Design: Introduction to computer aided drafting and tools to make drawings. Layout of the software, standard tool bar/menus and description, drawing area, dialog boxes and windows, Shortcut menus, setting up and use of Layers, layers to create drawings, customized layers, create, zoom, edit, erase and use changing line lengths through modifying existing lines (extend/lengthen) and other commands

Demonstration of a simple team design project: Product Design- Introduction, stages, Design Geometry and topology of engineered components creation of engineering models and their presentation in standard 3D view. Use of solid-modeling software for creating

associative models at the component and assembly levels; include: simple mechanical components-bolts, nuts, couplings; simple civil

Text Book(s)

1. Gopalakrishna, K. R. (2005) Engineering Graphics, 32nd edition, Subash Publishers Bangalore, India
2. Bhatt N.D., Panchai V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House, Gujarat, India
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education, New Delhi.
4. DSU Text book, Wiley-India Publications, Bangalore

Reference(s)

1. Luzzader, Warren. J and Duff John M., (2005) fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Basant Agarwal and Agarwal C.M., (2008), Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi.

SEMESTER/YEAR : I/II SEM
COURSE CODE : 20EN1105
TITLE OF THE COURSE : ENVIRONMENTAL STUDIES
L:T/A:P:C : 2: 0:0:2

Course Aim

This course aims at creating awareness regarding preservation of environment for providing safe and healthy atmosphere. This course deals with concepts of ecosystem, renewable and non-renewable energy resources, environmental pollution, laws and regulations governing the environment.

Course Objectives

The objectives of the Course are:

- To explain the importance of this course
- To expose engineering students to the basic concepts and principles of environment;
- To have knowledge of the current issues of pollution endangering life on earth
- To educate about the environmental resources, energy, pollution, management, impact assessment and law

Course Outcomes

After undergoing this course students will be able to:

• Delineate basic concepts that govern environmental quality, atmospheric principles and environmental standards;
• Recognize and conversant with sources and nature of pollution types, control and management
• Explain Energy resource types and their environmental implications
• Apply the process of environmental impact assessment and implications of Indian Environment Laws

Course content

Module 1: Basic Concepts of Environment

Scope and importance of environmental studies, Definition of environment- comprehensive understanding of environment, Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Types of xenobiotics: Chemical, Physical, Biological pollutants; Hazard & Risk, Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships- chronic and acute effects, Environmental Standards: AAQS, TLV's, Appraisal, Assessment & Abatement (Recognition, Evaluation & Control) of pollutants- Structure of Atmosphere; Atmospheric inversions, Environmental System.

Air Pollution: Criteria pollutants - Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; SMOG & Air-pollution episodes

Aerosols: Primary & Secondary pollutants, Acid Rain Cycle.

Module 2: Water Treatment

Hydrosphere, Lentic and Lotic Water Systems, Fresh Water as a resource; Rain Water Harvesting, Treatment of potable water, Waste water- Characteristics, Municipal Sewage Water and Treatment.

Waste Management

Types of Wastes: Municipal Solid Waste, Hazardous Waste, Nuclear Waste, Electronic Waste, Biomedical Waste, Solid Waste Management: Landfills, compostingnWater Standards

Module 3: Energy

Types of energy: Conventional sources of energy, fossil fuel, Coal, Nuclear based, Solar, wind, sea-Tidal Wave energy, Geo-Thermal, Non-conventional sources of Energy, Biofuels - biomass, biogas, Natural Gas; Hydrogen as an alternative future source of energy.

Module 4: Disasters & Management

Definition, origin and classification. Natural (Earthquakes, landslides, floods, Cyclones), Man-made disasters (biological, chemical, nuclear, radiological explosions) - definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters, Environment & Health - Occupational Health Hazards, Occupational Diseases, Epidemics, Pandemics, Endemics (Fluoride, Arsenic), Principles and Significance of Sanitation

Module 5: Environmental Impact Assessment (EIA) and Indian acts and regulations

Principles of EIA, Indian Acts and Rules, Wildlife (Protection) Act 1972. Water Act - 1974 (Rules 1975), Forest Conservation Act 1980 (Rules 2003), Air Act -1981 (Rules 1982,1983), Environment Protection Act, 1986

Text Book(s)

1. R.C. Gaur, "Basic Environmental Engineering (2008)", New age international (p) limited, publishers.
2. J. Glynn Henry and Gary. W. Heinke, "Environmental Science and Engineering (2004)", Pretice Hall of India.
3. P. Venugopala Rao, "A Text Book of Environmental Engineering (2012)", PHI Learning Pvt. Ltd.

Reference(s)

1. P.Aarne Vesilind, Susan M.Morgan, Thomson, "Introduction to Environmental Engineering" (2008), Thomson learning, Second Edition, Boston.
2. R Rajagopalan, "Environmental Studies - From Crisis to Cure" (2005) Oxford University Press, New Delhi.
3. R J Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies" (2014), Wiley India Pvt Limited, New Delhi.

SEMESTER/YEAR	: I SEM / I YEAR
COURSE CODE	:20AU0004
TITLE OF THE COURSE	: CONSTITUTION OF INDIA & PROFESSIONAL ETHICS
L : T : P : S/P : C	:2:0: 0:0 :0

Course objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.

Course outcomes

At the end of the course student will be able

- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Municipalities, Panchayats and Cooperative Societies,
- Understand Engineering ethics and responsibilities of Engineers

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

Directive Principles of State Policy & Relevance of Directive Principles State Policy fundamental Duties.

Union Executives - President, Prime Minister Parliament Supreme Court of India.

State Executives - Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th&91st Amendments.

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions.

Powers and functions of Municipalities, Panchyats and Co - Operative Societies.

Text Books:

1. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) PrenticeHall, 19th / 20th Edn., 2001

Reference Books:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

SEMESTER/YEAR	:	I YEAR
COURSE CODE	:	20AU0021
TITLE OF THE COURSE	:	KANNADA KALI - II
L : T : P : S/P : C	:	2:0: 0:0 :0

Course Learning Objectives:

Learners are Non - Kannadigas, so this course will make them,

- To Read and understand the simple words in Kannada language
- To learn Vyavaharika Kannada (Kannada for Communication)
- will create a some interest on Kannada Language and Literature

Lesson 1: Introducing each other - 1. Personal Pronouns, Possessive forms, Interrogative words.

Lesson 2 : Introducing each other - 2. Personal Pronouns, Possessive forms, Yes/No Type Interrogation

Lesson 3 : About Ramanaya. Possessive forms of nons, dubitive question, Relative nouns

Lesson 4 : Enquiring about a room for rent. Qualitative and quantitative adjectives.

Lesson 5 : Enquiring about the college. Predicative forms, locative case.

Lesson 6 : In a hotel Dative case defective verbs.

Lesson 7 : Vegetable market. Numeral, plurals.

Lesson 8 : Planning for a picnic. Imperative, Permissive, hortative.

Lesson 9 : Conversation between Doctor and the patient. Verb- iru, negation - ilia, non - past tense.

Lesson 10: Doctors advise to Patient. Potential forms, no - past continuous.

Lesson 11: Discussing about a film. Past tense, negation.

Lesson 12: About Brindavan Garden. Past tense negation.

Lesson 13: About routine activities of a student. Verbal Participle, reflexive form, negation.

Lesson 14: Telephone conversation. Past and present perfect past continuous and their negation.

Lesson 15: About Halebid, Belur. Relative participle, negation.

Lesson 16: Discussing about examination and future plan. Simple conditional and negative

Lesson 17: Karnataka (Lesson for reading)

Lesson 18: Kannada Bhaashe (Lesson for reading)

Lesson 19: Mana taruva Sangati alia (Lesson for reading)

Lesson 20: bEku bEDagaLu (lesson for reading)

1. Kannada Kali (S^a *£) - dorfcSeKfot aitfsfcs;. A Text Book to I.learn Kannada by Non - Kannadigas who come to study Diploma, Engineering and Health Sciences in Karnataka, satofc Etocaori ftu.a £@c3Gq,ooi>. cSoEJ.
2. Spoken Kannada - ಮಾತನಾಡುವ **top**. ಪ್ರಕಟಣೆ - ಕನ್ನಡ ಸಾಹಿತ್ಯ assess* dorfttedb.
3. Kannada Kirana - ಸೆತಾ: ಪ್ರಕಟಣೆ - ಬೆಂಗಳೂರು ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಆಫ್ ಲಾಂಗ್ವೇಜಸ್, ಬೆಂಗಳೂರು .

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SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2301					
TITLE OF THE COURSE	DISCRETE MATHEMATICS* CAL STRUCTURES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- Solve problems using relations and generating functions.
- Understand and Construct mathematical arguments.
- Use propositional and predicate logic in knowledge representation and program verification.
- Develop recursive algorithms based on mathematical induction.
- Know essential concepts in graph theory and related algorithms.
- Apply knowledge of discrete mathematics in Elementary Number Theory and problem solving.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Classify functions, basic set theory relations.	L4
CO2	Demonstrate the correctness of an argument using propositional and predicate logic, laws and truth tables.	L2
COS	Compare and differentiate graphs in different geometries related to edges.	E4
CO4	Apply mathematical induction, counting principles, recursion, elementary number theory.	L3
CO5	Apply and solve Euclidean Division Algorithm and Chinese Remainder Theorem.	E3

COURSE CONTENT:	
MODULE 1	
9Hrs	
RELATIONS AND FUNCTIONS: Relation and Types of relations. Closure Properties. Equivalence Relations. Partial Ordering Relations, n-ary relations. Functions: one-to-one, onto and invertible functions, sequences, indexed classes of sets, recursively defined functions, cardinality Counting Principles: Permutation, combination, the pigeon hole principle, inclusion-exclusion principle Self - Learning Component: Set theory definition and Properties	

MODULE 2	8Hrs
LOGIC: Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications, predicate logic, theory of inference for propositional logic and predicate logic. Introduction to Predicate Calculus.	
MODULE 3	9Hrs
NUMBER THEORY: Properties of Integers: Introduction, order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations and Chinese Remainder Theorem (CRT).	
MODULE 4	7Hrs
GRAPH THEORY: Graphs and multi-graphs, sub-graphs, isomorphic and homomorphic graphs, paths, connectivity, Euler and Hamilton paths, labelled and weighted graphs, complete, regular and bipartite graphs, planar graphs.	
MODULE 5	9Hrs
TREES AND GRAPH COLORING: Trees: Definitions-properties - fundamental theorems of trees-rooted trees-binary trees-spanning trees- Kruskal's Algorithm- Prims Algorithm- Cut-Set, BFS and DFS. Coloring of planar graphs, Chromatic Number- Chromatic partitioning- The four Color Problem-Five-color and Four-colortheorem-Thickness and crossing.	

TEXT BOOKS :

1. K. H. Rosen. Discrete Mathematics & its Applications. 7th Ed.. Tata McGraw-Hill, 2007.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India (PHI).

REFERENCES:

1. M.Huth and M. Ryan, Logic in Computer Science, Cambridge University N.Press, 2004.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2302					
TITLE OF THE COURSE	DATA STRUCTURES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	I/II	20EN1103	FUNDAMENTALS OF PROGRAMMING

COURSE OBJECTIVES :

- To introduce the concept of data structure and its applications
- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To introduce non-primitive data structures
- To analyse the complexity of a data structure
- To introduce static and dynamic memory allocation using C language
- To explain linear data structures - stack, queue, linked list
- To explain non-linear data structures -trees and graphs
- To train students to design an application as part of the course mini- project using their choice of data structure using C language.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline basic C program design for data structures	L2
CO2	Implement stack & queue data structure and their applications	L3
CO3	Apply concepts of dynamic memory allocation to real-time Problems	L3
CO4	Implement tree data structure and its applications	L3
CO5	Implement graph data structure and its applications	L3
CO6	Outline the concepts of file structures	L2

COURSE CONTENT:	
MODULE 1	8Hrs
INTRODUCTION TO DATA STRUCTURES: Definition, Types, Algorithm Design, C Pointers, C Structure, Array Definition, Representation of Linear Array in Memory, Array Operations (Insertion, Deletion, Search and Traversal), Single Dimensional Arrays, Two Dimensional Arrays, Function Associated with Arrays, Arrays as Parameters, Recursive Functions.	
MODULE 2	9Hrs
INTRODUCTION TO STACK AND QUEUE: Stack: Definition, Array Representation of Stack, Operations Associated with Stacks- Push & Pop, Applications of Stack: Recursion, Polish expressions, Conversion of Infix to Postfix, Infix to Prefix, Postfix Expression Evaluation, Tower of Hanoi. Queue: Definition, Representation of Queues, Operations of Queues- QInsert, QDelete, Priority Queues, Circular Queue.	
MODULE 3	9Hrs
DYNAMIC DATA STRUCTURE: Linked List: Types, Introduction to Singly Linked lists: Representation of Linked Lists in Memory, Traversing, Searching, Insertion & Deletion from Linked List. Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal). Applications: Polynomial Representation & Basic Operations, Stack & Queue Implementation using Linked Lists.	
MODULE 4	9Hrs
TREES & GRAPHS: Trees: Basic Terminology, Binary Trees and their Representation, Complete Binary Trees, Binary Search Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal), Application: Expression Evaluation. Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential Representation of Graphs, Adjacency Matrices, Graph Transversal, Connected Components and Spanning Trees.	
MODULE 5	7Hrs
FILE STRUCTURES: Physical storage media, File Organization, Linked Organization of File, Inverted File, Organization Records into Blocks, Sequential Blocks, Indexing & Hashing, Multilevel Indexing, Tree Index, Random File, Primary Indices, Secondary Indices.	

TEXT BOOKS:

1. AM Tannenbaum, Y Langsam, M J Augentien "Data Structures using C", Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data Structure and Program Design in C" PHI

REFERENCES :

1. Horowitz Anderson-Freed, and Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. DE Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2303					
TITLE OF THE COURSE	DIGITAL ELECTRONICS & LOGIC DESIGN					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	2	42	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- To understand various number systems and conversion from one to other number systems
- To introduce basic postulates of Boolean algebra
- To manipulate expressions into POS or SOP form.
- To introduce the methods for simplifying Boolean expressions like K-Map and Quine Mcclusky
- To understand the concept of don't care conditions and how they can be used to further optimize the logical functions
- To design simple combinational circuits such as multiplexers, decoders, encoders
- To understand the differences between combinational and sequential Logic circuits
- To familiar with basic sequential logic component-SR Latch
- To understand the basics of various types of memories.
- To present the working of various Flip- Flops (T flip-flop, D flip-flop, R-S flip-flop, JK flip-flop)
- To get familiarized with State Diagram, State Table, State Assignment
- To design combinational circuits using programmable logic devices.
- To design sequential circuits such as different types of Counters, Shift Registers

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate the knowledge of binary number systems, logic families, Boolean algebra and logic gates	L2
CO2	Analyze different methods used for simplification of Boolean expressions	L4
CO3	Design combinational logic circuits using combinational logic elements	L3
CO4	Design combinational circuits using Programmable Logic Devices	L3
CO5	Analyze sequential logic elements in the design of synchronous and asynchronous systems	L4
CO6	Design sequential systems composed of standard sequential modules, such as counters and registers	L3

COURSE CONTENT:	
MODULE 1	9Hrs
NUMBER SYSTEMS: BCD number representation, Unsigned and signed number representation, Binary arithmetic. BOOLEAN ALGEBRA AND SIMPLIFICATION: Laws of Boolean algebra, Theorems of Boolean algebra, Boolean/Switching functions and their implementation. SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions. Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.	
MODULE 2	8Hrs
DESIGN OF COMBINATIONAL LOGIC CIRCUITS: Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders, Magnitude comparator, BCD converter, Encoders, Priority encoders.	
MODULE 3	7Hrs
PROGRAMMABLE LOGIC: Programmable Logic Arrays, Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices.	
MODULE 4	9Hrs
INTRODUCTION TO SEQUENTIAL CIRCUITS : Introduction to Sequential Circuits. Combinational Vs sequential circuits, Clock, Clock Triggering, Memory elements and their excitation functions - Latches, T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements, State diagram, state table and state equation, Design of synchronous sequential circuits like Sequence Detectors and binary counters.	
MODULE 5	9Hrs
APPLICATION OF LOGIC CIRCUITS SEQUENTIAL CIRCUITS (REGISTERS AND COUNTERS): Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In -Parallel Out, Universal Shift Register, Applications of Shift Registers, Asynchronous and Synchronous Counters	

TEXT BOOKS :

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition, N. Pearson Education, 2018
2. Donald P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

REFERENCES:

1. D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
2. Charles H. Roth: Fundamentals of Logic Design, Jr., 7th Edition, Cengage Learning, 2014
3. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2304					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
***	***	W	***

COURSE OBJECTIVES :

- To learn data models, conceptualize and depict a database system using ER diagram
- To understand the internal storage structures in a physical DB design
- To know the fundamental concepts of transaction processing techniques

COURSE OUTCOMES

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate the basic elements of a relational database management system	L2
CO2	Identify the data models for relevant problems	L2
CO3	Apply normalization for the development of application software's	L3
CO4	Use Structured Query Language (SQL) for database manipulation.	L3
CO5	Understand transactions and their properties (ACID)	L2
CO6	Design and develop a large database with optimal query processing	L6

COURSE CONTENT:

MODULE 1

8Hrs

Introduction: Purpose of Database System—Views of data-data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.

MODULE 2	9Hrs
Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL -Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses..	
MODULE 3	9Hrs
Database Design: Dependencies and Normal forms, dependency theory -functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF	
MODULE 4	9Hrs
Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.	
MODULES	7Hrs
Embedded SQL: triggers, procedures and database connectivity. Introduction to NoSQL	

TEXT BOOKS :

1. Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", 5thEd, Tata McGraw Hill, 2006.
2. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8thed, Pearson Education, 2006.

REFERENCES :

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addison Wesley, 2007
2. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003
3. S. K. Singh, "Database Systems Concepts, Design and Applications", First T. Edition, Pearson Education, 2006

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2305					
TITLE OF THE COURSE	COMPUTATIONAL THINKING WITH PYT1 HON					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- To understand basic concepts of computational thinking.
- To introduce python programming for problem solving.
- To introduce different debugging and unit testing tools.
- To solve real world problems using python data structures.
- Learn to handle files and exception handling in python.
- To explore Python's object-oriented features.
- To build Web services and Networked programs in python.
- To train students to design an application as part of the course mini- project using computational thinking with python.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand basic concepts of computational thinking.	L2
CO2	Outline basic python programming for problem solving.	L2
CO3	Apply computational thinking to solve real world programs using Python	L3
CO4	Build python programs using core data structures like list, dictionaries and tuples	L3
CO5	Implement object oriented concepts using python	L3
CO6	Design applications related to web services and network Programming.	L3

COURSE CONTENT:	
MODULE 1	
	8Hrs

INTRODUCTION TO COMPUTATIONAL THINKING AND PYTHON: Introduction to computational thinking: Stages of Computational thinking, Design using Flowcharts, Implementation, Testing Python Basics: Values, expressions and statements, Conditional execution, Functions Iterations	
MODULE 2	9Hrs
PYTHON ENVIRONMENT AND DATA STRUCTURES : Python Environment: Usage of Debugging and Unit Testing tools in python, Introduction to Github, Executing the python programs using Jupyter notebooks, Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries	
MODULE 3	9Hrs
PYTHON FILES AND EXCEPTION HANDLING: Files: File types, modes, File functions, File attributes, File positions, Looping over file, Exception Handling: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions	
MODULE 4	9Hrs
PYTHON OBJECTS : Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.	
MODULE 5	7Hrs
Applications of Python Applications: Networked Programs, Using web services	

TEXT BOOKS :

1. "Python for Everybody-Exploring Data Using Python 3", Dr. Charles R. Severance,
2. "Introduction to Computing & Problem Solving with Python",Jeeva Jose,P.Sojan Lal, Khanna Book Publishing; First edition (2019).

REFERENCES :

1. "Computer Science Using Python: A Computational Problem-Solving Focus", Charles Dierbach, Introduction John Wiley, 2012.
2. "Introduction to Computation and Programming Using Python", John V Guttag,Prentice Hall of India, 2015.
3. "How to think like a Computer Scientist, Learning with Python", Allen Downey,Jeffrey Elkner and Chris Meyers, Green Tea Press, 2014.
4. "Learning to Program with Python", Richard L. Halterman, 2011.

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2306					
TITLE OF THE COURSE	AGILE SOFTWARE ENGINEERING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	-	2	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- Agile methodology, Scrums, Sprints.
- Agile testing, test automation, DevOps.

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compare and contrast the differences between Agile and other project management methodologies	L4
CO2	Interpret and apply various principles, phases and activities of the Scrum methodology	L3
CO3	Define the benefits of using an Agile approach to managing projects	L2
CO4	Understand Agile Testing principles for real life situations and learn the basics of SAFe for scaled agile	L2
CO5	Identify and use various tools for Agile development and DevOps principles for CI/CD	L3

COURSE CONTENT:	
MODULE 1	9Hrs
INTRODUCTION TO AGILE : Introduction to Software engineering, SDLC, Software process models- waterfall, V model, Iterative model, Spiral model; Introduction to Agile: Agile versus traditional method comparisons and process tailoring; Introduction to Agile, Various Agile methodologies -Scrum, XP, Lean, and Kanban, Agile Manifesto.	
MODULE 2	9Hrs
SCRUM AND SPRINT: Scrum: Scrum process, roles - Product Owner, Scrum Master, Team, Release manager, Project Manager, product manager, architect, events, and artifacts; Product Inception: Product vision, stakeholders, initial backlog creation; Agile Requirements - User personas, story mapping, user stories, 3Cs, INVEST, acceptance criteria, sprints, requirements, product backlog and backlog grooming; Test First Development; Pair Programming and Code reviews;	

MODULE 3	9Hrs
AGILE PROJECT MANAGEMENT: Sprint Planning, Sprint Reviews, Sprint Retrospectives, Sprint Planning - Agile release and iteration (sprint) planning, Develop Epics and Stories, Estimating Stories, Prioritizing Stories (WSJF technique from SAgile), Iterations/Sprints Overview. Velocity Determination, Iteration Planning Meeting, Iteration, Planning Guidelines, Development, Testing, Daily Stand-up Meetings, Progress Tracking, Velocity Tracking, Monitoring and Controlling: Burn down Charts, Inspect & Adapt (Fishbone Model), Agile Release Train	
MODULE 4	7Hrs
AGILE TESTING : Testing: Functionality Testing, UI Testing(Junit, Sonar), Performance Testing, Security Testing, A/B testing; Agile Testing: Principles of agile testers; The agile testing quadrants, Agile automation, Test automation pyramid; Test Automation Tools - Selenium, Traceability matrix;	
MODULES	8Hrs
DEVOPS: DevOps: Continuous Integration and Continuous Delivery; CI/CD: Jenkins, Git/Github Creating pipelines, Setting up runners Containers and container orchestration (Docker and Kubernetes) for application development and deployment; Build tools - maven; Checking build status; Configuration management - puppet, chef, ansible; Fully Automated Deployment; CM - Continuous monitoring with Nagios; Introduction to DevOps on Cloud	

List of Laboratory/Practical Experiments activities to be conducted :
1. Setting up Devops Environment
2. Writing Requirements Document, Requirement Analysis (user stories)
3. Estimation and Scrum Planning
4. Implementation and Testing Using Iterative Sprint Model
5. Test Automation using Selenium
6. Unit Testing using Junit or Sonar or Python Test framework
7. CI/CD using Jenkins as Orchestrion platform
8. Containerzation using Docker or Kubernetes

TEXT BOOKS :

1. Essential Scrum: A Practical Guide to the Most Popular Agile Process Kenneth S.Rubin 2012, published by Addison-Wesley Professional
2. Agile Software Development: The Cooperative Game Alistair Cockburn 2nd Edition, 2006, Addison-Wesley Professional

REFERENCES:

- 1 Scrum and XP from the Trenches Henrik Kniberg 2nd Edition, 2015, Published by C4Media, publisher of InfoQ.com
2. Agile Project Management: Creating Innovative Products, Second Edition By Jim Highsmith, Addison-Wesley Professional, 2009
3. Agile Project Management: Managing for Success, By James A. Crowder, She 11 i Friess, Springer

2014

4. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, By Andrew Stellman, Jennifer Greene, 2015, O'Reilly
5. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive ... By Sricharan Vadapalli, Packt, 2018
6. Agile Testing: A Practical Guide For Testers And Agile Teams, Lisa Crispin, Janet Gregory, Pearson, 2010
7. More Agile Testing: Learning Journeys for the Whole Team By Janet Gregory, Lisa Crispin, Addison Wesley, 2015
8. DevOps: Puppet, Docker, and Kubernetes By Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2307					
TITLE OF THE COURSE	DATA STRUCTURES LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To implement linear data structures - stack, queue, linked list
- To implement non-linear data structures -trees and graphs

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the programs in C to understand the different concepts of data structures.	L3
CO2	Implement stack & queue data structure and their applications, Analyse the output based on the given input data.	L3
CO3	Implement Conversions of Polish and reverse polish expressions and Record Experimental process and results	L4
CO4	Apply and implement concepts of dynamic memory allocation	L3
CO5	Use the concepts of file structures and communicate results effectively	L3

List of Laboratory/Practical Experiments activities to be conducted

Writing C programs:

1. To perform arithmetic storage/operations using arrays
2. To Implement C programs with concepts of pointers, structures
3. To implement multidimensional array Matrix Multiplication
4. To search element(s) in a multidimensional array
5. To search elements in data structure with different search methods
6. To implement stack , queue and their variations using arrays
7. To implement stack, queue and their variations using linked lists
8. To Implement Linked Lists and variations and use them to store data.
9. To implement graph & binary tree traversal techniques

10. To evaluate/convert infix/prefix/postfix expressions
11. To perform basic file operations

Open-Ended Experiments

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.
3. Mini-Project on applying suitable data structure to a given real-world problem

Textbooks

1. AM Tannenbaum, Y Langsam, M J Augentien "Data Structures using C", Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data Structure and Program Design in C" PHI

Reference Books

1. Horowitz Anderson-Freed, and Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. DE Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	20CS2308					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	*****

COURSE OBJECTIVES :

- Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
- To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To learn the SQL and NoSQL database system.
- To learn and understand various Database Architectures and its use for application development.
- To programme PL/SQL including stored procedures, stored functions, cursors and packages

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Install and configure database systems.	L3
CO2	Analyze database models & entity relationship models.	L3
CO3	Design and implement a database schema for a given problem-domain	L3
CO4	Understand the relational and document type database systems.	L2
CO5	Populate and query a database using SQL DML/DDL commands.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.

2. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.
3. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses.
4. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).
5. Write and execute suitable database triggers .Consider row level and statement level triggers.
6. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
7. Write a PL/SQL block to implement all types of cursor.
8. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
9. Mini project.

TEXT BOOKS :

1. Ramon A. Mata-Toledo, Pauline Cushman, Database management systems, TMGH, ISBN: IS978-0-07-063456-5, 5th Edition.

REFERENCES :

1. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle IOg Black Book, DreamTech.
2. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
3. Dalton Patrik, SQLServer - Black Book, DreamTech Press.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2401					
TITLE OF THE COURSE	PROBABILITY AND STATISTICS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
# ***	Sem/Year ***	Course Code ***	Title of the Course ***

COURSE OBJECTIVES :

- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.
- Calculate statistics related to Random variables and process such as mean, variance, etc.
- Evaluate standard distribution functions such as Poisson's, Normal distributions
- Apply functions of random variables such as characteristic function, moment generating function to calculate statistics.
- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compute and interpret descriptive statistics using numerical and graphical techniques.	L4
CO2	Understand the basic concepts of random variables and find an appropriate distribution for analyzing data specific to an experiment.	L2
CO3	Extend the concepts to multiple random variables and apply them to analyze practical problems.	L2
CO4	Make appropriate decisions using statistical inference that is the central to experimental research.	L4

COURSE CONTENT:	
MODULE 1	6 Hrs
INTRODUCTION TO PROBABILITY THEORY : Basic Notions of Probability, Axiomatic definition, properties, Conditional Probability and Independence - Baye's Theorem.	
MODULE 2	7 Hrs
DISCRETE PROBABILITY DISTRIBUTIONS: Discrete random variables and its properties - Bernoulli trials - Binomial Distribution and its properties - Poisson Distribution and its properties.	

MODULE 3	10 Hrs
CONTINUOUS PROBABILITY DISTRIBUTIONS Continuous random variables and its properties - Gamma Distribution and its properties - Exponential Distribution and its properties - Normal Distribution and its properties. BIVARIATE DISTRIBUTIONS: Bivariate random variables - Joint - Marginal - Conditional distribution.	
MODULE 4	9 Hrs
RANDOM PROCESS AND QUEUING THEORY Classification - Stationary process - Markov process - Markov chain - Poisson process - Random telegraph process. Auto correlation functions - Cross correlation functions - Properties - Power spectral density - Cross spectral density-Properties. Queuing Models, Methods for generating random variables and Validation of random numbers	
MODULES	10 Hrs
TESTING OF HYPOTHESIS Testing of hypothesis - Introduction-Types of errors, critical region, procedure of testing hypothesis- Large sample tests- Ztest for Single Proportion - Difference of Proportion, mean and difference of mean - Small sample tests- Student's t-test, F-test-chi-square test- goodness of fit - independence of attributes.	

TEXT BOOKS :

1. A First Course in Probability, S. Ross, Pearson International Edition, 9th Edition.
2. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 11th Edition.

REFERENCES:

1. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and L.Computer Science Applications, 2nd Ed., Wiley, 2001.
2. Robert V. Hogg, J.W. McKean, and Allen T. Craig: Introduction to Mathematical Statistics, Seventh Edition, Pearson Education, Asia.
3. Rohatgi, V K. and Saleh , A. K. Md. Ehsanes, "An Introduction to Probability and Statistics", (John Wiley and Sons), (2nd edition) (2000)
4. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
5. Probability and Statistics for engineers and scientists, R.,E.Walpole, R.H.Myers, S.L.Mayers and K.Ye, 9th Edition, Pearson Education (2012).
6. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2402					
TITLE OF THE COURSE	OBJECT ORIENTED DESIGN AND PROGRAMMING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	42	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand the basic concepts of object-oriented design techniques.
- Understand the fundamentals of object-oriented programming with Java.
- Draw UML diagrams for the software system.
- Impart basics of multi-threading and database connectivity.
- Develop GUI using event handling techniques in Java.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Apply the concepts of object-oriented programming in software design process.	L3
CO2	Develop Java programs using Java libraries and construct to solve real-time problems.	L3
CO3	Understand, develop and apply various object-oriented features using Java to solve computational problems	L2
CO4	Implement exception handling and JDBC connectivity in Java.	L3
CO5	Build an event-oriented GUI (graphical user interface).	L6

COURSE CONTENT:	
MODULE 1	09 Hrs
An Overview of Object-Oriented Systems Development: Introduction; Two Orthogonal Views of the Software; Object-Oriented Systems Development Methodology; Why an	

Object-Oriented? Overview of the Unified Approach. **Object Basics:** Introduction; An Object-Oriented Philosophy; Objects; Objects are Grouped in Classes; **Attributes:** Object State and Properties; Object behaviour and Methods; Object Respond to Messages; Encapsulation and Information Hiding; **Class Hierarchy:** Inheritance; Multiple Inheritance; **Polymorphism;** Object Relationships and Associations: Consumer-Producer Association; Aggregation and Object Containment; **Case Study** - A Payroll Program; **Object-Oriented Systems Development Life Cycle:** Introduction; Software Development Process; Building High-Quality Software; Object-Oriented Systems Development: A Use Case Driven Approach; Reusability.

MODULE 2	08 Hrs

Unified Modelling Language introduction; Static and Dynamic models; Why Modeling? Introduction to the UML; UML Diagrams; UML Class Diagram; Use-Case Diagram. **Introduction to Java:** Java's Magic: The Bytecode; JVM; Object-Oriented Programming; Simple Java programs; Two Control Statements; Lexical Issues; **Data Types; Variables, Arrays and String constructors; Operators; Control Statements; Introducing Classes:** Class Fundamentals; objects; methods; constructors; this Keyword; Garbage Collection; finalize() method; Parameter Passing; Overloading; Access Control Keywords. Inheritance basics; method overriding; abstract classes; Packages and interfaces. Exception handling fundamentals; multiple catch; nested try statements.

MODULE 3	09 Hrs

Multi-Threaded Programming :Multi-Threaded Programming: Java Thread Model; The main Thread; Creating a thread and multiple threads; Extending threads; Implementing Runnable; Synchronization; Inter Thread Communication; producer consumer problem. **Input/Output:** I/O Basic; Reading console input Writing Console output.

MODULE 4	08 Hrs

Event and GUI Programming:Introducing Swing; The Origins of Swing; Swing Is Built on the AWT; Two Key Swing Features; The MVC Connection; Components and Containers; The Swing Packages; A Simple Swing Application; Event Handling; J Label; JTextField; JButton

MODULE 5	08 Hrs

Database Access:
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet.

TEXT BOOK:

1. Bahrami A.; Object Oriented Systems Development using the Unified Modeling Language; McGraw Hill; 1999.
2. Schildt; Herbert. Java The Complete Reference; 8th Edition. US: McGraw-Hill Osborne Media; 2011.
3. Jim Keogh; J2EE: The Complete Reference; McGraw Hill Education in 2002.

REFERENCES:

1. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
- 2.Y. Daniel Liang, Introduction to Java Programming, 7th edition, Pearson, 2013.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2403					
TITLE OF THE COURSE	PRINCIPLES OF MICROPROCESSORS & COMPUTER ORGANIZATION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	4	-	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES:

- To introduce the architecture of 8086
- To understand the importance and function of each pin of 8086 Microprocessor
- To familiarize with the architecture of 8086 microprocessor and its operation
- To understand the various addressing modes required for assembly language
- Programming and to calculate the physical address.
- To learn the 8086 instruction set and write 8086 Assembly level programs
- To understand the importance of different peripheral devices and their interfacing to 8086
- Understand the concepts of Hardwired control and micro programmed control.
- To explain the current state of art in memory system design
- Discuss the concept of memory organization.
- Summarize the types of memory.
- Learn about various I/O devices and the I/O interface.
- Learn the different types of serial communication techniques.
- To understand DMA technique
- To provide the knowledge on Instruction Level Parallelism
- To understand the concepts of pipelining techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify the basic building blocks of 8086 microprocessor and use the addressing modes for executing programs efficiently	L2
CO2	Develop 8086 assembly language programs using modern assembler tools	L3
CO3	Discuss the computer arithmetic and design algorithms for various Arithmetic operations.	L2
CO4	Design data part and control part of a processor	L3
CO5	Analyze the performance of various classes of Memories	L4
CO6	Understand pipeline & parallel processing	L2

COURSE CONTENT:	
MODULE 1	8 Hrs
Introduction to Microprocessor & its Architecture: Introduction-Evolution of Microprocessor, The Microprocessor-Based Personal Computer Systems, Internal Microprocessor Architecture, Real mode memory addressing, Memory paging, 8086 pin diagram, Internal Architecture of 8086, Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing, Instruction formats	
MODULE 2	12 Hrs
Programming 8086: Assembler directives, Data Movement Instructions, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group, Assembly language programming with 8086, macros, procedures	
MODULE 3	10 Hrs
Processor Organization: Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle. Execution cycle in terms machine instructions. Information representation, Floating point representation (IEEE754), computer arithmetic and their implementation; Data Part Design: Fixed-Point Arithmetic-Addition, Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path, Control Part Design: Control unit design; Hardwired and Micro programmed Control unit. Discussions about RISC versus CISC architectures.	
MODULE 4	12 Hrs
Memory Technology: Memory hierarchy, static and dynamic memory, RAM and ROM chips, Memory address map, Auxiliary Memory, Associative Memory, Cache Memory and organization. Input/Output Organization: Peripheral devices, Input-Output Interface; I/O Bus and Interface Modules, Isolated versus Memory-Mapped I/O, Example of an VO interface unit, keyboard interface, Modes of Transfer; Programmed I/O, Interrupt-initiated I/O, Direct memory access (DMA)	
MODULE 5	10 Hrs
Pipelining: Basic Concepts, Arithmetic Pipeline, Instruction Pipeline; Four-Segment Instruction Pipeline, Pipeline hazards and their resolution, Parallel Processing; Flynn's classification, Multicore architectures, Introduction to Graphics Processing Units, Example: NVIDIA GPU Architecture	

TEXT BOOK:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009
2. Mano, Morris M. Computer system architecture. Dorling Kindsley Pearson, 2005.

REFERENCES:

1. Krishna Kant, "MICROPROCESSORS AND MICROCONTROLLERS Architecture, programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.
2. Douglas V Hall, "MICROPROCESSORS AND INTERFACING, PROGRAMMING AND HARDWARE" TMH, 2006.
3. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
5. V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , Computer Organization ,McGraw-Hill series 2002
6. Hayes, J.P , Computer Architecture and Organization, McGraw-Hill, 1998
7. Vincent P. Heuring and Harry F. Jordan , Computer Systems Design and Architecture (2nd Edition), Dec, 2003
8. David Patterson and John Hennessey, Computer Organization and Design, Elsevier. 2008
9. Comer, Douglas. Essentials of computer architecture. Chapman and Hall/CRC, 2017.
10. Hord, R. Michael. Parallel supercomputing in MIMD architectures. CRC press, 2018.
11. Tanenbaum, Andrew S. Structured computer organization. Pearson Education India, 2016.
12. William Stallings-Computer Organization and Architecture, Seventh Edition, Pearson Education

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2404					
TITLE OF THE COURSE	FINITE AUTOMATA AND FORMAL LANGUAGES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	2	50	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES :

- To learn general theory of automata, properties of regular sets and regular expressions.
- To understand basics of formal languages.
- To know push-down automata, context- free languages, Turing machines.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the concept of Automata	L1
CO2	Explain the concept of Regular Expression, languages and abstract machines to recognize them	L2
CO3	Know the generalized computation model and different types Computation	L2

COURSE CONTENT:	
MODULE 1	9Hrs
Introduction to Finite Automata: Study and Central concepts of automata theory, An informal picture of finite automata, deterministic and non-deterministic finite automata, applications of finite automata, finite automata with epsilon - transitions.	
MODULE 2	12Hrs
Regular expression and languages: Regular expressions, finite automata and regular expressions, algebraic laws of regular expressions, applications of regular expressions such as Grep, and Lex etc.. Properties of Regular Languages: closure properties of regular languages, Pumping Lemma, equivalence and minimization of automata	

MODULE 3	10Hrs
Context - free Grammars and Languages: Context free grammars, Context-free languages, Parse trees, Ambiguity in grammars and languages Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata	
MODULE 4	9Hrs
Properties of Context-Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages. Applications of CFG - such as spec of programming languages, parsing techniques, and Yacc	
MODULE 5	10Hrs
Introduction to Turing Machine- The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, restricted Turing Machines, Turing Machines and Computers. Chomsky hierarchy	

TEXT BOOKS :

1. Daniel I. A. Cohen, Introduction to Computer Theory, 2nd Edition, Wiley India Student Edition, 2008.
2. J.E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edn. Pearson Education , New Delhi 2008

REFERENCES :

1. K.L.P. Misra and N. Chandrashekar. Theory of Computer Science- Automata, Languages and Computation, 3rd Edn. PHI, New Delhi, 2007
2. C. Martin - Introduction to Languages and the Theory of Computation 2ndEdn, TMH, New Delhi, 2000.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2405					
TITLE OF THE COURSE	INTRODUCTION TO NETWORKS AND CYBERSECURITY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
Prerequisite Courses (if any)						
#	Sem/Year		Course Code	Title of the Course		
***	3		***	42		3

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- Understand the basic concepts of cyber security, how it has evolved, and some key techniques used today.
- Have an insight view of Security, Cryptography, Malware, IDS, Secure Programming etc
- Explore the subject through prescribed book, case studies, seminars and Assignments.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand and explore the basics of Computer Networks and working principles.	L2
CO2	Understand the concepts of Network security corresponding to various Internet Layers.	L2
CO3	Determine appropriate mechanisms for protecting the Network.	L2

COURSE CONTENT:	
MODULE 1	9Hrs
Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet Architecture; Comparison of the OSI and TCP/IP reference model. Top-down approach Cybersecurity: Basics of Cyber Security-Attacks, Vulnerabilities and Threats. Need for Network Security, Data Security and physical security.	
MODULE 2	9 Hrs
Application Layer- Introduction, providing services, Applications layer paradigms, Client server model, Standard client-server application-HTTP, DNS, SSH. Malware Detection System, Types of Malware, Viruses & Counter Measures, Worms, Bots. E-mail Security: PGP, S/MIME. Secure socket programming using UDP and TCP.	
MODULE 3	9 Hrs

Transport Level Security: Functionality and services, TCP and UDP basics, Principles of Cryptography, Web Security Considerations, Secure Sockets Layer (SSL), Transport Layer Security, Data/Message Integrity and Digital Signatures.	
MODULE 4	9 Hrs
Network Layer Security: Network Security and Services, IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Internet Key Exchange. Virtual Private Network (VPN), Wireless Networks Security.	
MODULES	9 Hrs
Data Link Layer: LLC and MAC Sublayer services, Error detection and correction Techniques. Physical Layer: Introduction to Guided transmission media and wireless transmission media. Transmission mode, Classification of networks. Firewall, Intrusion Detection System (IDS)	

TEXT BOOK:

1. Computer Networking- A top-down approach- James F Kurose and Keith W Ross,6th Edition, Pearson Education.
2. Computer Security- Principles and Practice, William Stalling, Laurie Brown 4th Edition, Pearson

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking -, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. James Graham, Richard Howard, Ryan Olson- Cyber Security Essentials CRC Press.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2406					
TITLE OF THE COURSE	FULL STACK DEVELOPMENT					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	-	2	42	3

Prerequisite Courses			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

1. Understand the major areas and challenges of web programming..
2. To create websites using HTML5, CSS3, JavaScript
3. Front end framework for developing Interactive WebApp using ReactJS
4. Understand server-side scripting language-Node.JS
5. Latest Framework for fast API development using GraphQL

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Know the fundamentals of front end web technologies like HTML5 and CSS3.	L2
CO2	Use of ReactJS a javascript library to build UI components	L3
CO3	Building real world application using Node.Js,Express	L3
CO4	Develop a fully functioning website and deploy on a web server.	L5

COURSE CONTENT:	
MODULE 1	
8 Hrs	
Markup Language (HTML5), CSS3 Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code - Anchors - Backgrounds - Images - Hyperlinks - Lists -Tables - HTML Forms, Video & Audio tag CSS3: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; Background images, Conflict	

Resolution, CSS box model, CSS3 features: Box Shadow, Opacity, Rounded corners, Attribute selector	
MODULE 2	9 Hrs
Client-Side Scripting: JavaScript, JSON JavaScript Basics — Arrays - Functions - JavaScript objects — HTML DOM - DOM methods — Events - Regular Expressions , JSON	
MODULE 3	9 Hrs
NodeJS Introduction to Node JS, Setup Dev Environment, Node JS Modules, Node Package Manager, File System, Debugging Node JS Application, Events, Express.JS, Database Connectivity, MVC Architecture In Node Js Applications	
MODULE 4	10 Hrs
React JS React.JS: Introducing React ,Main Principles of React, Building your first react app, Components in React, Transferring properties, Dealing with State, The Component life cycle, Virtual DOM, JSX	
MODULES	9 Hrs
GraphQL Introduction to GraphQL, GraphQL Vs. REST, GraphQL Vs. SQL, Your First GraphQL Query, Complex Types - Unions, Fragments, Interfaces, Graph Nodes, GraphQL with JavaScript, GraphQL with React, GraphQL Server-Exercise Problems	

Text Books:

1. Robert W. Sebesta, Programming the World Wide Web ,7th Edition, Pearson Education, 2008.
2. Basarat Ali Syed - Beginning Node.js-Apress ,2014.
3. Anthony Accomazzo, Ari Lerner, Clay Allsopp, David Guttman, Tyler McGinnis, Nate Murray, FullStack React - The Complete Guide to ReactJS & Friends, Fullstack.io, 2017

References:

1. Lionel Lopez, React Quickstart Step-by-Step Guide to Learning React Javascript Library
 2. Kirupa Chinnathambi, JavaScript Absolute Beginner's Guide, 1st Edition, 2017.
 3. Robert W Sebesta, Pearson, Programming the World Wide Web, 7th Edition, 2013.
 4. Kirupa Chinnathambi, Learning React, 1 Edition, Addison-Wesley Professional
 5. Mark Pilgrim, HTML5Up and Running, O'Reilly, 1st Edition, 2012.
- <https://reacthandbook.com/>

SEMESTER	IV
YEAR	II
COURSE CODE	20CS2407

TITLE OF THE COURSE	OBJECT ORIENTED PROGRAMMING LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
	**	**	****

COURSE OBJECTIVES :

- To learn an object oriented way of solving problems using java.
- To write Java programs using multithreading concepts and handle exceptions
- To write Java programs that connects to a database and be able to perform various operations.
- To create the Graphical User Interface using AWT Components & Swing Components.

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Develop simple java programs that make use of classes and objects	L3
CO2	Write Java application programs using OOP principles and proper program structuring.	L3
CO3	Make use of inheritance and interfaces to develop java application	L3
CO4	Model exception handling, multi threading concepts in java	L3
CO5	Create the Graphical User Interface based application programs by utilizing event handling features and Swing in Java	L3
CO6	Develop Java program that connects to a database and be able to perform various operations.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Basic programs using data types, operators, and control statements in Java.
2. Basic programs using Arrays, Strings in java
3. Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism and garbage collection
4. Programs involving: Exception handling, Multi-threading in Java
5. Programs involving: Packages, Interfaces in Java
6. Programs involving: Input and Output in Java
7. GUI Programming in Java
8. Programs involving : Database connectivity in Java
9. Mini Project

TEXT BOOKS :

1. Bahrami A.; Object Oriented Systems Development using the Unified Modeling Language; McGraw Hill; 1999.
2. Schildt; Herbert. Java The Complete Reference; 8th Edition. US: McGraw-Hill Osborne Media; 2011.
3. Jim Keogh; J2EE: The Complete Reference; McGraw Hill Education in 2002.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CS2408					
TITLE OF THE COURSE	MICROPROCESSORS LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	*****

COURSE OBJECTIVES :

- To develop and execute variety of assembly language programs of Intel 8086 including arithmetic and logical, sorting, searching, and string manipulation operations
- To develop and execute the assembly language programs for interfacing Intel 8086 with peripheral devices.

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Implement 8086 assembly language programs for microprocessor application using 8086 training boards	L3
CO2	Implement 8086 assembly language programs for microprocessor application using assembler and debuggers	L3
CO3	Design interfacing of various peripherals with 8086 microprocessor for simple applications	L3
CO4	Use Macros and Procedures in 8086 Programs	L3
CO5	Use assembly language and debugging tools when writing programs for a microprocessor	L3
CO6	Communicate effectively on the work done in the laboratory using formal report	L3

List of Laboratory/Practical Experiments activities to be conducted
Part-A: Software Programs Using Microprocessor Trainer Kit i) Programs involving : arithmetic operations, sorting ii) Programs on : code conversion (BCD TO HEX, Binary to ASCII, Binary to Gray) iii) Programs involving - Bit manipulation like checking: - Whether given data is positive or negative - Whether given data is odd or even

3. Logical 1's and 0's in a given data
Part- B: Software Programs Using MASM/TASM software i) Programs on : searching and sorting ii) Programs on : palindrome, string comparison iii) Programs on : current time display, Decimal up-counter display
Part-C: Hardware Programs to interface microprocessor with various peripherals Using Microprocessor Trainer Kit i) DC Motor Interface ii) Stepper Motor Interface iii) Matrix Keypad Interface iv) 7 Segment Display Interface

TEXT BOOKS :

1. Microprocessor and Interfacing - Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3501					
TITLE OF THE COURSE	COMPUTER NETWORKS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	2	-	52	4

Perquisite Courses (if any)			
#	Sem /Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- To Understand the working principle of layering structure and basic network components
- To explore the features of each layer by various approach and methods

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand and explore the basics of Computer Networks and physical layer	L2
CO2	Understand about data link layer and its protocols	L2
CO3	Understand about routing mechanisms and different routing protocols	L2
CO4	Identify the issues of Transport layer to analyse the congestion control mechanism	L2
CO5	Explain principles of application layer protocols	L2

COURSE CONTENT	
MODULE 1: Overview of Networks	9 Hrs
Network Components- Network Physical Structure, Classification of networks (1LAN-MAN-WAN), Protocols and Standards, Data representation and data flow, Layered Architecture — Comparison of the OSI and TCP/IP reference model. Physical Layer: Introduction to wired and wireless transmission media. Transm ission mode (Serial/Parallel signals, Analog/Digital Signals and Periodic/Aperiodic Signals), Line coding Schemes.	
MODULE 2: Data Link Layer	9 Hrs

Data Link Layer — MAC (Media Access Control) and LLC (Logical Link Control) sublayer Functionalities- Design Issues: Framing - Flow control (Simplest protocol, Stop and wait, sliding window) - Error control (CRC, Hamming code) — Ethernet Basics-Multi Access Protocols: ALOHA, CSMA/CD, Connecting Devices: Hubs, Bridges, Switches, Routers, and Gateways	
MODULE 3: Network Layer	8 Hrs
Network Layer Design issues, Routing Protocol Basics, Routing Algorithm (Distance Vector Routing, Link State Routing and Hierarchical Routing). IP addressing, IP Packet format IPV4, IPV6 and IP Tunneling. Congestion control algorithms, QoS (Traffic Shaping, Packet Scheduling).	
MODULE 4: Transport Layer	7 Hrs
Transport Layer functions- Multiplexing and Demultiplexing. Introduction to TCP and UDP, The TCP Service Model, The TCP Segment Header, The TCP Connection Management, TCP Flow Control- Sliding Window, TCP Congestion Control, User Datagram Protocol	
MODULE 5: Application Layer	6 Hrs
Principles of Network Applications, WEB and HTTP, FTP, E-MAIL(SMTP, POP3), TELNET, DNS, SNMP	

List of Laboratory/Practical Experiments activities to be conducted (13 Hrs)	
PART A	
1. Implement three nodes point - to - point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped. 2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion. 3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination. 4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets. 5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent Environment. 6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.	
PARTB	
Implement the following in Java:	
7. Write a program for error detecting code using CRC. 8. Write a program to find the shortest path between vertices using bellman-ford algorithm. 9. Using TCP/IP sockets, write a client — server program to make the client send the	

file name and to make the server send back the contents of the requested file if present. Implement the above program using as message queues or FIFOs as IPC channels.

10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using a leaky bucket algorithm.

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition, Pearson Education.

REFERENCES:

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Seventh Edition, Pearson Education, 2017.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
3. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2014.

SEMESTER	V

YEAR	III					
COURSE CODE	20CS3502					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Y ear	Course Code	Title of the Course
	**	***	***

COURSE OBJECTIVES:

- To introduce and implement various techniques for designing algorithms and advanced data structures
- To learn space and time complexity analysis of algorithms.
- To understand the Divide and conquer design strategy and the Greedy Technique
- To understand the concepts of Dynamic Programming Applications
- Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline the overview of Data structures and Algorithms	L1
CO2	Understand the different Algorithmic Design strategies	L2
CO3	Apply the Design principles and concepts to Algorithmic design	L3
CO4	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO5	Analyse the efficiency of Algorithms using Time and Space complexity theory	L4
CO6	Implement an existing algorithm to improve the run time efficiency	L3

COURSE CONTENT:	
MODULE 1: INTRODUCTION	8 Hrs
The role of Algorithms in Computing, Running time analysis — recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case complexity	
MODULE 2: DIVIDE AND CONQUER	9 Hrs
Recursive algorithms, Divide-and-Conquer recurrences, Methods for solving recurrences: substitution method, recursion tree method and the Master method. Examples-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication. GREEDY METHOD Minimum cost spanning tree, Knapsack problem, Fractional knapsack	

MODULE 3: DYNAMIC PROGRAMMING	9 Hrs
Integral knapsack (contrasted with the fractional variant: 0/1 knapsack), longest increasing subsequence, All pair shortest path in graph, Matrix chain multiplication, Travelling salesman Problem	
MODULE 4: APPLICATION OF GRAPH TRAVERSAL TECHNIQUES	7 Hrs
Recall representation of graphs, BFS, DFS, connected components, Strongly-connected components of DAGs, Kosaraju's algorithm 1 and 2, Applications.	
MODULE 5: REASONING ABOUT ALGORITHMS	6 Hrs
Complexity Analysis (Polynomial vs Non-Polynomial time complexity), P, NP-hard and NP-Completeness, Reductions.	

TEXT BOOK:

1. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012
2. Sara Basse, A. V. Gelder, "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley.
3. J.E Hopcroft, J.D Ullman, "Design and analysis of Computer algorithms", Pearson Education, 2009.
4. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008

SEMESTER	V			
YEAR	III			
COURSE CODE	20CS3503			
TITLE OF THE COURSE	OPERATING SYSTEMS			
SCHEME OF	Lecture	Tutorial	Practical Seminar/Projects	Total Credits

INSTRUCTION	Hours	Hours	Hours	Hours	Hours	
	3	1	-	-	52	4

Perequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	***	***	****

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various Memory and Virtual memory management, File system and storage techniques.
- To discuss the goals and principles of protection in a modern computer system.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Demonstrate need for OS and different types of OS	L2
CO 2	Analyze the performance of scheduling algorithms for the given problems	L4
CO 3	Demonstrate Process Coordination and synchronization techniques.	L2
CO4	Apply the deadlock handling mechanisms to solve the given problem	L3
CO 5	Apply suitable techniques for management of different Resources	L3
CO 6	Understand the principles of protection and security Mechanisms	L2

COURSE CONTENT:	
MODULE 1: OS Overview and System Structure	10 Hrs
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Computing environments. Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines;	
MODULE 2: Process Management	12 Hrs
Process Management: Process concept; Process scheduling; Operations on processes. Multi-threaded Programming: Overview; Multithreading models; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms.	

MODULE 3: Process Coordination	10 Hrs
Process Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	
MODULE 4: Memory Management	10Hrs
Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.	
MODULE 5: File System and Secondary Storage Structure	10 Hrs
File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing. Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection and Security: Protection: Goals of protection, Principles of protection, System Security: The Security Problem, Program Threats, System and Network Threats.	

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.

SEMESTER	V					
YEAR	III					
COURSE CODE	20CS3504					
TITLE OF THE COURSE	MACHINE LEARNING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Cr ed

						its
	3	-	2	-	52	4

Perequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	****

COURSE OBJECTIVES:

- Define machine learning and understand the basic theory underlying machine learning.
- To understand the working principle of Machine Learning Algorithms
- To apply various techniques of Machine Learning Algorithms
- Perform statistical analysis of machine learning techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Taxonomy Level
CO1	Describe the basic concepts and different types of Machine Learning	L2
CO2	Explore and analyse the mathematics behind Machine Learning algorithms	L2
CO3	Apply the design principles and concepts of Machine Learning Algorithms	L3
CO4	Apply effectively Unsupervised Machine Learning algorithms and various learning techniques for appropriate applications.	L3
CO5	Explore, analyse and validate the different Machine Learning algorithms	L3

COURSE CONTENT:

MODULE 1: Introduction to Machine Learning	7Hrs
Well posed learning problems, Designing a Learning system. Introduction to AI, Machine learning and Deep learning with applications. Types of learning: supervised, unsupervised and reinforcement learning. Perspective and Issues in Machine Learning.	

Classical paradigm of solving learning problems, The learning problems—classes and types of learning, fundamental of statistical learning and its framework. Introduction to feature representation and extraction.	
MODULE 2: Mathematics for Machine Learning	8Hrs
Introduction to Statics Probability (joint probability, conditional probability, Bayes theorem, different distributions, univariate and multivariate Gaussian distribution, PDF, MLE, Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals. Difference in error of two hypothesis, Comparing learning algorithms.	
MODULE 3: Supervised Learning	9Hrs
Introduction to Supervised Learning, Introduction to Perceptron model and its adaptive learning algorithms (gradient Decent and Stochastic Gradient Decent), Introduction to classification, Naive Bayes classification Binary and multi class Classification, decision trees and random forest. Regression (methods of function estimation) —Linear regression and Non-linear regression, logistic regression, Introduction To Kernel Based Methods of machine learning: K-Nearest neighbourhood , kernel functions, SVM, Introduction to ensemble based learning methods	
MODULE 4: Unsupervised Learning	8 Hrs
Introduction to Unsupervised Learning, Clustering (hard and soft clustering) Hierarchal clustering: K-means, Fuzzy C-Means (FCM) algorithm, Gaussian mixture models (GMM), Expectation Maximization algorithm, feature Engineering in Machine Learning, Dimensionality reduction, Linear Discriminant Analysis and Principle Component Analysis.	
MODULE 5: Model Selection	7Hrs
Machine Learning model validation - Confusion Matrix, Accuracy, Precision, F score, Cost function, Machine Learning Optimization algorithms: Gradient descent, stochastic GD. Regularization: Normalization and Standardization overfitting, underfitting, optimal fit, bias, variance, cross-validation.	
List of Laboratory/Practical Experiments activities to be conducted (13 Hrs)	
1. Implementation of linear and logistic regression 2. Implementation of SVM, KNN, Naïve Bayes ML algorithms 3. Implementation of Decision trees, Random Forest classifiers 4. Implement ensemble algorithms. 5. Implementation of different clustering algorithms and PCA Implementation of different neural networks Capstone project in specific domains (Health care, Transportation, Telecom etc.)	

TEXT BOOKS;

- I. Thomas M. Mitchell, Machine Learning, McGraw- Hill, Inc. New York. ISBN: 0070428077 9780070428072.
2. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series). The MIT Press; second edition, 2009.
2. V. N. Vapnik “ The Nature of statistical Learning”

SEMESTER	V					
YEAR	III					
COURSE CODE	20CT3501					
TITLE OF THE COURSE	PRODUCT ENGINEERING & ENTREPRENEURSHIP					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	-	-	02	39	03

COURSE OBJECTIVES:

- Experience with a set of tools and methods for product engineering
- Knowledge of the role of multiple functions in creating a new product
- Ability to coordinate multiple, interdisciplinary tasks to achieve a common objective
- Emphasis of specific knowledge from other courses through practice and reflection in an action-oriented setting

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify customer needs and pain points	LI
CO2	Generate concept & validate idea	L3
CO3	Use design thinking to architect a product	L3
CO4	Create a new product/prototype	L3
CO5	Pitch the product to Incubation Centres @ DSU	L2

COURSE CONTENT:	
Module-1:	
Introduction, Product Development Process and Organization, Opportunity Identification, Product Planning, Identifying Customer Needs	
Module-2:	
Product Specifications, Concept Generation, Lean Thinking, Concept Selection. Concept Testing, Value on Product Development, Waste in Product Development	
Module-3:	
Product Architecture, Industrial Design, Design for Environment, Design for Manufacturing and Supply Chain	
Module-4:	

Prototyping, Robust Design, Patents and Intellectual Property, Service Design, Product Development Economies, Product Management	
Module-5:	
Business Plan, Business Model Canvas	
	4 Hrs

PROJECT DELIVERABLES

1. Proposal Handout & Presentation a. The Problem b. Need c. Existing Alternatives d. Potential Market	13 Hours
2. Wireframe Sketches, Target Specifications a. List Critical Customer Needs b. Fora., Prepare a List of Target Specifications c. Prepare Wireframe	
3. Create App/Website	
4. Business Model	
5. Register your business	

TEXTBOOKS:

1. Ulrich Karl T, Eppinger Steve D., and Yang, Maria C., Product Design and Development, 7th Edition, McGraw-Hill Education 2020
2. Robin McKenzie, Design Theory: An Introduction for Product Design and Engineering, 1st Edition, July 2014

REFERENCE BOOKS

1. Pessoa, Marcus, Trabasso, Luis Gonzaga, The Lean Product Design and Development Journey — A Practical View, Springer International Publishing, 2017
2. Ali Jamnia, Introduction to Product Design and Development for Engineers, 1st Edition, CRC Press, June 2018
3. Product Design and Development, MIT Open Courseware -<https://ocw.mit.edu/courses/sloanschool-of-management/15-783j-product-design-anddevelopment-spring-2006/index.htm>

SEMESTER	V
YEAR	III

COURSE CODE	20CS3505					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	****	****	****

COURSE OBJECTIVES:

- To learn mathematical background for analysis of algorithm
- To understand the concept of designing an algorithm.
- To analyze the algorithms using space and time complexity.
- To learn dynamic programming and greedy method.
- To acquire knowledge of various applied algorithms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the Algorithms to understand the different concepts.	L3
CO2	Apply the Design principles and concepts to Algorithmic design	L3
CO3	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO4	Analyse worst-case and best — case running times of algorithms using asymptotic analysis.	L4
CO5	Implement an existing algorithm to improve the run time efficiency	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design a C program to solve the Tower of Hanoi. Compute the time complexity. 2. Apply divide and conquer method and Design a C program to search an element in a given array and Compute the time complexity. Binary search - recursive method 3. Apply Divide and Conquer method Design a C program to sort an array using Merge sort algorithm and compute its time complexity 4. Apply Divide and Conquer method Design a C program to sort an array using Quick

sort algorithm and compute its time complexity.

5. Apply Greedy method and Design a C program to find the minimum cost spanning tree using Prim's and Kruskal's Algorithm and compute its complexity
6. Apply Dynamic Programming Technique and Design a C program to find the all pairs shortest path using Dijkstra's Algorithm and computes its complexity
7. Design a C program to find the optimal solution of 0-1 knapsack problem using dynamic programming and Compute the time complexity
8. Design a C program to solve the Travelling Salesman Problem using dynamic programming and compute its time complexity.
9. Design a C program to find the longest common subsequence using dynamic programming and compute its time complexity
10. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

TEXT BOOK:

1. Levitin A, "Introduction to the Design And Analysis of Algorithms", Pearson Education, 2008.
2. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication, 2015.
2. Goodrich M.T., R Tomassia, "Algorithm Design foundations Analysis and Internet Examples", John Wiley and Sons, 2006.
3. Sara Basse, A. V. Gelder, "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley.

SEMESTER	V
YEAR	III
COURSE CODE	20CS3506
TITLE OF THE	OPERATING SYSTEMS LAB

COURSE						
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Pertuisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	***	****

COURSE OBJECTIVES:

- To learn creating process and Threads
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Implement System Calls	L2
CO2	Compare the performance of various CPU Scheduling Algorithms	L3
CO3	Analyze Deadlock avoidance and Detection Algorithms	L3
CO4	implement Semaphores	L2
CO5	Analyze the performance of the various Page Replacement Algorithms	L3
CO6	Implement File Organization and File Allocation Strategies	L2

List of Laboratory/Practical Experiments activities to be conducted		
Exp.	Division of	List of Experiments

No	Experiments	
1	System Calls	Write a C program to create a new process that exec a new program using system calls fork(), execlp() & wait()
2		Write a C program to display P1D and PPID using system calls getpid () & getppid ()
3		Write a C program using I/O system calls open(), read() & write() to copy contents of one file to another file
4	Process Management	Write a C program to implement multithreaded program using pthreads
5		Write C program to simulate the following CPU scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin
6	Process synchronization	Write a C program to simulate producer-consumer problem using semaphores
7	Deadlock	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
8		Write a C program to simulate deadlock detection.
9	Memory Management	Write a C program to simulate paging technique of memory management
10		Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
11	I/O System	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory
12		Write a C program to simulate the following file allocation strategies, a) Sequential b) Indexed

TEXT BOOKS:

I. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1- Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.

2- [Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997](#)

SEMESTER	V
YEAR	III
COURSE CODE	20CT3503
TITLE OF THE COURSE	Virtual Reality & Game-Theoretic Simulation

SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	--	--	2	39	03

COURSE OBJECTIVES:

- Develop professional VR apps using Unity 3D
- Run Unity 3D applications in VR on a smartphone
- Build tools to help users navigate 3D environments
- Learn key usability goals and pitfalls for Virtual Reality

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Develop professional VR apps using Unity 3D	L2
CO2	Run Unity 3D applications in VR on a smartphone	L2
CO3	Create a 3D environment from scratch in game engines	L2

COURSE CONTENT:	
MODULE 1	6Hrs
INTRODUCTION:	
Introduction to VR - Definition, Difference between VR & AR, Applications versus Games, Types of VR Experiences, Types of Head-Mounted Displays, How Virtual Reality Works? The Benefits of VR, 3D Computer Graphics, Human Factors	
MODULE 2	6Hrs
VR & Game Engines - Overview, Unity3D, VR and 3D Environments, Physics and Gaze Interaction, Virtual World Generator, Human Senses, Perceptual Psychology, Psychophysics, Geometric Modelling, Transforming Rigid Bodies, Game-Theoretic Systems	
MODULE3	6Hrs

3D UI and Locomotion - Overview, 3D Menus, Locomotion, Building Interfaces and Locomotion Systems, 3D Rotation Inverses and Conversions, Look-at & Eye Transforms, Canonical View and Perspective Transforms, Viewport Transforms	
MODULE4	6Hrs
3D User Interaction - Overview, 3D Interaction Design, Selection and Manipulation, Building Manipulation Systems, Graphical Rendering, Ray Tracing, Rasterization, Barycentric Coordinates, Anti-Aliasing, Image Warping, Panoramic Rendering	
MODULE5	6Hrs
Wayfinding and VR Input - Overview, Implementing Wayfinding, Building Wayfinding Tools, VR Usability and Pitfalls, Velocities, Tracking Systems, Drift Errors, Camera-Feature Detection Model, Perspective npoint Problem, Brain-Machine Interfaces	

TEXTBOOKS:	
1.	Virtual Reality - Steven M. LaValle, Cambridge University Press
2.	Complete Virtual Reality and Augmented Reality Development with Unity - Jesse Glover, Jonathan Linowes, Packt Publishing (April 17, 2019)
3.	Understanding Virtual Reality: Interface, Application and Design - William R. Sherman, Alan B. Craig, 1 st Edition, September 2002

SEMESTER	V					
YEAR	III					
COURSE CODE	20CT3504					
TITLE OF THE COURSE	CREATIVE CODING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits

	2	--	2	--	39	03

COURSE OBJECTIVES:

- The fundamentals of computational thinking applied through p5.js
- Best practices for designing software within an event-driven, object-oriented, real-time framework
- How to ideate, conceptualize, and design original creative works in the medium of software

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Examine fundamentals of computational thinking	L2
CO2	Write scripts using p5.js	L3
CO3	Ideate, conceptualize, and design original creative works	L3

COURSE CONTENT:	
MODULE 1	
Computational Thinking: Overview, Stages, Cornerstones, Pillars, Expressing and Analyzing Algorithms, Concepts of Computational Thinking, Techniques Associated with Computational Thinking, Computational Thinking in a Classroom	
6 Hrs	
MODULE2	
p5.js: Overview, Creative Graphics & Interactive Experiences, p5.js Web Editor, p5.js and Processing, Using a Local Server, First Sketch, Color, Constants, DOM, Data, Environment, Events, Foundation, I/O, Image, Lights, Camera, Math, Rendering, Shape	
7 Hrs	
MODULE3	
p5.js-contd: node.js and socket.io, 3D/WebGL, Coordinate System and Shapes, Structure, Transform, Typography, Anatomy of Functions, Built-in p5.js Functions, Touch, Unit Testing and Test-Driven Development	
7 Hrs	
MODULE4	
p5.js - Advanced Data, Sound, Mobile - Acceleration Ball Bounce, Simple Draw, Acceleration Color, Shake Ball Bounce, Titled 3D Box, p5.js libraries, Linking p5.js to HTMLfile	
7 Hrs	
MODULE5	
7 Hrs	

p5.ble.js - Overview, Introduction to Arduino and Bluetooth, Usage, p5.ble.js using Arduino, Bluetooth Le and p5.ble
p5.bots - Overview, APIs, Servers, Functions
p5.clickable - Overview, Creating, Moving & Resizing a Clickable, Clickable Events

List of Laboratory/Practical Experiments activities to be conducted (if any) :	Hours
Download and install sketch.js and setup a sketch to handle mouse/touch input.	6 hours
Setup a sketch to spawn particles with your mouse.	
Use three.js to setup a screen with a spinning cube.	
Create a web-based VR application made with three.js	
How do you update an object's transformation using three.js?	
Design an animation system using three.js	

TEXTBOOKS:	
1.	Lauren McCarthy, Casey Reas, Ben Fry, Getting Started with p5.js: Making Interactive Graphics in JavaScript and Processing, Maker Media Inc.
2.	Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and Programming, The Chartered Institute for IT

REFERENCES:

- 1 Creative Coding and Data Visualization with p5.js", Scott Muray, O'Reilly (13 January 2017)
- 2 "Processing: Creative Coding and Computational Art", Ira Greenberg Apress; 2nd Printing Edition (June 1, 2007)

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CT3505					
TITLE OF THE COURSE	CLOUD SECURITY SERVICES					
SCHEME OF Instruction	Lecture Hours	T utorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	--	02	-	39	03

COURSE OBJECTIVES:

- Explain basics concepts of Cloud Computing.
- Evaluate security issues with cloud infrastructure
- Implement cloud features to secure and harden the infrastructure
- Use tools to analyze system logs to detect possible security or performance problems

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Evaluate security issues with cloud infrastructure	L2
CO2	Implement cloud features to secure and harden the Infrastructure	L3
CO3	Use tools to analyze system logs to detect possible security or performance problems	L3

COURSE CONTENT:

MODULE 1		7 Hrs
Basics of Cloud Computing - Foundations and Models, Types, Designing a Cloud Computing Infrastructure or Service, Deployment and Configuration, Insuring Cloud Security and Mitigating Risks		
MODULE 2		7 Hrs
Shared Responsibility Model, Security Compliance, Identify and Access Services, IDirectory Services, Network Isolation-Fort and Beehive Theft		
MODULE 3		6 Hrs
Network Isolation VPC, VPC Endpoints and Private Link, Detective Controls, Auditing, CloudWatch and CloudWatch Logs, Guard Duty		
MODULE 4		7 Hrs
Security Hub, Encryption in Transit, Encryption at Rest, Database Encryption, Protecting Compute Resources, Protecting & Securing Endpoints		
MODULE 5		6 Hrs
Cloud Security Managed Services, Security Strategy, Intelligent Log Management, Security Intelligence, Operations Consulting, Threat Insights		

SI No	Program	Hours

1	Demonstrate the concept of Amazon Guard Duty and Detective using AWS	6 Hrs
2	Develop a connection between two devices using VPN concept	
3	Illustrate the concept of Log Analysis with Splunk	
4	Demonstrate the process of Hibernation through Instances	
5	Demonstrate the Cloud Watch Alarm System	
6	Show the demonstration of Cloud Watch Logs through EC2 Instances	
7	Demonstrate the use of VPC Flow Log	
8	Demonstrate VPC and subnet creation	
9	With the help of PaaS(pytho nanywhere.com), host a static website. The static website should have .html, .js, .css files.	
10	Create an account with ThingSpeak • Create a new Channel • Understand the concept of Read Key and Write Key • Create a new Project • Import a csv fde • Analyze the data using Histogram	

TEXT BOOKS:

1	RonaldL.Krutz,CloudSecurity:AComprehensiveGuidetoSecureCloudComputing, 30 July 2010
2	John R. Vacca, Cloud Computing Security: Foundations and Challenges, 30 August 2016
3	Chris Dotson, Practical Cloud Security: A Guide for Secure Design and Deployment, 31 March 2019

REFERENCES:

1	Vic (J.R.) Winkler, Securing the Cloud: Cloud Computer Security Techniques and Tactics Paperback - 1 June 2011
2	Adrian Pruteanu and Zeal Vora,Enterprise Cloud Security and Governance: Efficiently set data protection and privacy principles Paperback — Import, 29 December 2017
3	Routavaara, Ilkka. "Security monitoring in AWS public cloud." (2020)
4	NIST Special Publication 500-292, NIST Cloud Computing Reference Architecture, September 2011

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3601					
TITLE OF THE COURSE	COMPILER DESIGN AND SYSTEMS SOFTWARE					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	1	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
\$	**	**	***

COURSE OBJECTIVES:

1. To explain the basic system software components such as assembler, loader, linkers, compilers.
2. Provide an understanding of the fundamental principles in compiler design
3. To discuss the techniques of scanning, parsing & semantic elaboration well enough to build or modify front end.
4. To illustrate the various optimization techniques for designing various optimizing compilers.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the architecture of a hypothetical machine, structure and design of assembler.	L2
CO2	Analyse how linker and loader create an executable program from an object module created by assembler	L4
CO3	Describe the major phases of compilation and to apply the knowledge of Lex tool & YACC tool	L2
CO4	Explain the syntax analysis phase and identify the similarities and differences among various parsing techniques and grammar transformation methods	L2
CO5	Use formal attributed grammars for specifying the syntax and semantics of programming languages.	L3
CO6	Summarize various optimization techniques used for dataflow analysis and generate machine code from the source code of a novel language.	L2

COURSE CONTENT:	
MODULE 1: Introduction to System Software, ASSEMBLERS	IOHrs
Introduction to System Software, Machine Architecture of SIC and SIC/XE.	

ASSEMBLERS: Basic assembler functions: A simple assembler, Assembler algorithm and data structures, Machine dependent assembler features: Instruction formats and addressing modes - Program relocation, Machine independent assembler features: Literals, Symbol-defining statements, Expressions, Program blocks	
MODULE 2 : LOADERS AND LINKERS:	9Hrs
Basic loader functions: Design of an Absolute Loader, A Simple Bootstrap Loader, Machine dependent loader features: Relocation, Program Linking, Algorithm and Data Structures for Linking Loader, Machine-independent loader features: Automatic Library Search, Loader Options, Loader design options: Linkage Editors, Dynamic Linking	
MODULE 3: COMPILERS	UHrs
Introduction: Language Processors, Structure of compiler, The science of building a compiler, Applications of compiler technology. LEXICAL AND SYNTAX ANALYSIS: Role of lexical Analyzer, Specification of Tokens, Lexical Analyzer generator Lex. SYNTAX ANALYSIS I: Role of Parser, Syntax error handling, Error recovery strategies, Writing a grammar: Lexical vs Syntactic Analysis, Eliminating ambiguity, Left recursion, Left factoring.	
MODULE 4: SYNTAX ANALYSIS II	12Hrs
Top down parsing: Recursive Descent Parsing, First and follow, LL (1), -Bottom up parsing: Shift Reduce Parsing, Introduction to LR parsing Simple LR: Why LR Parsers, Items and LR0 Automaton, The LR Parsing Algorithm. SYNTAX-DIRECTED TRANSLATION: Syntax-Directed Definitions: Inherited and Synthesized Attributes, Evaluation orders for SDDs: Dependency graphs, Ordering the evaluation of Attributes, S-Attributed Definition, L-Attributed Definition, Application: Construction of Syntax Trees.	
MODULE 5: INTERMEDIATE CODE GENERATION	10Hrs
Three Address Code: Addresses and Instructions, Quadruples, Triples, indirect triples. CODE GENERATION: Issues in the design of code generator, Basic Blocks, Optimization of Basic Blocks, The Code Generation Algorithm, Peephole optimization. MACHINE INDEPENDENT OPTIMIZATION: The Principal Sources of Optimization	

TEXT BOOKS:

1. Leland L. Beck, "System Software - An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2006.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers - Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.

REFERENCES:

1. V. Raghavan, Principles of Compiler Design!, Tata McGraw Hill Education Publishers, 2010.
2. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
3. D.M.Dhamdhare, Systems Programming and operating systems, Second Revised edition, Tata McGraw Hill.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3602					
TITLE OF THE COURSE	SECURE PROGRAMMING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	2	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	I,II/I	20EN1103	FUNDAMENTALS OF PROGRAMMING

COURSE OBJECTIVES:

- To enhance and understand student competence on basic concepts of cyber security and code protection.
- To understand and analyze the importance of Secure Programming Design Principles.
- To develop competence in Robust secure programming concepts.
- To gain insights to maintain a secure repository.
- To develop competence in cryptography algorithms to be used to protect the data.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the Basic concepts of Secure Programming	L1
CO2	Understand and Demonstrate Secure Programming Principles	L2
CO3	Apply concepts of secure programming concepts for Software Development	L3
CO4	Analyze and conclude requirements, importance, and need of secure programming.	L4
CO5	Develop secure crypto systems for Data base Management	L5

COURSE CONTENT:	
MODULE 1: Introduction to Secure Programming	8 Hrs
Fundamentals of secure programming in C. Various security vulnerabilities (e.g., buffer overflows)	

in C. Introduction; Definitions (policy, mechanism, enforcement, property), Definitions (safety, liveness, and CIA properties); Best practices (e.g., coding standards). Unenforceability; Threats; Tradeoffs; Secure design; Access control; Authentication; Authorization; Memory segmentation; Buffer overflows;	
MODULE 2: Secure Programming Design Principles	4Hrs
Secure Programming Design Principles Overview; Principle of Least Privilege; Fail-Safe Defaults; Principle of Economy of Mechanism;	
MODULE 3: Robust Programming	5Hrs
Robust Programming Overview; Robust Programming Basic Principles; An Example of Fragile Code; Error Handling; Cohesion, New Interfaces	
MODULE 4: Databases	5Hrs
Client-state manipulation, Databases; Information management; SQL queries, SQL injection attacks, Code injections; XSS;	
MODULE 5: Cryptography	4Hrs
Symmetric cryptography Asymmetric cryptography; Diffie-Hellman; RSA; Signatures; MACs; Password management	

List of Laboratory/Practical Experiments activities to be conducted (13 Hrs)
C programs on: 1. Memory segmentation, buffer over flows, authentication etc 2. Fail safe defaults principles 3. Robust programming; fragile code, error handling etc 4. SQL queries, injection attacks, code injections etc 5. Various Cryptography algorithms (DH, RSA); Password management etc.

TEXT BOOKS:

1. Foundations of Security: Neil Daswani, Christoph Kern, and Anita Kesavan. Apress, 2007 (1st ed). ISBN-10: 1590597842; ISBN-13: 978-1590597842
2. Secure Coding: Principles and Practices: Mark Graff and Kenneth Wyk

REFERENCES:

1. The C Programming Language: Brian Kernighan and Dennis Ritchie., 2nd Edition.
2. Computer Systems: A Programmer's Perspective: Randy Bryant's and David R. O'Halloran. 2nd Edition.
3. Hacking: The Art of Exploitation: Jon Erickson., 2nd Edition.
4. Secure Coding in C and C++: Robert Seacord., 1st Edition.
5. Programming. A Modern Approach: K. N. King, Published by W. W. Norton & Company.
6. Building Secure and Reliable Systems: Heather Adkins, Betsy Beyer, Paul Blankinship and 3

more published by O'Reilly

7. Fundamentals of Information Security Systems: David Kim and Michael Solomon

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3603					
TITLE OF THE COURSE	CLOUD APPLICATION DEVELOPMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To give insights into the Cloud computing Technology, Service Oriented Architecture (SOA) and Virtualization.
- To recognize the basic programming for building the Cloud Application and to be familiar with version control tool.
- To understand the design and development framework for Cloud Applications.
- To deploy the cloud infrastructure using different methods from the scratch.
- To apply and map theoretical knowledge to practical through case studies and tutorials.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the cloud architecture, different cloud delivery and deployment models and the idea of Virtualization	L2
CO2	Construct the Cloud Application and work with the version control tool.	L3
CO3	Select the appropriate cloud framework for the development of cloud applications.	L5
CO4	Implement cloud-based application by exploring real time methods and tools.	L6
CO5	Examine the cloud services offered by various vendors and emerging technologies.	L4

COURSE CONTENT:	
MODULE 1: Introduction	8Hrs
Introduction- Cloud Computing Architecture — The Cloud Reference Model — Cloud Characteristics -Cloud Deployment Models: Public, Private, Community, Hybrid Clouds- Cloud Delivery Models: IaaS, PaaS, SaaS Virtualization: Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Paravirtualization, Full Virtualization	
MODULE 2: Understanding Cloud Programming	8Hrs
Introduction to Cloud development using HTML5-Tag and Structural elements, Input elements and Data Attributes, Management and support and scripting. CSS3-Styling HTML, JavaScript-Variables and control statement, functions and API's Client side Javascript	
MODULE 3: Design and Developing cloud Application	9 Hrs
Building Native Cloud Application: REST APIs and JSON - Using RESTAPI's with WatsonAI Services. JSON Data types-Arrays, objects, Parse, Server and HTML Developing Cloud Applications with Node.js and React: Create server-side applications using Node.js and develop the front-end using React.	
MODULE 4: Deploying Cloud Applications and services	7 Hrs
Cloud Application deployment models: Amazon Web Services- Compute Services, Storage Services, Communication Services, Google AppEngine- Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations. Microsoft Azure- Azure Core Concepts	
MODULE 5: CASE Study	7 Hrs
Introduction to Emerging technologies supported by Cloud: AI, IoT, Blockchain, Analytics. Cloud Infrastructure: -Docker and Containers. Cloud Storage: Direct Attached-File Storage-Block Storage-Object Storage-Content Delivery Networks (CDN). Cloud Native and Emergent Cloud Trends: Hybrid Multicloud-Serverless-Microservices-Cloud Native-DevOps-Application Modernization. Need for Cloud Security.	

TEXTBOOKS:

1. Rajkumar Buyya, Christian Vecchio Ia, and Thamarai Selvi Mastering Cloud Computing McGraw Hill Education
2. Deitel, Deitel and Neito, "Internet and World Wide Web — How to program", Pearson Education Asia, 5th Edition, 2011

REFERENCES:

1. Tom Marrs, "JSON at Work - Practical Data Integration for the Web", O'REILLY, First edition, 2017
2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press (2012)
3. Dan Marinescu, "Cloud Computing: Theory and Practice", M K Publishers, 1st Edition, 2013
4. A.Srinivasan, J.Suresh, "Cloud Computing, A practical approach for learning and implementation", Pearson, 2014

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CT3601					
TITLE OF THE COURSE	LEAN STARTUP METHODOLOGY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Project sHours	Total Hours	Credits
	--	--	02	02	26	02

COURSE OBJECTIVES:

- Use the Business Model Canvas innovation tool to approach either a personal or corporate challenge or opportunity.
- Identify and communicate the nine key elements of a business model.
- Explain how to develop a strategic business plan

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Communicate nine key elements of a Business Model	LI
CO2	Use Business Model Canvas Tool	L3
CO3	Develop Strategic Business Plan	L3

COURSE CONTENT:

Exposure to Business Model Techniques like, Channels, Customer Segments, Relationships, Key Resources, Key Activities, Cost structures, Pain, and Gain Relief of Core Customers.

List of Laboratory/Practical Experiments activities to be conducted (if any) :

Build the various elements of the lean model canvas to your business proposition with inputs and data from field survey

Develop key hypothesis for your proposed solution

Work with founders to finalize the business model

TEXT BOOKS:

1. Timmons, Jeffry A. and Spinelli, Stephen Jr. (2009). New Venture Creation: Entrepreneurship for the 21st Century, 8th edition. McGraw-Hill Irwin, Boston. Chapter 3
2. Lindsay, Noel (2010). Business Plan Template

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CT3602					
TITLE OF THE COURSE	SPECIAL TOPIC					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	-	4	26	2

Guidelines on Special Topics

All the students will do research on current technologies and publish a research paper as the special topic for this semester. A research paper is an academic writing assignment that offers analysis, explanation, and justification based on extensive, independent study.

Students have to go through a hands-on workshop as training for writing and publishing the research paper in SCOPUS indexed journals or Conferences or UGC High Impact Factor journals. The research paper can either be based on the Project work or any other research work. Students will be divided into teams and under the supervision of the project guide, they will draft and publish the paper.

The objective of a Special Topic as a Research paper:

- Students will be able to Formalize and produce Descriptive research studies.
- To apply methodologies, concepts, and research findings.
- To compare existing results with proposed ones with unique features.
- Students will be able to write research papers on their major project/ research carried out and undergo the process of publishing quality work in various SCOPUS-indexed journals or conferences.

The outcome of the Special Topic:

- Students will publish research papers in SCOPUS-indexed journals or Conferences or UGC High impact Factor journals by the end of the semester.

The guidelines for evaluation of a special topic are as follows (50 Marks):

Guidelines	MARKS
Literature survey and Design	15 Marks
Implementation, methodology, results and diagrams	15 Marks
Submission	10 Marks
Acceptance notification	10 Marks

Note: Published paper will get 10 Marks in Phase-1 Review-1 of Project in next semester.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3604					
TITLE OF THE COURSE	COMPILER DESIGN AND SYSTEM SOFTWARE LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Experiment on the basic techniques of compiler construction and tools that can be used to perform syntax-directed translation of a high-level programming language into an executable code.
- Know the implementation of assemblers, loaders and various parsing techniques.
- Learn how to optimize and effectively generate machine codes.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify patterns, tokens & regular expressions for lexical analysis.	L2
CO2	Develop LEX and YACC programs for lexical and syntax analysis phases of Compiler.	L3
CO3	Implement the pass 1 of two pass assembler and absolute loader algorithm	L3
CO4	Analyze and Implement the bottom up parsing technique	L4
CO5	Implement front end of the compiler by means of generating intermediate codes.	L3

List of Laboratory/Practical Experiments activities to be conducted
1a. Program to count the number of characters, words, spaces and lines in a given input file.
1b. Program to recognize and count the number of identifiers in a file.
2a. Program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.

2b. Program to recognize whether a given sentence is simple or compound.
3a. Program to count no of: i. +ve and -ve integers ii. +ve and -ve fractions
3b. Program to count the no of „scanf' and „printf' statements in a C program. Replace them with “readf' and “writef' statements respectively.
4. Program to evaluate arithmetic expression involving operators +, -, *, /
5. Program to recognize a valid variable which starts with a letter, followed by any number of letters or digits.
6. Program to recognize the strings using the grammar ($a^n b^n ; n \geq 0$)
7. C Program to implement Pass1 of Assembler
8. C Program to implement Absolute Loader
9. C program to find the FIRST in context free grammar.
10. C Program to implement Shift Reduce Parser for the given grammar $E \rightarrow E + E$ $E \rightarrow E * E$ $E \rightarrow *(E)$ $E \rightarrow id$
11. C Program to implement intermediate code generation for simple expression

TEXT BOOKS:

1. Leland L. Beck, “System Software - An Introduction to Systems Programming”, 3rd Edition, Pearson Education Asia, 2006.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers - Principles, Techniques and Tools”, 2nd Edition, Pearson Education, 2007.

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CS3605					
TITLE OF THE COURSE	CLOUD APPLICATION DEVELOPMENT LABORATORY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To Demonstrate operation of cloud and to develop simple cloud-based applications
- To design and deploy cloud-based applications using various tools and to explain command usage and sequence.
- To Handle virtualization environment, technology and familiarize in efficient cloud-based application development.
- To implement version control system commands and work with Docker containers

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
1	Understand the installation of Virtual box and VMware, installation of gcc C-compiler and the ping command to test the communication between the guest OS and Host OS.	L2
2	Understand and establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it and the usage of Google App Engine in Eclipse.	L2
3	Understanding of Windows Azure environment and Containerization using Docker.	L2
4	Practice several commands of version control system and deploy application in Dockers.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Install Oracle Virtual box and create two VMs on your laptop/Desktop. 2. Test ping command to test the communication between the guest OS and Host OS 3. Use gcc to compile c-programs. Split the programs to different modules and create an application using make command 4. Find a procedure to transfer the files from one virtual machine to another virtual machine. 5. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it. 6. Develop a Hello World application using Google App Engine in Eclipse. 7. Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories 8. Develop a Windows Azure Hello World application. 9. Install Google App Engine. Create hello world app and other simple web applications using python/java. Use GAE launcher to launch the web applications 10. Launch GUI applications inside Docker Container & access them from the Docker Host system.

TEXTBOOKS:

1. Rajkumar Buyya. Christian Vecchio la. and Thamarai Selvi Mastering Cloud Computing McGraw Hill Education
2. Deitel, Deitel and Neito, “Internet and World Wide Web - How to program”, Pearson Education Asia, 5th Edition, 2011

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CT3603					
TITLE OF THE COURSE	DATA-DRIVEN DECISION MAKING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	--	02	--	39	03

Prerequisite Courses (if any)			
*it	Sem/Year	Course Code	Title of the Course
*	*	***	*****

COURSE OBJECTIVES:

- To perform data cleaning & pre-processing on real-time datasets
- To work on live projects on modeling data
- To visualize data

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Write programs to clean and pre-process data	L3
CO2	Write programs to process and model data	L3
CO3	Derive insights from data through data visualization and storyboarding	L3

COURSE CONTENT:	
MODULE 1	
6 Hrs	
Overview, Data Science Lifecycle and Process, Types of Analytics, Making Business-Defined Decisions using Data Analytics, Steps to Clean and Pre-process Data, Data Processing Techniques, Data Modelling, Ensemble Models	
MODULE2	
6 Hrs	
Cleaning and Data Pre-processing Scrapy- Linear Algebra, Integration, Calculus, Ordinary Differential Equations, Signal Processing NumPy - Basic Array Operations (Multiply Slice, Flatten, Reshape, Index Arrays), Advanced Array Operations (Stack, Split, Broadcast), Linear Algebra Pandas - Indexing, Manipulating, Renaming, Sorting, Merging Data Frame, Impute Missing Files, Handle Missing Data	
MODULE 3	
6 Hrs	
Data Processing - Statsmodels - Linear Regression, Correlation, Ordinary Least Squares,	

Survival Analysis, Generalized Linear Models, Bayesian Models, Univariate and Bi-variate Analysis, Hypothesis Testing	
MODULE4	6 Hrs
Modelling Scikit-Learn - Classification (Spam Detection, Image Recognition), Clustering (Drug Response, Stock Price), Regression (Customer Segmentation, Grouping Experiment Outcomes), Decision Tree, K-NN and Naïve Bayes	
MODULE5	6 Hrs
Data Visualization Matplotlib- Line Plots, Scatter Plots, Area Plots, Bar Charts & Histograms, Pie Charts, Stem Plots, Contour plots, Quiver Plots, Spectrograms Seaborn - Correlation, Aggregate Statistics, Uni-Variate & Bi-Variate Distributions, Linear Regression Models, Multi-Plot Grids	

List of Laboratory/Practical Experiments activities to be conducted (if any) :	Hours
Considering any data set apply the functionalities of pandas like merging sorting, indexing, and manipulating.	9 hours
Consider any data set and apply data pre-processing methods like identifying missing data and filling missing data.	
Write a program for Sales prediction using linear regression analysis. Dataset.	
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify anew sample.	
Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	
Assuming a set of documents that need to be classified, use the naive Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.	
Write a program to implement k-means clustering algorithm to predict iris flower species.	

TEXTBOOKS :

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Publications, 2014.
2. Han, Kambar and Pei, Data Mining Concepts and Techniques, MK Publications, 3rd Edition.

REFERENCES:

- 1 Data Pre-Processing <https://scikit-learn.org/stable/moduleJreprocessing.html>
- 2 Python Data Science Handbook:
<https://tanthiamhuat.files.wordpress.com/2018/04/pythondatasciencehandbook.pdf>

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CT3604					
TITLE OF THE COURSE	HUMAN COMPUTER INTERACTION					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	--	02	--	39	03

COURSE OBJECTIVES:

- Illustrate overall goals of human-computer interaction.
- Map relationship between HCI, user experience design, human factors engineering, and psychology.
- Discuss trends in HCI technology including virtual reality, augmented reality, and robotics.
- Elaborate the role of design principles and heuristics in user interface design.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Map relationship between HCI, user experience design, human factors engineering, and psychology.	L2
CO2	Analyze the use of HCI to domains like healthcare, education, and cybersecurity.	L3
CO3	Discuss trends in HCI technology including virtual reality, augmented reality, and robotics.	L3
CO4	Explore emerging ideas in HCI research, such as context-sensitive computing, gesture-based interaction, and social computing.	L3

COURSE CONTENT:	
MODULE 1	6 Hrs
Introduction, Design Principles and Feedback Cycles, Direct Manipulation & Invisible Interfaces, Human Abilities, Design Principles and Heuristics	
MODULE2	6 Hrs
Characteristics of Interaction Design, Digital Materials and Interaction Design, Contextual Design - Overview, Key Principles, Process, Task-Artifact Cycle, GOMS Model	
MODULE 3	6 Hrs
Unity 3D - Basics of C#, Variables, Functions, Logic & Operators, Inheritance, Class Constructors, Arrays, Overview, Unity 3D for HCI, Asset Workflow, Creating Gameplay,	

Importing Models, Input- Input Manager, Mobile Device Input, Unity XR Input	
MODULE4	6 Hrs
Graphics - Render Pipelines, Visual Effects Components, Optimizing Graphics Performance, Animation - Clips and Controllers, Performance and Optimization, User-Interfaces - Unity UI, Immediate Mode GUI, Navigation and Pathfinding, 3D Physics for Object-Oriented Projects	
MODULE5	6 Hrs
Overview of JavaScript for Unity, Starting with Coding Physics, Using Advanced Physics Concepts, Particle Emitters and Special Effects, Enhancing User Experience: GUI & Sound	

Experiments	Hours
1. Develop Unity 2D project with cube component and print a message in console. 2. Develop a unity project to demonstrate Life cycle Functions. 3. Develop a unity project to demonstrate the use of Data Types by printing the status of the player. 4. Develop a unity project to demonstrate the use of Data Types by printing the status of the player. 5. Create a unity project to visualize the game data using class and object. 6. Create a unity project to capture various key input in game play. 7. Develop a unity project by making use of Multimedia components. 8. Develop a unity project to move the paddle using physics. 9. Develop a unity program with running Background using Materials. 10. Develop a project to demonstrates the basics of Collision detection and how to create physical materials and triggers in Unity.	9 Hrs

TEXTBOOKS:	
1.	Andrew Monk, Fundamentals of Human-Computer Interaction, 1st Edition,, Academic Press, 28th January 1985
2.	Alan DIX, Janet Finlay, Gregory D. Abowd, Russell Beale, Human-Computer Interaction

REFERENCES:	
1	Learning C# Programming with Unity 3D, Alex Okita, 1st Edition, CRC Press, Routledge; 1 Edition
2	Learning Unity 3D Programming with Unity Script: Unity's JavaScript for Beginners, Janine Suvak, Technology in Action, Apress; 1st ed. edition

SEMESTER	VI					
YEAR	III					
COURSE CODE	20CT3605					
TITLE OF THE COURSE	Blockchain & Cryptocurrency					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	--	02	--	39	03

COURSE OBJECTIVES:

- The alternative consensus mechanisms to Bitcoin's Proof-of-work, including Proof-of-Stake, voting based consensus algorithms, and federated consensus.
- The various enterprise-level blockchain implementations, such as JP Morgan's Quorum, Ripple, Tender Mint, and Hyperledger, including the industry use cases for blockchain, ICOs, and the increasing regulations surrounding blockchain.
- The challenges with scaling and obstacles to widespread blockchain adoption, as well as the possible solutions within vertical scaling (e.g. block size increases, Segregated Witness, and the Lightning Network) and horizontal scaling (e.g. sidechains, sharding).

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Illustrate alternative consensus mechanisms to Bitcoin's Proof-of-work, including Proof-of-Stake, voting-based consensus algorithms, and federated consensus.	L2
CO2	Describe the properties of crypto economics as it relates to its two compositional fields: cryptography and economics, as well as the goals for crypto economics with respect to distributed systems fundamentals	L2
CO3	Analyse enterprise-level blockchain implementations, such as JP Morgan's Quorum, Ripple, Tender Mint, and Hyperledger	L1

COURSE CONTENT:	
MODULE 1	6Hrs
Distributed Systems and Alternative Consensus - Overview, Blockchain Architecture, CAP Theorem, Byzantine General Problem, Alternative Consensus Mechanisms of Bitcoin's Proof-of-Work, Proof-of-Stake, Voting based Consensus Algorithms, Federated Consensus	

MODULE 2	6Hrs
Crypto economics - Overview, Properties, Attacks, Enterprise Blockchain Overview, Platforms, Getting Started with Bitcoin - Setting up a Regtest Environment, Building a Payment Gateway, Bitcoin Smart Contracts, Rootstock, Building your own Cryptocurrency, Readercoin, Peer-to-Peer Auctions in Ethereum, Building an Auction DApp - Ganache	
MODULE 3	6Hrs
Scaling Blockchain - Vertical Scaling on-Chain, Vertical Scaling Off-Chain, Horizontal Scaling, Advanced Scaling and Generalizations, Tontine Game with Truffle and Drizzle, Tontine Contract, Cplayer as a CRUD Contract, Tontine Interfaces, Ctontine Contract, Truffle Unit Tests, Frontend with Drizzle,	
MODULE4	6Hrs
Use Cases and Industries, Regulation and Caveats, Anonymity through Altcoins, Advanced Anonymity & Generalizations, Connecting Ganache to MetaMask, Blockchain-Based Futures System, Futures Smart Contract, Web3j, Initial Coin Offering, Token Contracts	
MODULE5	6Hrs
Enterprise Blockchain Implementations - JP Morgan's Quorum, Ripple, Tender mint, and Hyperledger, Blockchains in Business - Public versus Private and Permissioned versus Permission less Blockchains, The Ethereum Enterprise Alliance, Blockchain-as-a-Service, Quorum	

	EXPERIMENTS	HOURS
1	Implement Voting based algorithm in blockchain using solidity .	9 Hrs
2	Generate your own blocks in blockchain regtest environment, consider the mining rule, that one can spend a block reward only if it has 100 blocks mined before it. So generate 101 blocks to make 50 regtest BTC spendable.	
3	Introduction to Ethereum Blockchain Development with DApps and Ethereum VM	
4	Building Auction DApp With Ethereum and Solidity Programming Language	
5	Working with Ethereum Blockchain Applications through Remix IDE	
6	Building Bidding Form in Web3jsfor Ethereum Auction DApp	
7	Working with web3js API and JSON to Build Ethereum Blockchain Applications	
8	Deployment Environments for Managing Ethereum Smart Contracts	
9	Work with Ethereum Private Network with Golang with Geth	
10	Compiling and Deploying Ethereum Contracts Using Solidity Compiler	

TEXTBOOKS:

1.	Mastering Bitcoin: Unlocking Digital Crypto-Currencies- Andreas M. Antonopoulos, O'Reilly Media Inc. 2020
2.	Mastering Blockchain - Expert Insight- Imran Bashir, Second Edition, Packt, 2018
3.	Blockchain: Ultimate guide to understanding Blockchain, Bitcoin, Cryptocurrencies, Smart Contracts- Mark Gates, Wise Fox Publishing, June 2017
4.	Programming Bitcoin: Learn How to Program Bitcoin from Scratch, Jimmy Song, O'Reilly Media Inc.
5.	Blockchain for Dummies, Manav Gupta, IBM Limited Edition, John Wiley & Sons, Inc. 2017

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CT4701					
TITLE OF THE COURSE	Product Analytics					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	01	--	--	02	26	02

COURSE OBJECTIVES:

1. **Analyze** and understand User Behaviour.
2. Explore the skills to leverage product analytics for data driven decision making.
3. **Get the idea** of tools and technologies around Product Analytics.

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Describe what is product analytics and why needed.	L2
C02	Explain analyzing user behavior.	L2
C03	Describe the role of product analytics in data driven decision making.	L2
C04	Identify and explain the business case with example reflecting product performance improvement and optimize user experience	L2

COURSE CONTENT:
26 Hours
A/B Testing and Experimentation, Customer Segmentation, Personalization, Performance • Understanding A/B testing principles. • Practical guide to A/B testing with Google Optimize. • Hands-on: Designing and running an A/B test. Resources: - o Google Optimize (Free tool for A/B testing) - o Article: "A/B Testing: A Comprehensive Guide" by CXL

• Segmentation strategies for targeted analysis. • Leveraging data for personalized user experiences. • Case studies of successful personalization. Resources: - o Article: "The Power of Personalization in Product Development" by SmarterHQ. - o Case Study: "How Netflix Uses Segmentation for Personalization" by Kissmetrics.
• Measuring product success and health. • Churn analysis and strategies for reducing churn. • Sentiment analysis of user feedback. Resources: - o Tool: Amplitude for product health measurement. - o Article: "Mastering Customer Churn Analysis" by Mixpanel.

TEXT BOOKS:	
1.	"Lean Analytics: Use Data to Build a Better Startup Faster" by Alistair Croll and Benjamin Yoskovitz
2.	"Product Leadership: How Top Product Managers Launch Awesome Products and Build Successful Teams" by Richard Banfield, Martin Eriksson, and Nate Walkingshaw

REFERENCE BOOKS:	
1.	"Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CT4702					
TITLE OF THE COURSE	IPR & Art of Raising Capital					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	01	--	--	02	26	02

COURSE OBJECTIVES:

- Create an understanding on Intellectual Properties and the importance of it.
- To understand Trademarks and Trade secrets. To create awareness of unfair completion and methods of it.
- Create awareness on the protection copyrights and patents. Understand the ownership rights and transfer. New developments in IPR.
- Create awareness on raising capital nuances
- To create awareness around sources of capital, investment rounds, mistakes to avoid and recommended tools

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Discuss the importance of intellectual property rights, agencies responsible, registration, and regulations.	L2
C02	Classify trademarks and trade secrets, as well as their legal protection and practical implications for managing and enforcing these intellectual property rights.	L2

C03	Explain various types of Unfair Competition and the Students get well-versed with exposure to licensing, transfer of Copyrights and Patents, and new developments in IPR.	L2
C04	Recognize nuances in raising capital for start-ups, as well as the pros and cons	L2
C05	Identify awareness of sources of capital, investment rounds, investor expectations, and deal closing along with recommended tools.	L2

COURSE CONTENT:

MODULE 1

6Hrs

Introduction: Introduction to Intellectual property, types of intellectual property, importance of intellectual property rights, agencies Responsible for Intellectual property Registration, Regulatory - Compliance and Liability Issues

MODULE 2

5Hrs

Trademarks: Purpose and function of trademarks, acquisition of trademark rights, Transfer of Rights, protectable matter, selecting and evaluating trademark, Registrations of Trademarks, Claims. New Developments Trade Secrets: Determination of trade secret status, liability for misappropriation of trade secrets, protection for submission, Unfair Competition- Misappropriation right of publicity, false advertising

MODULE 3

5Hrs

Copy rights: Fundamental of copy right, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, notice of copy right. New Developments Patents: introduction, patent searching process, ownership rights and transfer. New Developments

MODULE 4

5 Hrs

Raising Capital for Start-ups - Milestones, Expectations of Investors, Story Telling, Marketing, Pros & Cons of raising capital, Org structure, Crafting the pitch

MODULE 5

5 Hrs

Sources of the capital , Investments Rounds, deciding investment amounts & prospects, what to look for in an investor, Terms & Deal Closing, Mistakes to avoid & Recommended Tools

TEXTBOOKS:	

1.	Intellectual property right, Deborah, E. Bouchoux, Cengage learning.
2.	R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi

REFERENCE BOOKS:	

1.	Intellectual Property Rights: N K Acharya: ISBN: 9381849309
2.	The Art of Startup Fundraising by Alejandro Cremades

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CT4703					
TITLE OF THE COURSE	Big Data Analytics & Deep Learning					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	--	--	02	39	03

COURSE OBJECTIVES:

- Understand the foundational concepts of big data, including its characteristics, types, and lifecycle, and recognize the role of big data in various industries and domains.
- Gain proficiency in using Hadoop and its components, such as HDFS and MapReduce, to store, process, and analyze large-scale datasets efficiently.
- Develop a strong understanding of Apache Spark and its functionalities, including RDDs, DataFrames, shared variables, and key-value pairs, and apply them to perform distributed data processing and analytics tasks.
- Acquire knowledge of the fundamentals of deep learning, including neural networks, activation functions, and different types of deep learning models, and grasp their applications in solving complex real-world problems.
- Gain practical hands-on experience by using popular deep learning frameworks like TensorFlow and libraries like Keras to build, train, and evaluate deep learning models for various tasks, such as image recognition, natural language processing, and data generation.

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Discuss the fundamentals of big data concepts, such as	L2

	characteristics and types, as well as how to store and process large-scale datasets using HDFS for data storage and MapReduce for distributed data processing.	
C02	Utilize Apache Spark to perform efficient and scalable data processing and analytics tasks, leveraging concepts such as RDDs, DataFrames, shared variables, and key-value pairs to develop distributed data processing solutions.	L3
C03	Explain the fundamentals of deep learning, including neural networks, activation functions, and various types of deep learning models.	L3
C04	Interpret deep learning models for tasks such as image recognition, natural language processing, and data generation.	L3
C05	Demonstrate practical skills in implementing deep learning models using popular frameworks like TensorFlow and libraries like Keras, enabling the ability to build and train the deep learning models for complex data-driven problems and analyze their performance.	L3

COURSE CONTENT:	
MODULE 1	8Hrs
Introduction to big data and Hadoop	
Overview of bigdata, Characteristics of bigdata, types of bigdata, Lifecycle of bigdata, Analytical Process Models, Tools. What is Hadoop? HDFS, Features of HDFS, MapReduce: Dataflow in MapReduce, MapReduce API, Examples.	
MODULE 2	8Hrs
Overview, Components, Resilient Distributed Dataset (RDD), Data Frames, RDD Operations, Shared Variables and Key-Value Pairs, Spark Context, Functions, Spark Libraries, Properties. Examples.	
MODULE 3	8Hrs
Introduction to Deep Learning - Overview, Neural Networks & Types, Elements of Neural	

Networks, Activation Function (variants and Types)	
MODULE 4	8Hrs
Artificial Neuron, Perceptron, types of perceptron models, Multi-layer perceptron and limitations of perceptron model, Long-Short-Term memory, Self-organizing maps.	
MODULE 5	7 Hrs
Supervised and Unsupervised Models, CNN, Boltzmann Machine, Restricted Boltzmann Machine, Autoencoders & Types, Recursive Neural Tensor Network.	

TEXT BOOKS:	
1.	"Deep Learning: A Practitioner's Approach" by Adam Gibson and Josh Patterson, 1st edition, 2017, O'Reilly.
2.	Big Data Analytics - Turning Big Data into Big Money, Frank Ohlhorst, John Wiley & Sons Inc. 2013

REFERENCE BOOKS:	
1.	"Big Data: A Revolution That Will Transform How We Live, Work, and Think", Viktor Mayer-Schönberger and Kenneth Cukier, 2013, Houghton Mifflin Harcourt.
2.	Learning Apache Spark with Python, Wenqiang Feng, February 2020- https://runawayhorse001.github.io/LearningApacheSpark/pyspark.pdf
3.	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, 3rd edition O'Reilly.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CT4705					
TITLE OF THE COURSE	Augmented & Mixed Reality					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	--	--	02	39	03

COURSE OBJECTIVES:

- Explore ARKit to create augmented reality scenes and objects for your apps
- Build and debug your AR app

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Discuss augmented reality technology, its applications in various industries, and its potential for creating innovative and immersive experiences.	L2
C02	To interpret complete and realistic augmented reality experiences that seamlessly integrate virtual objects with the real world is dependent on the basics of AR Functionality.	L3
C03	Discuss Feature Points and Plane-Finding, Light Estimation, Anchors, Interface Issues, lack of UI Metaphors, AR's Technical Constraints, the 3D Barrier, User-Flow, and Design to overcome technical challenges .design effective user interfaces for augmented reality applications.	L2
C04	Classify Surface Detection and Plane Creation, Hit-Testing and Pose, Placing with Anchor Points, Occlusion Between Virtual Assets, Light Estimation for developing advanced and realistic augmented reality applications that accurately interact with the	L2

	real-world environment.	
C05	Utilize Poly for 3D assets, grasp mixed reality concepts, and develop mixed reality experiences using Unity, resulting in innovative and captivating applications.	L3

COURSE CONTENT:	
MODULE 1	8Hrs
Basics of Augmented Reality, Difference between Augmented Reality and Virtual Reality, Hardware Requirements, Google AR, AR Applications - Shopping and Retail, Business, social media, gaming, Education, Healthcare, Non-profits	
MODULE 2	8 Hrs
Basics of AR Functionality - AR Core - Placing and Positioning Assets, Scale and the Size of Assets, Occlusion, Lighting for Increased Realism, Solid Augmented Assets, Context Awareness, Tracking in AR, Outside-in Tracking, Inside-out Tracking, Motion Tracking	
MODULE 3	8 Hrs
Feature Points and Plane-Finding, Light Estimation, Anchors, Interface Issues and Lack of UI Metaphors, AR's Technical Constraints, 3D Barrier, User-flow, Design Drafting	
MODULE 4	8 Hrs
Surface Detection and Creating Planes, Hit-Testing and Pose, Placing with Anchor Points, Occlusion Between Virtual Assets, Light Estimation: Matching Virtual Light to Real Light	
MODULE 5	7Hrs
Multi-Plane Detection and Spatial Mapping, Processing Needs in Mobile AR, Breaking Immersion, Framing as a Creative Device, Introduction to Poly, Poly Examples, Introduction to Mixed reality, Mixed Reality using Unity	

TEXT BOOKS:	
1.	Practical Augmented Reality: A Guide to the Technologies, Applications and Human Factors for AR and VR- Steve Aukstakalnis, Addison-Wesley Professional; 1 Edition (8

	September 2016)
2.	Augmented and Virtual Reality in Libraries- Jolanda-Pieta van Arnhem, Christine Elliott, Marie Rose, Rowman & Littlefield Publishers (May 24, 2018
3.	Augmented Reality for Developers: Build Practical Augmented Reality Applications with Unity, ARCore, ARKit, and Vuforia- Jonathan Lonowes, Krystian Babilinski, October 9, 2017, Packt Publishing

REFERENCE BOOKS:	
1.	Unity Virtual Reality Projects: Learn Virtual Reality by developing more than 10 engaging projects with unity 2018 - second edition by Jonathan Linowes
2.	Designing for Mixed Reality, Kharis O'Connell, September 2016, O'Reilly Media Inc.

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CT4706					
TITLE OF THE COURSE	Edge Computing with IoT					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	--	--	02	39	03

COURSE OBJECTIVES:

- Provides insights on transitioning from current Cloud-centric and 4G/5G wireless environments to Fog Computing
- Examines methods to optimize virtualized, pooled, and shared resources
- Identifies potential technical challenges and offers suggestions for possible solutions
- Discusses major components of Edge computing architectures such as middleware, interaction protocols, and autonomic management

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Discuss insights on transitioning from current Cloud-centric and 4G/5G wireless environments to Fog Computing.	L2
C02	Examine methods to optimize virtualized, pooled, and shared resources	L4
C03	Identify potential technical challenges and offers suggestions for possible solutions	L2
C04	Examine major components of Edge computing architectures such as middleware, interaction protocols, and autonomic management	L4
C05	Use edge systems using Amazon IoT Greengrass Software Development Kit	L3

COURSE CONTENT:	
MODULE 1	8Hrs
Internet of Things and New Computing Paradigms - Overview of Edge Computing, Edge Methodology, Addressing the Challenges in Federating Edge Resources, Management and Orchestration of Network Slices, Network Slicing Management in Edge, Optimization Problems in Edge Computing	
MODULE 2	8Hrs
Edge Middleware, Middleware Infrastructures, System Model, Clusters for Lightweight Edge Clouds, Architecture Management - Storage and Orchestration, IoT Integration, Security Management for Edge Cloud Architectures	
MODULE 3	8Hrs
How 5G is driving Edge Adoption, Open-Source Edge IoT Projects - Eclipse Kura, EdgeX Foundry, StarlingX, OpenEdge, MS IoT Edge, KubeEdge, Eclipse ioFog, Comparison of IoT Hardware Boards and Frameworks, IOT Data Analysis: Data Source, Ingestion, Stream Processing, Presentation	
MODULE 4	8Hrs
Microsoft Azure: Event Hubs, Stream Analytics, Azure Cosmos DB, Power BI, Google: Pub/Sub, Cloud Data Flow, Big Query, Cloud data Labs and Data Studio, Amazon IoT Greengrass - Overview, Architecture, Lambda Runtime, Shadows Implementation, Message Manager, Group Management, Discovery Service, Stream Manager, Local Resource Access	
MODULE 5	7 Hrs
Amazon: Kinesis Steaming, Kinesis Analytics, S3/Dynamo DB, Amazon Quick Sight, IOT hardware Boards Study, Intel Edison, Intel Galileo, Samsung Artik, Microsoft IOT Boar, Amazon IoT Greengrass - Local Machine Learning Inference, Local Secrets Manager, Connectors with built-in Integration with Services, Protocols and Software.	

TEXTBOOKS:	
1.	Principles of Fog and Edge Computing: With Applications and Case Studies, June 21, 2018 by S.Balamurugan
2.	Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) Hardcover - 1 March 2019 by Rajkumar Buyya & Satish Narayana Srirama

REFERENCE BOOKS:	
1.	Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren
2.	Securing the Internet of Things Elsevier 3. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations

SEMESTER	VII					
YEAR	IV					
COURSE CODE	20CT4707					
TITLE OF THE COURSE	AWS Web Services					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	--	—	02	39	03

COURSE OBJECTIVES:

- To understand fundamental concepts and hands-on knowledge of Cloud Computing using AWS Platform
- Conceive, Design and Develop state-of-the-art AWS Networking, Database, Storage Services
- Ability to understand and apply evolve Security and privacy in AWS Cloud across various domains like Storage, Database and applications.

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Discuss fundamentals of Cloud computing, Amazon EC2, load balancing and Auto scaling.	L2
C02	Classify state-of-the-art AWS platforms for running compute, network and storage services.	L2
C03	Examine state-of-the-art AWS Networking, Database and Storage Services.	L4
C04	Demonstrate hands-on knowledge of Storage services, S3, EFS, Glacier, EBS storage gateway by designing any AWS application.	L3
C05	Interpret AWS database services design principles, framework and protocols of dependable systems and appropriate projects for real-world problems.	L3

COURSE CONTENT:	
MODULE 1: Introduction	8 Hrs
What is Cloud Computing? How Does Cloud Computing Work? What is AWS? AWS Free Tier, Compute Services: Amazon EC2, Elastic Load Balancing, Auto Scaling	
MODULE 2: Networking Services	6Hrs
Amazon VPC, Amazon Route 53	
MODULE 3: AWS Security	6Hrs
Shared Responsibility Model, AWS IAM and KMS	
MODULE 4: Storage Services	9Hrs
Amazon S3, Amazon EBS, Amazon EFS, Amazon Glacier, AWS Storage Gateway, Amazon Cloud Front	
MODULE 5: AWS Database Services, Application Services	10Hrs
Amazon RDS, Amazon DynamoDB, Amazon ElastiCache, Amazon Simple Email Service (Amazon SES), Amazon Simple Notification Service (Amazon SNS), Amazon Simple Queue Service (Amazon SQS), Amazon Simple Workflow Service (Amazon SWF]	

TEXTBOOKS:	
1.	Ben Piper, David Clinton, 'AWS Certified Solutions Architect Study Guide: Associate SAA-C02 Exam (Aws Certified Solutions Architect Official: Associate Exam)" Paperback - 22 February 2021

REFERENCE BOOKS:	
1.	John Paul Mueller, "AWS for Developers For Dummies", Wiley publications.
2.	David Clinton and Ben Piper, "AWS Certified Cloud Practitioner Study Guide: CLF-C01 Exam", Wiley publications.

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CT4801					
TITLE OF THE COURSE	Technology Strategy					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	01	--	--	02	26	02

COURSE OBJECTIVES:

- Create awareness of strategic frameworks, and tools for development of technical strategy
- Understand the art of technology decision-making, anticipate and respond to the
- Behavior of competitors, suppliers, and customers with cross industrial examples.
- Understand how the high technology firms create, capture, and deliver value through
- Inter-firm relationships such as alliances, collaborations, and joint ventures

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Identify technology strategy approaches, roles and Understand performance dynamics and S-curves for organizations to anticipate technological advancements	L2
C02	Discuss the knowledge on strategic frameworks, tools for development of technical strategy.	L2

C03	Discuss the nuances of technology strategy using cross-industry examples.	L2
C04	Describe awareness on alliances, collaborations & joint ventures as part of technology strategy based on examples.	L2
C05	Interpret the importance of establishing strategic alliances within technology ecosystems to gain access to new markets, resources, and knowledge.	L3

COURSE CONTENT:

MODULE 1

6Hrs

Introduction to Technology, what is Technology and Technology strategy, Roles, Technology Push and market Pull, Performance Dynamics & S-Curves

MODULE 2

5 Hrs

Adoption and Industry Dynamics - Adoption Dynamics & Diffusion, Drivers of Diffusion rates, Roger's categories of adoption, Industry Dynamics - Industry patterns of entry/exit,

MODULE 3

5 Hrs

Capturing Value from Technology - Drivers of Value capture, Patents, Standards, Mechanism for appropriation

MODULE 4

5 Hrs

Technology, Social Systems, and Society - Impact of Technology, Open Innovation, First mover advantage

MODULE 5

5Hrs

Disruptions of incumbents, make or buy decision making, Innovation frontier, Technology ecosystems.

TEXT BOOKS:

1.	Constantinos C. Markides and Paul A. Geroski. 2005. Fast Second: How Smart Companies Bypass Radical Innovation to Enter and Dominate New Markets. Jossey-

	Bass. San Francisco

REFERENCE BOOKS:	
1.	The Innovator & DNA: Mastering the Five Skills of Disruptive Innovators, by Dyer, Gregersen, and Christensen, Harvard Business Press.

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CT4803					
TITLE OF THE COURSE	Artificial Intelligence As A Service					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	--	--	02	39	03

COURSE OBJECTIVES:

- Understand the concept and fundamentals of Artificial Intelligence as a Service, including its applications and benefits.
- Deploy AI models and services on cloud platforms and integrate them into applications.
- Develop practical skills in integrating AI services into real-world applications.

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Discuss the context, purpose of AI technologies in various practical applications.	L2
C02	Interpret the problem-solving skills needed when working on real-world problems using heuristics and search algorithms.	L3
C03	Utilize knowledge Representation, based agents, techniques, and rules for problem-solving.	L4
C04	Demonstrate Probabilistic reasoning, Bayesian Theorem, Bayesian belief Network, Markov's decision process Simulated Annealing, Constraint satisfaction problem for providing appropriate solution to the given problem.	L4
C05	Utilize practical skills to work with natural language data, NLP	L4

	techniques, building NLP models to solve various real-world applications.	

COURSE CONTENT:		
MODULE 1		7 Hrs
Introduction to AI: Overview of AI, History, Types of AI, Applications of AI, Agents: Types, Intelligent agent, agent environment, Turing Test.		
MODULE 2		8 Hrs
Problem-Solving Searching algorithms: informed and uninformed searching algorithms, Hill climbing algorithm, Means-Ends analysis, Adversarial search:		
MODULE 3		8 Hrs
Knowledge Representation, Knowledge-based agents, knowledge representation techniques, Propositional logic, First-order logic, forward chaining and backward chaining, AI reasoning.		
MODULE 4		8 Hrs
Uncertain Knowledge Representation, Probabilistic reasoning, Bayesian Theorem, Bayesian belief Network, Markov's decision process. Simulated Annealing, Constraint satisfaction problem.		
MODULE 5		8 Hrs
Natural Language Processing Semantics, Syntax, Formal Grammar, Tokenization, Markov Models, Text Categorization, Bag-of-Words Model, Topic Modelling, Wordnet, Skip-Gram Architecture		

TEXTBOOKS:	
1.	Artificial Intelligence- Elaine Rich, Kevin K and S B Nair, 3rd Edition, McGraw Hill Education, 2017
2.	Artificial Intelligence: A Modern Approach- Stuart Russell and Peter Norvig, Prentice Hall 3rd, 2009

3.	Natural Language Processing and Information Retrieval- Tanveer Siddiqui, U.S. Tiwary, Oxford University Press 2008

REFERENCE BOOKS:	
1.	Artificial Intelligence: Structures and Strategies for Complex Problem-Solving George F Luger Pearson Addison Wesley 6th Ed, 2008
2.	Artificial Intelligence E Rich, K Knight, and S B Nair Tata Mc-Graw Hill 3rd Edition

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CT4804					
TITLE OF THE COURSE	Quantum Cryptography					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	--	--	02	39	03

COURSE OBJECTIVES:

- Be armed with a fundamental toolbox for understanding, designing and analyzing quantum protocols.
- Understand quantum key distribution protocols.
- Understand how untrusted quantum devices can be tested.
- Be familiar with modern quantum cryptography - beyond quantum key distribution

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Describe the basic concepts and components of quantum computing, such as qubits, quantum gates, and quantum algorithms.	L2
C02	Discuss the current state of quantum computing technologies and understand the concept of monogamy of entanglement.	L2
C03	Classify the limitations and trade-offs associated with quantifying information and extracting randomness.	L2
C04	Analyze the security implications and vulnerabilities associated with key distribution and error correction mechanisms.	L3
CO5	Explain the quantum cryptographic protocols using entanglement and understand its significance in achieving secure communication.	L2

COURSE CONTENT:	
MODULE 1	8 Hrs
Introduction to Quantum Computing, Qubits, Quantum Gates, Measuring Qubits in a Basis, Pure and Mixed Quantum States, The Partial Trace, Classical-Quantum States, Generalized Measurements, Encrypting Quantum Bits with Quantum One-Time Pad	
MODULE 2	8Hrs
The Power of Entanglement, Separable States, Entangled States and Purification, Sharing a Classical Secret using Quantum States, Verifying Entanglement using a Bell Experiment, Monogamy of Entanglement	
MODULE 3	8 Hrs
Quantifying Information, Trace Distance, Min-Entropy, Uncertainty Principles as a Guessing Game, Introduction to Privacy Amplification, Strong Randomness Extractors, Randomness Extraction using Two-Universal Hashing	
MODULE 4	8Hrs
Construction of Two-Universal Hash Functions, Introduction to Key Distribution, Challenge of Being Correct and Secure, Key Distribution over a Noisy Channel, Practical Error Correction in Key Distribution Protocols	
MODULE 5	7 Hrs
BB84 Protocol, Warmup: Security Against a Classical Eavesdropper, E91 Protocol: Purifying Protocols using Entanglement, Quantum Key Distribution: Definition and Concepts, Introduction to Device Independent Quantum Cryptography	

TEXT BOOKS:	
1.	Quantum Computing - A Gentle Introduction- Eleanor Rieffel and Wolfgang Polak, MIT Press, 2011
2.	Introduction to Quantum Computing- Philip Kaye, Raymond Laflamme, Michele, Oxford University Press, 2007
3.	Applied Quantum Cryptography- Kollmitzer, Christian, Pivk, Mario, Springer-Verlag Berlin Heidelberg, 2010

REFERENCE BOOKS:	
1.	Quantum Cryptography and Computing, Ryszard Horodecki, Sergei Ya. Kilin, Janusz Kowalik, IOS Press, 2010
2.	https://qiskit.org/textbook/preface.html .

SEMESTER	VIII					
YEAR	IV					
COURSE CODE	20CT4805					
TITLE OF THE COURSE	Industrial Internet of Things					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	--	--	02	39	03

COURSE OBJECTIVES:

- Explain the implementation of industrial processes, specialized control devices and protocols
- Connect basic sensors to AWS IoT, Azure IoT, OEM IoT, Google IoT platforms and extract this data from the cloud itself to your devices

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
C01	Explain the concept and key technologies of Industrial IoT (IIoT) and the different industrial environments scenarios	L2
C02	Describe automation architecture with reference to CIM pyramid and monitor and control of industrial processes and devices.	L2
C03	Implement the industrial data sources to the cloud and securing IIoT data flow	L3
C04	Usage of IIoT technologie architecture and open-source tools such as mosquito as MQTT, Apache Kafka etc. for solving I-IoT applications.	L3
C05	Interpret data twin for simulating and manage a large amount of data using Apache Cassandra for storing and querying.	L3

COURSE CONTENT:	
MODULE 1	8 Hrs
Introduction to Industrial IoT, IoT Key Technologies, IoT and I-IoT - Similarities and Differences, Industry Environments and Scenarios covered by I-IoT, Industrial Process and Devices	
MODULE 2	8Hrs
CIM Pyramid - CIM Pyramid Architecture - Devices and Networks, I-IoT Data Flow - Measurements and the Actuator Chain, Controllers, Industrial Protocols, Supervisory Control and Data Acquisition [SCADA]	
MODULE 3	8Hrs
Implementing the Industrial IoT Data Flow, Discovering OPC, IoT Edge versus the I-IoT Edge, I-IoT Data Sources and Data Gathering, Securing I-IoT Data Flow	
MODULE 4	8Hrs
Developing I-IoT and Architecture - OSGi, Microservice, Containers and Serverless Computing, Standard I-IoT Flow, Implementing a Custom Industrial IoT Platform - An Open Source Platform in Practice, Mosquitto as MQTT Connector, Apache Kafta Overview, Kafta as a Data Dispatcher	
MODULE 5	7 Hrs
Apache Cassandra Overview, Storing Time-Series Data on Apache Cassandra, Industrial OEM Platforms, Predix Platform, MindSphere Platform, Open System Architecture, Overview of Digital Twin	

TEXT BOOKS:	
1.	Hands-On Industrial Internet of Things- Giacomo Veneri, Antonio Capasso, 2018
2.	Industrial Internet of Things: Cyber Manufacturing Systems- Sabina Jeschke, Christia Brecher, Houbing Song, Danda B. Rawat, Springer], 2017
3.	Industrial Internet of Things and Cyber-Physical Systems: Transforming the conventional to Digital-Pardeep Kumar, Vasaki Ponnusamy, Vishal Jain, Advances in Computer and Electrical Engineering, 2020

REFERENCE BOOKS:	
1.	Sravani Bhattacharjee, Practical Industrial Internet of Things Security: A practitioner's guide to securing connected industries,2018
2.	Cristina Alcaraz, Security and Privacy Trends in the Industrial Internet of Things, 2019
3.	Ioana Culic, Alexandru Radovici, Cristian Rusu, Commercial and Industrial Internet of Things Applications with the Raspberry Pi: Prototyping IoT Solutions,2020
4.	Gerardus Blokdyk, Industrial internet of things Standard Requirements,2018

VII SEM ■ OPEN ELECTIVE - II

SEMESTER	VII					
YEAR	IV					
COURSE CODE	200E0035					
TITLE OF THE COURSE	LEAN STARTUP METHODOLOGY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	--	--	--	39	03

COURSE OBJECTIVES:

1. **Analyze** the opportunities and identify the potential problem to build a solution
2. **Devise** the solution to solve the given problem and build core PoC and business model (0).
3. **Explain** the business model iterations based on the Field experience with customers.
4. **Get the idea** of acquiring / retaining customers as well basic finance aspects.
5. **Describe** and illustrate the current and future path forward of your (potential) start-up.

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Explain their understanding of Business model leveraging their field experience.	L2
CO2	Interpret and evaluate the Business Model(s).	L3
CO3	Describe the Lean Start up Methodology with their practical experience.	L2
CO4	Identify and explain the success and failures using Business Model(s).	L2
CO5	Register Start-Up.	L5

COURSE CONTENT:	
MODULE 1	6Hrs
VISION: Start, Define, Learn & Experiment.	
MODULE 2	6Hrs
Leap, Test, Measure & Pivot	
MODULE 3	7Hrs
ACCELERATE: Batch, Grow, Adapt, Innovate	
MODULE 4	10Hrs
BUSINESS MODEL PART I: Business Model Definition, 9 Building Blocks, Business Model Canvas, Patterns	
MODULE 5	10Hrs
BUSINESS MODEL PART II: Design - Customer insights, Ideation, Prototyping, Story Telling Strategy - BM environment, Evaluating BM's, Manage	
CASE STUDY	
Case Studies for LSM - General Electric, Intuit, Qualcomm ,Toyota, we can include these cases in the syllabus.	

TEXT BOOKS:	
1.	Eric Ries "The Lean Startup", ISBN-978-0670921607. https://ia801206.us.archive.org/31/items/TheLeanStartuoErickRies/The%20Lean%20Startuo%20-%20Erick%20Ries.odf
2.	Alex Osterwalder, Yves Pigneur "Business Model Generation Handbook" ISBN-978-0-470-87641 http://alvarestech.com/temp/PDP2011/pdf/Business%20Model%20Generation%20O(l).pdf

REFERENCE BOOKS:	
1.	Steve Blank "The Four Steps to the Epiphany: Successful Strategies for Products That Win", ISBN-13 : 978-0989200509

2.	The Entrepreneur's Guide to Customer Development: A "Cheat Sheet" to the Four Steps to the Epiphany Paperback - Import, 6 February 2012, ISBN-13: 978-0982743607

DAYANANDA SAGAR UNIVERSITY
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SCHOOL OF ENGINEERING



SCHEME & SYLLABUS
FOR
BACHELOR OF TECHNOLOGY (B.Tech)-2021

COMPUTER SCIENCE & TECHNOLOGY
(CST)
(WITH EFFECT FROM 2021-22)

SCHEME - B.TECH - 2021-22 ONWARDS
LSEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	c	SEM	COURSE CODE
1	101-105 & 121-123	21EN1101	LINEAR ALGEBRA AND CALCULUS	CR	3	1	-	-	4	*	***
2	101-105 & 121-123	21EN1102	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	•	***
3	101-105 & 121-123	21EN1103	BASIC ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
4	101-105 & 121-123	21EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	•	***
5	101-105 & 121-123	21EN1105	FUNDAMENTALS OF PROGRAMMING	CR	3	-	4	-	5	*	***
6	101-105 & 121-123	21EN1106	ENVIRONMENTAL SCIENCES	CR	2	-	-	-	2	•	***
7	101-105 & 121-123	21EN1107	KANNADA KALI/MANASU	CR	1	-	-	-	1	•	***
					17	01	08	—	22		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2021-22 ONWARDS
LSEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	21EN1101	LINEAR ALGEBRA AND CALCULUS	CR	3	1	-	-	4	*	***
2	101-105 & 121-123	21EN1108	ENGINEERING PHYSICS	CR	3	-	2	-	4	•	***
3	101-105 & 121-123	21EN1109	BASIC ELECTRONICS	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	21EN1110	ENGINEERING GRAPHICS AND DESIGN	CR	1	-	4	-	3	•	...
5	101-105 & 121-123	21EN1111	ENGINEERING MECHANICS	CR	2	-	-	-	2	*	***
6	101-105 & 121-123	21EN1112	BIOLOGICAL SCIENCES	CR	2	-	-	-	2	•	***
7	101-105 & 121-123	21EN1113	TECHNICAL COMMUNICATION	CR	2	-	-	-	2	•	***
8	101-105 & 121-123	21EN1114	DESIGN THINKING	CR	-	-	2	-	1	*	###
					16	01	10	—	22		
9	101-105 & 121-123	21AU0004	CONSTITUTION OF INDIA AND ETHICS	AU	02	--	--	--	--	•	...

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2021-22 ONWARDS
II SEM - CHEMISTRY CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	c	SEM	COURSE CODE
1	101-105 & 121-123	21EN1201	TRANSFORMS AND DIFFERENTIAL EQUATIONS	CR	3	1	-	-	4	*	***
2	101-105 & 121-123	21EN1102	ENGINEERING CHEMISTRY	CR	3	-	2	-	4	•	***
3	101-105 & 121-123	21EN1103	BASIC ELECTRICAL ENGINEERING	CR	3	-	-	-	3	*	***
4	101-105 & 121-123	21EN1104	ELEMENTS OF MECHANICAL ENGINEERING	CR	2	-	2	-	3	•	***
5	101-105 & 121-123	21EN1105	FUNDAMENTALS OF PROGRAMMING	CR	3	-	4	-	5	*	***
6	101-105 & 121-123	21EN1106	ENVIRONMENTAL SCIENCES	CR	2	-	-	-	2	•	***
7	101-105 & 121-123	21EN1107	KANNADA KALI/MANASU	CR	1	-	-	-	1	•	***
					17	01	08	—	22		

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B.TECH - 2021-22 ONWARDS
ILSEM - PHYSICS CYCLE

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	101-105 & 121-123	21EN1201	TRANSFORMS AND DIFFERENTIAL EQUATIONS	CR	3	1	-	-	4	*	***
2	101-105 & 121-123	21EN1108	ENGINEERING PHYSICS	CR	3	-	2	-	4	•	***
3	101-105 & 121-123	21EN1109	BASIC ELECTRONICS	CR	3	-	2	-	4	*	***
4	101-105 & 121-123	21EN1110	ENGINEERING GRAPHICS AND DESIGN	CR	1	-	4	-	3	•	...
5	101-105 & 121-123	21EN1111	ENGINEERING MECHANICS	CR	2	-	-	-	2	*	***
6	101-105 & 121-123	21EN1112	BIOLOGICAL SCIENCES	CR	2	-	-	-	2	•	***
7	101-105 & 121-123	21EN1113	TECHNICAL COMMUNICATION	CR	2	-	-	-	2	•	***
8	101-105 & 121-123	21EN1114	DESIGN THINKING	CR	-	-	2	-	1	*	###
					16	01	10	—	22		
9	101-105 & 121-123	21AU0004	CONSTITUTION OF INDIA AND ETHICS	AU	02	--	--	--	--	•	...

CR - Credit, AU - Audit, L - Lecture, T - Tutorial, P - Practical, S/P - Seminar/Project, C - No. of Credits

SCHEME - B. TECH - 2021-2 ONWARDS

III

SEM - COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR /AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	J	C	SEM	COURSE CODE
1	104	21CS2301	DISCRETE MATHEMATICAL STRUCTURES	CR	3	-	-	-	3	*	***
2	104	21CS2302	DATA STRUCTURES	CR	3	-	-	-	3	*	***
3	104	21CS2303	DIGITAL ELECTRONICS & LOGIC DESIGN	CR	3	-	-	-	3	*	***
4	104	21CS2304	FULL STACK DEVELOPMENT	CR	2	-	2	-	3	*	***
5	104	21CS2305	COMPUTATIONAL THINKING WITH PYTHON	CR	2	-	2	■	3	*	***
6	104	21CS2306	INTRODUCTION TO NETWORKS & CYBERSECURITY	CR	3	-	-	-	3	*	***
7	104	21CS2307	DATA STRUCTURES LAB	CR	-	-	2	-	1	*	***
8	104	21CS2308	DELD Lab	CR	-	-	2	-	1		
9	104	21CT2301	DESIGN TECHNOLOGY	CR	-	-	2	2	2	*	***
		21CT2302	INNOVATIVE BUSINESSES & BREAKTHROUGH TECHNOLOGIES								
10	104	21CS2310	LIBERAL STUDIES-I	CR	1	-	-	-	1	*	***
					17	-	10	02	23		

CR-CREDIT, AU-AUDIT, L-LECTURE, T-TUTORIAL, P-PRACTICAL, J - SEMINAR/PROJECT, C-NO. OF CREDITS

SCHEME - B.TECH — 2021-22 ONWARDS

IV

SEM ■ COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR /AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	J	C	SEM	COURSE CODE
1	104	21CS2401	PROBABILITY AND STATISTICS	CR	3	-	-	-	3	*	***
2	104	21CS2402	DESIGN AND ANALYSIS OF ALGORITHMS	CR	3	-	-	-	3	*	***
3	104	21CS2403	PRINCIPLES OF MICROPROCESSORS AND COMPUTER ORGANIZATION	CR	4	-	-	-	4	*	***
4	104	21CS2404	FINITE AUTOMATA & FORMAL LANGUAGES	CR	3	-	2	-	4	*	***
5	104	21CS2405	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	CR	3	-	-	-	3	*	***
6	104	21CS2406	LINUX PROGRAMMING & SCRIPTING	CR	2	-	2	-	3	*	***
7	104	21CS2407	DAA LAB	CR	-	-	2	-	1	*	***
8	104	21CS2408	MICROPROCESSORS LABORATORY	CR	-	-	2	-	1	*	***
9	104	21CT2401	SMALL E-BUSINESS LAUNCH	CR	-	2	-	2	2	*	***
10	104	21CS2410	LIBERAL STUDIES-11	CR	1	-	-	-	1	*	***
					19	2	08	02	25		

CR-CREDIT, AU-AUDIT, L-LECTURE, T-TUTORIAL, P-PRACTICAL, J - SEMTNAR/PRO JECT, C-NO. OF CREDIT

SCHEME - B. TECH - 2021-22 ONWARDS

V SEM - COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	p	J	C	SEM	COURSE CODE
1	104	21CT3501	DATABASE MANAGEMENT SYSTEMS	CR	03	-	-	-	03	*	***
2	104	21CT3502	OPERATING SYSTEMS	CR	03	01	-	-	04	*	***
3	104	21CT3503	MACHINE LEARNING	CR	03	-	-	02	04	*	***
4	104	21CT3504	PRODUCT DESIGN & DEVELOPMENT	CR	02	-	-	02	03	*	***
5	104	21CT35XX	TECHNOLOGY ELECTIVE-I	CR	02	-	-	02	03	*	AS INDICATED IN ELECTIVE LIST
6	104	21OEXXXX	OPEN ELECTIVE-I	CR	03	-	-	-	03	*	***
7	104	21CT3505	DATA MANAGEMENT SYSTEMS LABORATORY	CR	-	-	02	-	01	*	***
8	104	21CT3506	OPERATING SYSTEMS LABORATORY	CR	-	-	02	-	01	*	***
9	104	21CT3507	MOOC	CR	02	-	-	-	02	*	***
					18	01	04	06	24		

CR - CREDIT, AU - AUDIT, L - LECTURE, T - TUTORIAL, P - PRACTICAL, J - SEMINAR/PROJECT, C - NO. OF CREDITS

V SEM- TECHNOLOGY ELECTIVE - I

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	C	SEM	COURSE CODE
1	21CT3508	VR AND GAME-THEORETIC SIMULATION	02	-	-	02	03	*	***
2	21CT3509	CREATIVE CODING	02	-	-	02	03	*	***
3	21CT3510	CLOUD SECURITY SERVICES	02	-	-	02	03	*	***

V SEM-OPEN ELECTIVE-1

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	C	SEM	COURSE CODE
1	210E0036	SMALL E-BUSINESS LAUNCH	03	-	-	-	03	*	♦**

SCHEME - B. TECH - 2021-22 ONWARDS

VI SEM - COMPUTER SCIENCE & TECHNOLOGY

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	p	S/P	C	SEM	COURSE CODE
1	104	21CT3601	COMPILER DESIGN AND SYSTEM SOFTWARE	CR	03	01	-	-	04	*	***
2	104	21CT3602	COMPUTER NETWORKS	CR	03	-	-	-	03	*	***
3	104	21CT3603	CLOUD COMPUTING	CR	03	-	-	-	03	*	***
4	104	21CT3604	LEAN STARTUP METHODOLOGY	CR	-	-	02	02	02	*	***
5	104	21CT36XX	TECHNOLOGY ELECTIVE - II	CR	02	-	-	02	03	*	AS INDICATED IN ELECTIVE LIST
6	104	21CT3605	SPECIAL TOPICS-I	CR	-	-	-	02	01	*	***
7	104	21OEXXXX	OPEN ELECTIVES -II	CR	03	-	-	-	03	*	***
8	104	21CT3606	COMPILER DESIGN AND SYSTEM SOFTWARE LAB	CR	-	-	02	-	01	*	***
9	104	21CT3607	COMPUTER NETWORKS LAB	CR	-	-	02	-	01	*	***
					14	01	06	06	21		

CR - CREDIT, AU - AUDIT, L - LECTURE, T - TUTORIAL, P - PRACTICAL, J - SEMINAR/PROJECT, C - NO. OF CREDITS

VI SEM-TECHNOLOGY ELECTIVE - II

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	C	SEM	COURSE CODE
1	21CT3608	HUMAN COMPUTER INTERACTION	02	-	-	02	03	*	***
2	21CT3609	DATA-DRIVEN DECISION MAKING	02	-	-	02	03	*	***
3	21CT3610	BLOCKCHAIN & CRYPTO CURRENCY	02	-	-	02	03	*	***

VI SEM - OPEN ELECTIVE - II

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	J	c	SEM	COURSE CODE
1	210E0021	PRODUCT ENGINEERING & ENTREPRENEURSHIP	03	-	-	-	03	*	***

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1101	LINEAR ALGEBRA AND CALCULUS	3	1	-	-	4

COURSE LEARNING OBJECTIVES:

1. To understand the basic concepts of linear algebra to illustrate its power and utility through applications to science and Engineering.
2. To study the basic concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. To discuss the algebraic as well as geometric perspectives pertaining to the course.
4. To learn the basic functions represented in a variety of ways: graphical, numerical, analytical, or verbal.
5. To develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.
6. To understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change.
7. To understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.

COURSE OUTCOME:

At the end of this course the students are expected to

1. Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.
2. Apply the abstract concepts of matrices and system of linear equations using decomposition methods
3. Explain the basic notion of vector spaces and subspaces
4. Apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces.
5. Analyze functions using limits, derivatives, and integrals.
6. Recognize the appropriate tools of calculus to solve applied problems.

COURSE CONTENT:

Total: 52 Hours

Module-1

LINEAR EQUATIONS AND VECTOR SPACES

Introduction - Row reduction and echelon forms- Gaussian-Elimination - Solution sets of linear equations - LU decomposition - Inverse of a matrix by Gauss Jordan method, Linear spaces - Subspaces - Linear independence - Span - Bases and Dimensions.
Self Learning Component: Algebra of Matrices.

Module-2

LINEAR TRANSFORMATIONS AND ORTHOGONALITY

Linear transformations - Basic properties - Invertible linear transformation - Matrices of linear transformations - Vector space of linear transformations- Orthogonal Vectors - Projections onto Lines - Projections and - The Gram- Schmidt Orthogonalization process.

Self Learning Component: Examples of vector spaces and subspaces, Rank of a matrix.

Module-3

EIGEN VALUES AND EIGEN VECTORS

Introduction to Eigen values and Eigen vectors - Characteristic equation - Diagonalization of a Matrix- Diagonalization of symmetric matrices - Quadratic forms - Singular Value Decomposition - QR factorization.

Self Learning Component: Determinant and Properties of Eigen values and Eigen vectors

Module-4

DIFFERENTIAL CALCULUS

Taylor's Theorem- Taylor's series - Maclourin Series- Indeterminate forms and L- Hospital's Rule- Partial Differentiation - Total derivative-Chain Rule of Partial Differentiation-Differntiation of Implicit function, Euler's Theorem on homogeneous function- Jacobian- Maxima and Minima of functions of two variables-Taylor's Theorem.

Self Learning Component: Functions and graphs, Limits and Continuity, Differentiation

Module-5

INTEGRAL CALCULUS

Reduction formula-improper integrals- Beta and Gamma integrals-Double integration-Change of order of integration-triple integration.

TEXT BOOK(S)

1. D C Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4 th Edition, Thomson Brooks/Cole, Second Indian Reprint 2007.
3. G.B. Thomas, Maurice T Weir and Joel Hoss Thomas's Calculus ,12th Edition, Pearson India.

REFERENCE BOOKS

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42 nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press (2016)
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003
5. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2014.
6. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1102	ENGINEERING CHEMISTRY	3	-	2	-	4

COURSE LEARNING OBJECTIVES:

- The Theory Course intends to provide chemical concepts most relevant to engineering students and demonstrate them in an applied context.
- The student is exposed to the principles required to understand important contemporary topics like alternate energy sources, corrosion control, polymer technology, phase equilibria nanomaterials and green chemistry and catalysis.
- The underlying theme is to emphasize on applications of these concepts to real world problems

COURSE OUTCOME:

- Appreciate the basic principles of electrochemistry, use of different types of electrodes in analysis and evaluate cell potential for different cell reactions.
- Know construction, working and applications of various energy storage devices such as batteries, fuel cells and supercapacitors.
- Understand basic principles of corrosion and apply suitable techniques for corrosion control. Also know the technological importance and processes involved in metal finishing.
- Know the synthesis, structure -property relationship and applications of commercially important polymers and polymer composites. Understand properties and applications of nanomaterials. Also learn the principles of green chemistry for a sustainable and eco-friendly world.

COURSE CONTENT:

Total: 40 Hours

Theory -Syllabus

Module-1

Chemical Energy Source:

Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV & NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol, octane number, cetane number, anti-knocking agents, power alcohol, Biodiesel & Biogas.

Solar Energy:

Thermal energy: Photovoltaic cells- Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique.

Module-2

Energy Science and Technology

Single electrode potential - Definition, origin, sign conventions. Standard electrode potential- Definition-Nernst equation expression and its Applications. EMF of a cell-

Definition, notation and conventions. Reference electrodes- Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Numerical problems on EMF. Ion-selective electrode- glass electrode

Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries-primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries.

Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell.

Module-3

Corrosion Science:

Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Corrosion control, Metal coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method. Surface Modification Techniques:

Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes, Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper.

Module-4

High Polymers: Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Elastomers - Deficiencies of natural rubber and advantages of synthetic rubber. Synthesis and application of silicone rubber, Conducting polymers-Definition, mechanism of conduction in polyacetylene. Structure and applications of conducting Polyaniline.

Nanotechnology: Introduction, properties, synthesis by sol-gel. Fullerenes, Carbon nanotubes, dendrimers and nano-composites

Module-5

Water Technology:

Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method, Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis-Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment.

Instrumental Methods of Analysis: Instrumental methods of analysis, Principles of spectroscopy-Beer's Lamberts law, Difference between spectrometer and spectrophotometer, Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base).

TEXT BOOK(S)

1. Dr. S. Vairam, Engineering Chemistry, Wiley-India Publishers, 2017,
2. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015

REFERENCE BOOK(S)

1. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
2. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

List of Laboratory/Practical Experiments activities to be conducted:

28 Hrs

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by Complexometric titration.
2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
3. Determination of Alkalinity of the given water sample
4. Preparation of MgO nanoparticles by solution combustion method (Demonstration experiment) and spectrometric analysis.
5. Electroless plating of copper (Demo experiment)
6. Preparation of Polyaniline (Demo experiment)

Instrumental methods of Analysis

1. Potentiometric titration-Estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of hydrochloric acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient, surface tension, density of a given liquid
4. Colorimetric estimation of copper in a given solution
5. Determination of Pka of given weak acid.
6. Determination of calorific value of coal/oil using Bomb calorimeter (Group

REFERENCE BOOKS:

1. Dayanada Sagar University laboratory manual.
2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1103	BASIC ELECTRICAL ENGINEERING	3	-	-	-	3

COURSE LEARNING OBJECTIVES:

This course enables students:

- To impart basic knowledge of electrical quantities such as current, voltage, power and energy
- To distinguish between passive and active electrical components
- To explain the general structure of electrical power system
- To define basic laws of electric circuit and to solve related problems
- To understand basics of earthing, protective devices and wiring
- To introduce concepts, analogies and laws of magnetic circuits
- To learn the working principle, construction and characteristics of various DC machines
- To study the construction, principle of operation and types of transformers
- To understand the working principles of measuring equipment.

COURSE OUTCOME:

- Explain the basic knowledge about the Electric and Magnetic circuits.
- Applying basic laws and determine various circuit parameters in AC and DC Circuits.
- Analyze the working of various Electrical Machines.
- Explain the construction, basic principle of operation, applications and determine performance parameters of various measuring instruments
- Outline the knowledge of Green Energy, Electrical Safety Rules & standards

COURSE CONTENT:

Total: 45 Hours

Module -1

ELECTRICAL CIRCUIT CONCEPTS

Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, ohm's law, inductor, and capacitor; types of electrical circuits, voltage and current divider rule, Kirchhoff's laws, Peak, average and rms values of ac quantities; apparent, active and reactive powers; phasor analysis, Power factor, impedance and admittance, power and energy in electrical elements, introduction to 3 phase systems

Module -2

MAGNETIC CIRCUIT CONCEPTS

Basics of magnetic circuits, laws of magnetism, magnetic field, magnetic lines of force, permeability, Electromagnetic Fields: Relation between field theory and circuit theory; numerical on capacitance calculations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Self and Mutual inductance of simple configurations.

Module-3

DC Machines and Transformers

De Machines: Basic principles of electromagnetic energy conversion, Construction, operation, characteristics, performance, of de generators and motors, testing of de machines, applications, Transformers: Construction, working principle, equivalent circuit, voltage regulation, efficiency, Auto-transformers

Module-4

SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors. General working principles and construction of indicating instruments. Electro-magnetic Instruments for the measurement of current, voltage, power and energy. Instruments for the measurement of power factor, frequency, Potentiometers. CRO, Calibration of instruments; importance, procedures and standards

Module-5

POWER STATION PRACTICES, ECONOMICS, AND GREEN ENERGY CONCEPTS

Energy generation-conventional generation of electrical energy using thermal, hydro, nuclear and, non-conventional sources of energy; overview on green energy technology, load forecasting, electricity tariffs, power factor improvement, power plant economics, Overview on electrical safety standards in industries

Text Books

1. D.P.Kothari and I.J. Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGraw Hill, 2010
2. B.L Thereja and A.K Thereja, "A text book of Electrical Technology (Vol III) (Transmission, distribution, and Utilization)", 23rd Edition, S Chand and Company.

Reference Books

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, 'Introduction to Electrical Engineering', 2nd Edition, McGraw-Hill, 1992
2. P.S. Dhogal, 'Basic Electrical Engineering - Vol. I & II', 42nd Reprint, McGraw-Hill, 2012.
3. A. K Sawhney, A course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai & Co. (P) Limited January 2015
4. NPTEL - <https://nptel.ac.in/courses/108/108/108108076/>

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1104	ELEMENTS OF MECHANICAL ENGINEERING	2	-	2	-	3

COURSE LEARNING OBJECTIVES:

The objectives of the Course are to:

- Introduce different ways power generation using renewable and non-renewable energy resources
- Understand thermodynamic cycles for power generation
- Explain materials used for engineering applications
- Learn transmission of power using Gear & Belt Drives
- Understand manufacturing process like metal cutting, welding and Foundry
- Introduce mechatronics, PLC, instrumentation & control systems
- Explain rapid prototyping, 3D printing and electric mobility
- Develop skills to use tools, machines, and measuring instruments

COURSE OUTCOMES:

- Identify various renewable and non-renewable energy resources
- State laws of thermodynamics used for energy conversion
- Compare power transmission using gear and belt drives
- Select different manufacturing methods like metal cutting, joining and foundry
- Construct different types of fitting, welding, sheet metal, turning models
- Demonstrate working of engines, turbines, pumps, 3D printing; wood working, foundry & smithy operations

COURSE CONTENT:

Total: 28 Hours

Module-1

Energy Conversion

Renewable & Nonrenewable energy resources: Introduction to Steam, Hydro & Nuclear power plants, solar, wind and biomass energy based power plants, Effect of power generation on environment

Thermodynamics: First and second laws of thermodynamics, Efficiency, COP, Carnot theorem, Numericals

Module-2

Prime Movers & Pumps

Gas and Vapour cycles: Carnot, Otto, Diesel, Brayton, Rankine & Refrigeration cycles

Prime movers: 4 stroke- petrol and Diesel engines, Gas turbines-open and closed

Cycle, steam turbines-Impulse and reaction, Numericals.

Introduction to pumps: Working of centrifugal and reciprocating

Module-3

Materials & Mechanical Design

Materials: Introduction to ferrous, non-ferrous & composites, Stress-strain diagrams, Mechanical Properties for materials

Mechanical Design: Introduction, Simple Stresses and strains, Elastic constants,

Power Transmission: Gear & Belt Drives, Numerical problems

Module-4

Manufacturing Processes

Metal cutting: Introduction, classification of machine tools, basic operations on lathe, drilling, shaper, milling, grinding, introduction to CNC machining

Joining Processes: Welding- classification, gas, arc, laser & friction welding, brazing and soldering

Foundry: Basic terminology, Types of patterns, sand moulding

Module-5

Advanced Technologies in Mechanical Engineering

Mechatronics: Introduction, Mechatronics, PLC, Instrumentation & control systems

Robotics: Introduction, Robot anatomy, configurations, Sensors, applications

Rapid prototyping & 3D Printing: Introduction & applications, powder-based additive manufacturing processes

Electric Mobility: Introduction, electric, hybrid and autonomous vehicles

List of Laboratory/Practical Experiments activities to be conducted:

28 Hrs

1. Fitting Shop- Simple exercises involving fitting work-Dove tail.
2. Welding Shop- Simple butt and Lap welded joints using arc welding
3. Sheet-metal Shop- Fabrication of tray, Making Funnel complete with soldering
4. Lathe machining on plain and step turning

Demonstration of:

1. Pelton wheel and Francis turbine
2. 4 stroke petrol and diesel engines
3. Lathe, milling, drilling, grinding & CNC milling machines and wood turning lathe
4. Foundry and smithy operations
5. 3D printing parts

Industrial Visit- Report making

Text books:

1. Nag P K (2017). "Basics and applied thermodynamics", Second edition, Tata McGraw Hill, New Delhi.
2. P.N. Rao (2018). "Manufacturing Technology-Foundry, Forming and Welding", Volume 1, 4th Edition, Tata McGraw Hill Publishing Co Ltd.
3. P.N. Rao (2018). "Manufacturing Technology- Metal Cutting and Machine Tools", Volume 2, 4th Edition, Tata McGraw Hill Publishing Co Ltd.

REFERENCES:

1. EI -Wakil M. M (2017). "Power plant technology", Tata McGraw Hill edition, New Delhi.
2. Larminie J, Lowry J (2017). "Electric vehicle technology explained", John Wiley and & Sons Ltd. USA.
3. William D. Callister and David G. Rethwisch (2011). "Fundamentals of Materials Science and Engineering: An Integrated Approach", John Wiley & Sons; 4th Edition.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1105	FUNDAMENTALS OF PROGRAMMING	3	-	4	-	5

COURSE LEARNING OBJECTIVES:

- To develop student competence in writing clear, correct, and maintainable programs that implement known algorithms.

COURSE OUTCOMES:

- Express algorithms learned implicitly in school explicitly in algorithmic form and calculate the number of basic operations (exact or upper bound).
- Trace the execution of short programs/code fragments involving fundamental programming constructs.
- Write a short program/code fragment for a given task using fundamental programming constructs.
- Debug a short program/code fragment with fundamental programming constructs manually, and debug more complex code using a modern IDE and associated tools.
- Design a large program, conduct a personal code review, and contribute to a small-team code review focused on common coding errors and maintainability using a provided checklist.

COURSE CONTENT:

Total: 56 Hours

Module-1

BASICS AND OVERVIEW OF C

Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement.

Module-2

ARRAYS AND STRINGS

Arrays: Introduction, declaration & initialization of array, reading and writing array elements, Operations on array: Traversal, searching, sorting. Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using two-dimensional array.

Strings: Definition, declaration, initialization, and representation. String handling functions and character handling functions.

Module-3

POINTER AND FUNCTIONS

Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers.

Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion.

Module-4

STRUCTURES AND UNIONS

Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures.

Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs.

Module-5

DYNAMIC MEMORY ALLOCATION AND FILES

Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory.

Files: Defining, opening and closing of files. Input and output operations.

List of Laboratory/Practical Experiments activities to be conducted :
1. Design a C program to Swapping of two numbers. (Simple Expressions).
2. Design a C program to Convert Celsius to Fahrenheit.
3. Design a C program to find the simple interest as per the below conditions (Simple expressions, Integer division issues (data loss), Explicit typecasting, when p, t, r are integers and si is float.
4. Design a C program to find the largest of 3 numbers. a) Using if and no else. (Conditionals) b) Using nested if. (conditionals and Boolean expressions) c) Using Ladder if else if d) Using Ternary operator.
5. Design a program that takes three coefficients (a, b, and c) of a Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots.
6. Design a C program to read the vehicle type (Use c or C for car, b or B for bus, t or T for Tempo for vehicle type) and Duration of customer vehicle

parked in parking slot. Parking fare is calculated as per the rates given below: print the total parking charges.

Vehicle	First Rate	Second Rate
Car	Rs 20/hr for first 2hr	Rs 30/hr for next
Bus	Rs 40/hr for first 2hr	Rs 50/hr for next
Tempo	Rs 30 /hr for first 2hr	Rs 40/hr for next

7. a Write a program to calculate the factorial of a given number,
b Write a program using four functions to check if the given number is a palindrome.

8. a Sum of natural numbers ($\text{sum}(n) = n + \text{sum}(n-1)$);
b. Write a program to calculate Power of a number ($b^n = b * b^{n-1}$).

9. Write a program to calculate nth fibonacci number give n first two numbers in the series.

Inputs	n	Output
0,1	3	2
1,5	4	11
2,4	7	42
8,1	5	19
3,5	6	34

10. a Write a program using four functions to check if the given number is a palindrome.
b. Write a program to calculate GCD of two numbers.

11. Write a program to emulate a calculator with the following operations: Addition, Subtraction, Multiplication, Division - using functions, switch and break.)

12. Write a program using four functions to compute the sine of a value using Taylor's series approximation - pass by value.

13. Write a program to find the sum of n different using four functions and arrays.

Use the following function prototype:

void input(int n, int a[n]);

int add(int n, int a[n]);

void output(int n, int a[n], int sum) and main().

14. Write a program to add two matrices using separate function for input, add matrices, display matrix and main function.

15. String handling:

a) Write a function to reverse the string in reverse and display it. (Strings)

b) Write a function to concatenate the two strings without using strcat.(Strings) c) Write a function to find the length of the string.
16. Write a program using Bubble sort technique to sort an array of integer elements .(Sorting technique, Const array arguments.)
17. Write a program to search an array of elements of data type requested by the user for a given item using binary search algorithm. (Searching technique, Const array arguments).
18. Write a program with functions to add and multiply two complex numbers. Define a structure Complex to represent a complex number. The main function should call other functions for the purposes of input, computations and display. (Structs as arguments).
19. Write a program to add n fractions using function.
20. Define a structure, student, to store the following data about a student: rollno (integer), name (string) and marks(integer). Your program must contain the following functions: (Array of Structures). (5 marks) • A function to read the students data. • A function to display records of each student. • A function to sort the records of student RankWise • A function print all students details • A function to search student details by Rollno • A function to print the names of the students having the highest test score

TEXT BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.
2. Reema Thareja, "Programming in C". Oxford University Press, Second Edition, 2016

REFERENCES:

1. R. S Bichkar, "Programming with C and Data Structure", University Press, 2014
2. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science - A Structured Approach Using C", Cengage Learning, 2007
3. Brian W. Kernigham and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, PHI, 2012
4. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press 2013.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1106	ENVIRONMENTAL SCIENCES	2	-	-	-	2

COURSE LEARNING OBJECTIVES:

- To understand the concepts of ecosystem, energy and non-renewable energy resources
- To learn water quality aspects requirement and water safety plans
- To explain solid waste and sewage management
- To create awareness of noise, air & land pollution and knowledge of the current issues and pollution endangering life on earth
- To learn environmental laws and regulations
- To understand environmental protection protocols and regulations

COURSE OUTCOMES

- Analyse basic concepts that govern environmental quality, atmospheric principles and environmental standards
- Compare different Energy resource and their environmental implications
- Identify different types of pollution, waste streams
- Identify different natural and manmade disasters and prevention
- Apply the process of environmental impact assessment and implications of Indian Environment Laws

COURSE CONTENT:

Total: 28 Hours

Module-1

Basic Concepts of Environment

Scope and importance of environmental studies, Definition of environment-comprehensive understanding of environment, Basic concepts: Xenobiotic, natural & anthropogenic; why are we concerned? Types of xenobiotics: Chemical, Physical, Biological pollutants; Hazard & Risk, Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships-chronic and acute effects, Environmental Standards: AAQS, TLV's, Appraisal, Assessment & Abatement (Recognition, Evaluation & Control) of pollutants- Structure of Atmosphere; Atmospheric inversions, Environmental System.

Air Pollution: Criteria pollutants - Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; SMOG & Air-pollution episodes

Aerosols: Primary & Secondary pollutants, Acid Rain Cycle.

Module-2

Water Treatment

Hydrosphere, Lentic and Lotic Water Systems, Fresh Water as a resource; Rain Water Harvesting, Treatment of potable water, Waste water- Characteristics, Municipal Sewage Water and Treatment.

Waste Management

Types of Wastes: Municipal Solid Waste, Hazardous Waste, Nuclear Waste, Electronic Waste, Biomedical Waste, Solid Waste Management: Landfills, composting
Water Standards

Module-3

Energy

Types of energy: Conventional sources of energy, fossil fuel, Coal, Nuclear based, Solar, wind, sea-Tidal Wave energy, Geo-Thermal, Non-conventional sources of Energy, Biofuels - biomass, biogas, Natural Gas; Hydrogen as an alternative future source of energy.

Module-4

Disasters & Management

Definition, origin and classification. Natural (Earthquakes, landslides, floods, Cyclones), Man-made disasters (biological, chemical, nuclear, radiological explosions) - definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters, Environment & Health - Occupational Health Hazards, Occupational Diseases, Epidemics, Pandemics, Endemics (Fluoride, Arsenic)
Principles and Significance of Sanitation

Module-5

Environmental Impact Assessment (EIA) and Indian acts and regulations

Principles of EIA, Indian Acts and Rules, Wildlife (Protection) Act 1972. Water Act - 1974 (Rules 1975), Forest Conservation Act 1980 (Rules 2003), Air Act -1981 (Rules 1982,1983), Environment Protection Act, 1986

TEXT BOOKS:

1. Benny Joseph (2005). "Environmental Studies", Tata McGraw - Hill Publishing Company Limited, New Delhi.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy (2009). "Environmental Studies". Wiley India Private Ltd., New Delhi.

REFERENCES:

1. P.Aarne Vesilind, Susan M.Morgan, Thomson (2008). "Introduction to Environmental Engineering" (2008), Thomson learning, Second Edition, Boston.
2. R. Rajagopalan (2005). "Environmental Studies - From Crisis to Cure" Oxford University Press, New Delhi.
3. R. J. Ranjit Daniels and Jagadish Krishnaswamy (2014). "Environmental Studies" (2014), Wiley India Pvt Limited, New Delhi.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1107'	KANNADA KALI	1	-	-	-	1

COURSE OBJECTIVES:

- To introduce Kannado language & culture to Non - Kannada speakers.
- To train them to communicate in colloquial Kannada with connivance

COURSE OUTCOMES:

- The learners can communicate in Kannada & acquaint themselves with Kannada culture

COURSE CONTENT

- Introduction to Karnataka & Kannada Culture.
- Evolution of Kannada.
- Introduction to Kannada Alphabets.
- Introduction to Kannada Numbers.
- Kannada words, sentences & phrase making for colloquial communication.

REFERENCE BOOKS:

1. Kannada Kali -Dr. Lingadevaru Halemane
2. Kannada Paotagalu- Editor: Dr. Chandrashekara Kombara.
3. SLN Sharma & K Shankaranarayana "Basic Grammar", Navakarnataka Publications.
4. Spoken Kannada. Publication: Kannada Sahitya Parishat Bengaluru.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN12O1	TRANSFORMS AND DIFFERENTIAL EQUATIONS	3	1	-	-	4

COURSE LEARNING OBJECTIVES:

1. To provide the basic concepts and necessary fundamentals to formulate, solve and analyze engineering problems.
2. To discuss the theoretic as well as geometric perspectives.
3. To understand the Fourier Series and Laplace Transform to solve real world problems.
4. To make strong foundation of the integral transforms and their inverses.
5. To understand the basic concepts of ODE and PDE to illustrate its power and utility through applications to science and Engineering.

COURSE OUTCOME:

At the end of this course the students are expected to

1. Apply Laplace transform and its inverse to solve differential and integral equations.
2. Represent the periodic functions using Fourier series.
3. Use Fourier transforms and its inverse in practical applications of engineering problems.
4. Apply transform techniques to analyze continuous-time and discrete-time
5. Solve engineering problems using the principles of solution of differential equations.
6. Solve ordinary differential equations using Laplace transform.
7. Apply the partial differential equation for solving engineering problems.

COURSE CONTENT:

Total: 52 hours

Module-1

LAPLACE TRANSFORM AND INVERSE LAPLACE TRANSFORM

Basic concepts, Laplace transform of basic functions-Linearity and First shifting theorem, Laplace transforms of derivatives and integrals, Second shifting theorem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differential equations.

Self Learning Component: Differentiation of functions

Module-2

FOURIER SERIES

Fourier Series, Dirichlet's conditions, Euler's Formulae, Fourier series of discontinuous functions, Even and odd functions, Change of interval, Parseval's theorem, Complex form of Fourier series

Self-Learning Component: Basic definitions of series, examples

Module-3

FOURIER TRANSFORM AND INVERSE FOURIER TRANSFORM

Fourier transform and Fourier's integral theorem, Fourier cosine integral, Fourier sine integral, Basic properties of Fourier transform.

Self Learning Component: Basic definitions and properties of integration

Module-4

ORDINARY DIFFERENTIAL EQUATION

Basic definitions-First Order first degree differential equations-Non homogeneous equations reducible to Homogeneous form-Exact differential equations-Bernoulli equation-Linear differential equations of second order with variable coefficients-Second order D.E with constant coefficients.

Self Learning Component: Basic definitions of differential equation and examples

Module-5

PARTIAL DIFFERENTIAL EQUATION

Formation of partial differential equation -Solutions of partial differential equation - Linear equations of the first order- Charpit's Method-Rules for finding the complementary function- Finding the particular integral-Method of separation of variables-Heat equation- Wave equation -Laplace equation

Self Learning Component: Geometrical interpretation of Partial Differential equation

TEXT BOOKS

1. B.V Ramana, Higher Engineering Mathematics, Mc Graw Hill education India Pvt Ltd, 31st edition
2. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2014.
3. G.B.Thomas, Maurice T Weir and Joel Hass Thomas's Calculus , 12th Edition, Pearson India.

REFERENCE BOOKS

1. P. P. G. Dyke, An introduction to Laplace transform and Fourier Series, 4th Edition, Springer (2004).
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 10th edition.
4. Stanley J. Farlow, Partial Differential Equations for Scientists and Engineers.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1108	ENGINEERING PHYSICS	3	-	2	-	4

COURSE LEARNING OBJECTIVES:

- > To introduce the basic concepts of Quantum mechanics which are essential in understanding and solving problems in engineering,
- > To review different types of Engineering materials -Electronic, electrical, mechanical and Magnetic materials Properties and their applications in Science and Engineering.
- > To understand Bond structure of solids, Semiconductors and electrical conductivity of SC's, and their applications.
- > To explain semiconductor devices like LED, Photodiode and Solar cell and Semiconductor BJT.
- > To explain Thin-film Phenomena, Thin-film fabrication Process and their applications in engineering.
- > To learn how to fabricate Nano materials by using Top-down and Bottom -up approachS To review Nano science and technology and its practical applications in biology, engineering and medicine.

COURSE OUTCOME:

- Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimensions.
- Discuss the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering
- Illustrate Semiconductors , Semiconductor devices like Photo diode, LED, Solar cell and BJT and its applications
- Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and Summarize theoretical background of laser, construction and working of different types of lasers and its applications in science and engineering
- Interpret Basic concepts of Thin films and Thin film deposition processes and their applications leads to Sensors and engineering devices
- Discuss Nano materials, Properties and fabrication of Nano materials by using Top-down and Bottom -up approach's-Applications for Science and technology

COURSE CONTENT:

Total: 42 Hours

Module-1

Quantum Mechanics: Foundations of quantum theory, Wave function and its

properties, de-Broglie hypothesis, Heisenberg Uncertainty principle. One dimensional time independent Schrodinger wave equation, Eigen values and Eigen functions. Applications: one dimensional motion of an electron in a potential-well.

LASER PHYSICS: Introduction to lasers. Conditions for laser action. Requisites of a Laser system Principle, Construction and working of Nd-YAG and , Semiconductor Laser. Application of Lasers in Defense (Laser range finder), Engineering (Data storage) and Applications of Lasers in medicine

Module-2

Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valance band (Mention the expression), Intrinsic carrier concentration Conductivity of semiconductors.

Semiconducting devices for optoelectronics applications: Principle and working of LED, photodiode, Solar cell, BJT and Numericals

Module-3

Introduction to Engineering materials: Classification of Engineering Materials such as Conductors, Semiconductors, Insulators. Electrical conductivity of metals and Semiconductors. Effect of temperature, composition on resistivity of materials.

Dielectrics: Introduction -Dielectric polarization- Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientation polarizations (qualitative) - Lorentz Internal field - Claussius-Mossoti equation - Applications of Dielectrics. Numericals.

Module-4

Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC, BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals

Mechanical Engineering Materials - mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test- (4 hours)

Module-5

Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films.

Nano Science Stechnology: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up

approach- Ball-milling and Photolithography, Process. Fundamental Principles of Bio-Physics SApplications of Nano technology in Biology and Engineering.

LABORATORY EXPERIMENTS

List of Experiments:

- 1.1-V characteristics of a Zener Diode
I-V Characteristics of a Zener diode in forward and reverse bias condition(Module 2)
2. Planck's constant
Measurement of Planck's constant using LED(Module 2)
3. Transistor characteristics
Input and output characteristics of a NPN transistor in C-E configuration(Module2)
4. Dielectric constant
Determination of dielectric constant of a dielectric material (Module 2)
5. Torsional Pendulum
Determination of moment of inertia of a circular disc using torsional pendulum
6. Diffraction grating
Determination of wavelength of a laser light using diffraction grating (Module 4)
7. LCR series and parallel resonance
Study the frequency response of a series and parallel LCR circuit (Module 3)
8. Band gap energy
Determination of energy gap of an intrinsic semiconductor (Module 2)

TEXT BOOKS

1. S. M. Sze, Semiconductor devices, Physics and Technology, Wiley.Publishing
2. Engineering Physics (2019), DSU Pearson, New Delhi

REFERENCE BOOKS

1. M. Young (1977), Optics & Lasers An Engineering Physics approach, Springer
- 2 K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
3. S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi
4. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1109	BASIC ELECTRONICS	3	-	2	-	4

COURSE OBJECTIVES

This course enables students:

- To introduce the concepts of fundamentals of semiconductor devices with the basic knowledge of the flow of current in semiconductor devices such as diodes and transistors
- To Explain the characteristics of various semiconductor devices and the concept of Integrated circuits
- To understand the principles of electronic circuits for operations of energy conversions from AC to DC, noise removal and building the required power supply
- To understand how a particular electronic device can increase the power of a signal and also to be acquainted with gain calculations
- To implement the Boolean functions and to realize basic logic gate operations and logic functions
- To understand the basics of communication system, to modify the characteristics of carrier signals according to the information signals
- To study the fundamentals of electromagnetic waves
- To identify and understand the different blocks present in transmitter and receiver.
- To describe various parameters of Op-Amp, its characteristics and specifications.
- To understand the various applications of Op-Amp.

COURSE OUTCOMES

- Explain the fundamentals of semiconductor devices, analog and digital circuits
- Design and analyze the behavior of analog and digital circuits.
- Outline the overview of communication systems and oscillators.
- Solve various kinds of numerical problems
- Develop the analog and digital circuits using simulation tool

COURSE CONTENT:

Total: 45 Hours

Module-1

Semiconductor Diodes Semiconductor materials- intrinsic and extrinsic types, Ideal Diode. Terminal characteristics of diodes: p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region, Zener diode, Series voltage regulator, Rectifier Circuits: Half wave and full wave, Reservoir and smoothing circuits.

Module-2

Transistors - Introduction, Transistor construction, operation and characteristics; Configuration types: Common base and common emitter configuration, Active region operation of transistor, Transistor amplifying action, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Transistor as a

switch: cut-off and saturation modes. Field Effect Transistors: Construction and characteristics of n-channel JFET, Types of power amplifiers: Class A operation, Class B operation, Class AB operation.

Module-3

Operation Amplifier

Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non-inverting amplifier, comparator, summing amplifier, integrator, differentiator. The concept of positive feedback, Oscillator circuits using op amps: RC phase shift oscillator, wein bridge oscillator.

Module-4

Communication system - The radio frequency spectrum, electromagnetic waves, A simple CW transmitter and receiver, modulation, demodulation, AM transmitter, FM transmitter, Tuned radio frequency receiver, Superheterodyne receiver. RF amplifiers, AM demodulators.

Module-5

Digital circuits - Logic functions, Switch and lamp logic, logic gates, combinational logic, bistables/flipflops, application of Flipflops, Integrated circuit logic devices: introduction to Microprocessor and microcontrollers (Architecture), Related Problems.

TEXT BOOKS

1. Electronic Devices and Circuit Theory: Robert L Boylestad and Louis Nashelsky, Pearson Education, Eleventh Edition, 2013.
2. Electronic Circuits: Fundamentals and applications, Michael Tooley, Elsevier, Third edition, 2006

REFERENCE BOOKS

1. David A Bell, Electronic Devices and Circuits, PHI, 5th edition, 2007.
2. Millman & Halkias, Electronics Devices and Circuits, McGraw Hill, second edition, 2010
3. Modern Digital and Analog Communication Systems by B.P.Lathi. Oxford University Press, Fourth edition, 2010
4. NPTEL- <https://nptel.ac.in/courses/122/106/122106025/>
5. Virtual Labs- <http://vlabs.iitkgp.ac.in/be/>

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1110	ENGINEERING GRAPHICS & DESIGN	1	-	4	-	3

COURSE OBJECTIVES:

- To create awareness and emphasize the need for Engineering Graphics
- To understand the principles of geometrical curves and construct manually
- To learn using professional CAD software for construction of geometry
- To construct orthographic projection of points, lines, planes and solids
- To develop the lateral surfaces of solids
- To construct isometric projections of planes and solids
- To create simple engineering 3D components and assembly

COURSE OUTCOMES

- Identify usage of instruments, dimensioning & tolerances, conventions and standards related to working drawings
- Construct points, lines, planes and solids using orthographic projections principles
- Construct geometries of planes and solids using isometric projection principles
- Develop section of solids for different planes of inclination
- Construct lateral surfaces of solids using geometry development principles
- Create associative models at the component and assembly levels for product design

COURSE CONTENT:

Total 70 hours

Module-1

Introduction: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling of figures, symbols and drawing instruments, Introduction to orthographic & perspective projection. Types of projections, Principles of Orthographic projection
Plain & Miscellaneous Curves: Construction of ellipse, parabola, hyperbola, Construction of Tangent and Normal at any point on these curves. Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Construction of Tangent and Normal at any point on these curves.

Module-2

Projection of Points and Lines: Projections of points located in same quadrant and different quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.
Projection of planes: Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by change of position method.

Module-3

Projection of Solids: Projection of solids such as prisms, pyramids, cone, cylinder, tetrahedron, Projections of solids with axis perpendicular and parallel to HP and VP,

solids with axis inclined to one or both the planes, suspension of solids.

Module-4

Sections of Solids: Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other, obtaining true shape of section.

Development of Surfaces: Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.

Module-5

Isometric Projection: Principles of isometric projection, isometric scale, Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions, Conversion of orthographic views into isometric projection and vice versa

Module-6

Computer Aided Design: Introduction to computer aided drafting and tools to make drawings. Layout of the software, standard tool bar/menus and description, drawing area, dialog boxes and windows, Shortcut menus, setting up and use of Layers, layers to create drawings, customized layers, create, zoom, edit, erase and use changing line lengths through modifying existing lines (extend/lengthen) and other commands. Demonstration of a simple team design project: Product Design- Introduction, stages, Design Geometry and topology of engineered components creation of engineering models and their presentation in standard 3D view. Use of solid-modeling software for creating associative models at the component and assembly levels; include: simple mechanical components-bolts, nuts, couplings; simple civil fixtures -windows, doors, bath, sink, shower, etc. Applying colour coding to the components.

TEXT BOOKS:

1. Gopalakrishna, K. R. and Sudheer Gopala Krishna (2015). "Computer Aided Engineering Drawing", Subash Publishers, Bangalore, India.
2. Bhatt N.D. (2019). "Engineering Drawing", 53rd Edition, Charotar Publishing House, Gujarat, India.

REFERENCES:

I.Dhananjay .A .J, (2018). "Engineering Drawing with Introduction to AutoCAD", Tata McGraw-Hill Publishing Company Ltd.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1111	ENGINEERING MECHANICS	2	-	2	-	3

COURSE OBJECTIVES:

- Explain different types of forces and couples, resolution of forces and couples, equilibrium conditions and related theorems
- Explain concepts of friction and their relevance in Engineering problems
- Describe centroid, center of gravity and differences between them, area moment of inertia, examples of planar objects and computations for them
- Describe Trusses and its classification, assumptions in analysis of trusses, forces in members in a truss
- Calculate various dynamic quantities of translational motion and projectile motion
- Explain principles of dynamics in plane motion analysis

Course Outcomes

- Analyze structure using free body diagrams and principle of statics
- Analyze structures using concept of equilibrium conditions considering effect of frictional forces
- Calculate the centroid and moment of inertia of composite geometrical sections
- Compute axial forces in members of determinate truss
- Analyze plane kinematics and kinetics of particles/rigid bodies

COURSE CONTENT:

Total 28 hours

Module-1

Introduction to Engineering Mechanics

Introduction to Engineering Mechanics, Force Systems Basic concepts, Particle Equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Resultant- Moment of Forces and its Application; Couples and Resultant of force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium.

Module-2

Friction

Introduction, Types of friction, Limiting friction, Cone of Friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Ladder friction, related problems.

Module-3

Centroid, Centre and gravity and Moment of inertia

Introduction, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition,

Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone.

Module-4

Analysis of Trusses

Introduction, Classification of trusses, Equilibrium in two and three dimension; Method of Sections; Method of Joints; To determine if a member is in tension or compression; Simple Trusses; Zero force members.

Module-5

Dynamics

Introduction, Rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates); Projectile motion, Relative and constrained motion; Basic terms, general principles in dynamics; Types of motion, Instantaneous Centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies.

TEXT BOOKS:

1. Irving H. Shames (2006), "Engineering Mechanics", 4th Edition, Prentice Hall publications.
2. A. Nelson (2009), "Engineering Mechanics: Statics and dynamics", Tata McGraw Hill publications.

REFERENCES:

1. R.C. Hibbler (2006), "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.
2. Bansal R.K (2010), "A Text Book of Engineering Mechanics", Laxmi Publications.
3. H.J. Sawant, S.P Nitsure (2018), "Elements of Civil Engineering and Engineering Mechanics", Technical Publications.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21EN1112	BIOLOGICAL SCIENCES	2	-	-	-	2

COURSE OBJECTIVES

1. To familiarize the student with the structure and function of important components of biological systems and cellular processes.
2. Biological systems and processes will be analyzed from an engineering perspective, with an emphasis on how these can be re-designed for industrial processes and commercial products.

COURSE OUTCOMES

1. Student understands biological systems
2. Student gets the engineering aspects from biological systems

COURSE CONTENT:

Total 28 hours

Biology in the 21st Century: The new world in the post genome era. Past, present and future of our society, industry and life style: impact of discoveries and technological innovations in biology. Challenges and excitement of research in biology and bioengineering. Bioengineering as an emerging science at the intersection of biology, engineering, physics and chemistry.

Career opportunities in biotechnology, biomedical engineering, pharmaceutical industry, agro-biotechnology and in the diverse areas of basic science and medical research. Emerging trends of collaboration between industry and academia for development of entrepreneurship in biotechnology.

Quantitative views of modern biology. Importance of illustrations and building quantitative/ qualitative models. Role of estimates. Cell size and shape. Temporal scales. Relative time in Biology. Key model systems - a glimpse.

Management and transformation of energy in cells. Mathematical view - binding, gene expression and osmotic pressure as examples. Metabolism. Cell communication. Genetics. Eukaryotic genomes. Genetic basis of development. Evolution and diversity. Systems biology and illustrative examples of applications of Engineering in Biology.

TEXT BOOKS:

1. R. Phillips, J. Kondev and J. Theriot, Physical Biology of the Cell, Garland Science Publishers. 2008.1st edition.
2. J. B. Reece, L. A. Urry, M. L. Cain, S. A. Wasserman, P.V.Minorsky, and R.B.Jackson. Campbell Biology, Benjamin Cummings publishers. 2010. 9th edition.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1113	TECHNICAL COMMUNICATION	2	-	-	-	2

COURSE LEARNING OBJECTIVES:

The objectives of the Course are:

- To improve students lexical, grammatical competence
- To enhance their communicative skills
- To equip students with oral and appropriate written communication skills
- To inculcate students with employability and job search skills
- To achieve proficiency in English
- To develop professional communication skills
- To create interest among the students about a topic by exploring thoughts and ideas
- To enable students with good use of tenses
- To learn the use of body language and improve verbal message
- To equip with Types of Teams and Leadership styles to develop managing skills in corporate world.
- To acquire skills for placement

COURSE OUTCOMES

- Explain communication and types of Communication: Managerial, Corporate, Technical & Organizational Communication.
- Distinguish Listening and hearing. Demonstrate various aspects of speaking. Discuss Word formation and types.
- Write a report, essay. Minutes of Meeting. Evaluate current issues and debate
- Use Leadership skills and Team building. Solve Tense exercise.
- Write a job application and CV.
- Discuss topic and speak on the spot. Interpret data

COURSE CONTENT:

Module-1

Language Skills & Communication and Types of Communication.

Definitions. Communication process diagram. Types of Communication: Managerial, Corporate, Technical & Organizational Communication.

Barriers to effective Communication.

Listening: Types & its Importance. Difference between hearing & listening.

Speaking: Different aspects of Effective Speaking.

Reading: Extensive and intensive.

Word Formation and Types of Word Formation.

Word Family.

Module-2

Group Discussion and Writing Skills

Report Writing: Importance. Steps for Report Writing.

Group Discussion: Definition, How GD helps in Student Life & Corporate Life.

Minutes of Meeting: Importance; Steps for writing MOM in Organizations.

Module-3

Team Building; Leadership Styles & Tenses.

Teams: Definition, Importance, Types of Team;

TEAM BUILDING:

Approaches to team building, Characteristics of Effective Teams, Creating Effective Teams Key Team Roles, Team Processes, Interpersonal Processes in Teams, Task and maintenance leadership, Team Dynamics, Team cohesiveness, Decision Making in Teams, Diversity, Characteristics of "High Performance Teams," Principles of Effective Teamwork, Turning Individuals into Team Players, Teams and Quality Management, Relationship between team working and innovation in organization.

Leadership: Styles of Leadership; Characteristics of a good leader, Influence of different forces on leadership

LAB BASED: Tenses: Types of tenses, structure & usage. (Exercises based on tenses)

Module-4

JOB APPLICATION, RESUME, COVER LETTER & Data Interpretation.

JOB Application, Covering Letter; Resume/CV Writing;

Difference between Job Application & Resume.

Writing Covering letter and Resume.

Module-5

DATA Interpretation-Tables, Bar-graph, Pie chart & Flowchart.

(Theoretical as well as Numerical).

Activities:

1. Activities on Fundamentals of Inter-personal Communication and Building Vocabulary -Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations and Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations and usage of vocabulary.
2. Activities on Group Discussion , Interview Skills and Debate- Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference and video-conference and Mock Interviews-Critical thinking skills in debate,

analytical research , organize thoughts, note-taking skills, effective speech composition and delivery and team work

REFERENCE BOOKS

1. Chauhan, Gajendra S., L. Thimmesha and Smita, Kashiramka (2019). Technical Communication, Cengage Learning, New Delhi.
2. Bailey, Stephen. Academic Writing: A Handbook for International Students. Routledge, 5th Edition.
3. Kumar, Shiv K., Nagarajan, Hemalatha. (2007). Learn Correct English - A Book of Grammar, Usage and Composition.
4. Ramon, Meenakshi, Sharma, Sangeeta. (2009). Technical Communication. Oxford University Press.
5. English Vocabulary in Use. (2008) Cambridge University Press.

COURSE CODE	COURSE TITLE	L	T	p	S/P	C
21EN1114	DESIGN THINKING	-	-	2	-	1

COURSE OBJECTIVES:

- Introduce students to a discipline of design thinking that enhances innovation activities in terms of value creation, speed, and sustainability
- Learn application of design methods and tools on real world problem
- To impart knowledge and skills to use various workbenches in Autodesk Fusion 360.
- To provide hands-on training in virtual modeling and table-top modeling.
- Application of design thinking, design methods and tools on real world problem.

Course Outcomes

- Apply the design thinking principles and recognize the significance of innovation
- Develop creative ideas through design criteria & brainstorming sessions
- Sketch various part models related to engineering field using Autodesk Fusion 360
- Evaluate project on ideation & generate solution
- Construct table top models using card board and clay

COURSE CONTENT:

Total 28 hours

Module-1

Design Thinking

Introduction, Phases of design thinking, Design thinking: an iterative and non-linear process.

Module-2

Scope and Morphology of Design Process

Creativity and Idea Generation, Concept Development, Testing and Prototyping, Brainstorming & decision making.

Module-3

Design Communication and Presentation

Types of design communications, Barriers and Difficulties in Communication

Module-4

Project on Ideation

Generation of Solution from Students for Problem Brief Generated. Brainstorming session with students on example problem.

Module-5

Project on Creativity

Table-top modelling: Using paper and cardboard based modelling, clay modelling.

TEXT BOOKS:

1. C. L. Dym and Patrick Little (2015). "Engineering Design- A Project Based Introduction", John Wiley.
2. N. Cross (2021). "Engineering Design Methods: Strategies for Product Design", John Wiley.

REFERENCES:

1. Tim Brown (2019). "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Business.
2. Bruce Hannington and Bella Martin (2015). "Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions", Rockport Publishers.

COURSE CODE	COURSE TITLE	L	T	P	S/P	C
21AU0004	CONSTITUTION OF INDIA & ETHICS	2	-	-	-	-

Course objectives

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.

Course outcomes

At the end of the course student will be able

- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Municipalities, Panchayats and Cooperative Societies,
- Understand Engineering ethics and responsibilities of Engineers

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

Directive Principles of State Policy & Relevance of Directive Principles State Policy fundamental Duties.

Union Executives - President, Prime Minister Parliament Supreme Court of India.

State Executives - Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th&91st Amendments.

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions.

Powers and functions of Municipalities, Panchyats and Co - Operative Societies.

Text Books:

1. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) PrenticeHall, 19th / 20th Edn., 2001

Reference Books:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2301					
TITLE OF THE COURSE	DISCRETE MATHEMATICAL STRUCTURES					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Solve problems using relations and generating functions.
- Understand and Construct mathematical arguments.
- Use propositional and predicate logic in knowledge representation and program verification.
- Develop recursive algorithms based on mathematical induction.
- Know essential concepts in graph theory and related algorithms.
- Apply knowledge of discrete mathematics in Elementary Number Theory and problem solving.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Classify functions, basic set theory relations.	L4
CO2	Demonstrate the correctness of an argument using propositional and predicate logic, laws and truth tables.	L2
CO3	Compare and differentiate graphs in different geometries related to edges.	L4
CO4	Apply mathematical induction, counting principles, recursion, elementary number theory.	L3
CO5	Apply and solve Euclidean Division Algorithm and Chinese Remainder Theorem.	L3

COURSE CONTENT:	
MODULE 1	8Hrs
RELATIONS AND FUNCTIONS: Relation and Types of relations, Closure Properties, Equivalence Relations, Partial Ordering Relations, n-ary relations, Functions: one-to-one, onto and invertible functions, sequences, indexed classes of sets, recursively defined functions, cardinality Counting Principles: Permutation, combination, the pigeon hole principle, inclusion-exclusion principle Self - Learning Component: Set theory definition and Properties	
MODULE 2	8Hrs
LOGIC: Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications, predicate logic, theory of inference for propositional logic and predicate logic. Introduction to Predicate Calculus.	
MODULE 3	8Hrs
NUMBER THEORY: Properties of Integers: Introduction, order and inequalities, absolute value, mathematical induction, division algorithm, divisibility, primes, greatest common divisor, Euclidean algorithm, fundamental theorem of arithmetic, congruence relation, congruence equations and Chinese Remainder Theorem (CRT).	
MODULE 4	7Hrs
GRAPH THEORY: Graphs and multi-graphs, sub-graphs, isomorphic and homomorphic graphs, paths, connectivity, Euler and Hamilton paths, labelled and weighted graphs, complete, regular and bipartite graphs, planar graphs.	
MODULE 5	8Hrs
TREES AND GRAPH COLORING: Trees: Definitions-properties - fundamental theorems of trees-rooted trees-binary trees-spanningtrees. Coloring of planar graphs. Chromatic Number- Chromatic partitioning- The four Color Problem-Five-color.	

TEXT BOOKS:

1. K. H. Rosen, Discrete Mathematics & its Applications, 7th Ed., Tata McGraw-Hill, 2007.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall India (PHI).

REFERENCES:

1. M.Huth and M. Ryan, Logic in Computer Science, Cambridge University N.Press. 2004.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2302					
TITLE OF THE COURSE	DATA STRUCTURES					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
	**	***	***

COURSE OBJECTIVES:

- To introduce the concept of data structure and its applications
- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To introduce non-primitive data structures
- To analyse the complexity of a data structure
- To introduce static and dynamic memory allocation using C language
- To explain linear data structures - stack, queue, linked list
- To explain non-linear data structures — trees and graphs

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline basic C program design for data structures	L2
CO2	Implement stack & queue data structure and their applications	L3
CO3	Apply concepts of dynamic memory allocation to real-time Problems	L3
CO4	Implement tree data structure and its applications	L3
CO5	Implement graph data structure and its applications	L3
CO6	Outline the concepts of file structures	L2

COURSE CONTENT:	
MODULE 1	7Hrs
INTRODUCTION TO DATA STRUCTURES: Definition, Types, C Pointers, C Structure, Arrays, Representation of Linear Array in Memory. Array Operations (Insertion, Deletion, Search and Traversal), Single Dimensional Arrays, Two Dimensional Arrays, Function Associated with Arrays, Arrays as Parameters Recursive Functions.	
MODULE 2	9Hrs
INTRODUCTION TO STACK AND QUEUE: Stack: Definition, Array Representation of Stack. Operations Associated with Stacks- Push & Pop, Applications of Stack: Recursion, Polish expressions, Conversion of Infix to Postfix, Infix to Prefix. Postfix Expression Evaluation, Tower of Hanoi. Queue: Definition. Representation of Queues, Operations of Queues, Priority Queues, Circular Queue.	
MODULE 3	9Hrs
DYNAMIC DATA STRUCTURE: Linked List: Types, Introduction to Singly Linked lists: Representation of Linked Lists in Memory, Traversing, Searching. Insertion & Deletion from Linked List. Doubly Linked List. Operations on Doubly Linked List (Insertion, Deletion, Traversal). Applications: Polynomial Representation & Basic Operations, Stack & Queue Implementation using Linked Lists.	
MODULE 4	8 Hrs
TREES & GRAPHS: Trees: Basic Terminology, Binary Trees and their Representation, Complete Binary Trees, Binary Search Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal), Application: Expression Evaluation. Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential Representation of Graphs, Adjacency Matrices, Graph Transversal	
MODULE 5	6 Hrs
FILE STRUCTURES: Physical storage media. File Organization, Linked Organization of File, Inverted File, Organization Records into Blocks. Sequential Blocks, Indexing & Hashing	

TEXT BOOKS:

1. AM Tannenbaum, Y Langsam, M J Augentien "Data Structures using C", Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo. "Data Structure and Program Design in C" PHI

REFERENCES:

1. Horowitz Anderson-Freed, and Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. D E Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2303					
TITLE OF THE COURSE	DIGITAL ELECTRONICS & LOGIC DESIGN					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand various number systems and conversion from one to other number systems
- To introduce basic postulates of Boolean algebra
- To manipulate expressions into POS or SOP form.
- To introduce the methods for simplifying Boolean expressions like K-Map and Quine Mcclusky
- To understand the concept of don't care conditions and how they can be used to further optimize the logical functions
- To design simple combinational circuits such as multiplexers, decoders, encoders
- To understand the differences between combinational and sequential Totic circuits
- To familiar with basic sequential logic component-SR Latch
- To understand the basics of various types of memories.
- To present the working of various Flip- Flops (T flip-flop, D flip-flop, R-S flip-flop, JK flip-flop)
- To get familiarized with State Diagram, State Table, State Assignment
- To design combinational circuits using programmable logic devices.
- To design sequential circuits such as different types of Counters, Shift Registers

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Demonstrate the knowledge of binary number systems. Logic families, Boolean algebra and logic gates	L2
CO2	Analyze different methods used for simplification of Boolean expressions	L4
CO3	Design combinational logic circuits using combinational logic elements	L3
CO4	Design combinational circuits using Programmable Logic Devices	L3
CO5	Analyze sequential logic elements in the design of synchronous and asynchronous systems	L4
CO6	Design sequential systems composed of standard sequential modules, such as counters and registers	L3

COURSE CONTENT:	
MODULE 1	9Hrs
NUMBER SYSTEMS: BCD number representation, Unsigned and signed number representation, Binary arithmetic. BOOLEAN ALGEBRA AND SIMPLIFICATION: Laws of Boolean algebra. Theorems of Boolean algebra, Boolean/Switching functions and their implementation. SIMPLIFICATION OF BOOLEAN EXPRESSIONS AND FUNCTIONS: Canonical forms, Sum-of-Products Method, Truth Table to Karnaugh Map, Karnaugh Simplifications, Don't-care Conditions. Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.	
MODULE 2	8Hrs
DESIGN OF COMBINATIONAL LOGIC CIRCUITS: Modular combinational logic elements- Multiplexers and Demultiplexers, Decoders, Magnitude comparator, BCD converter, Encoders, Priority encoders.	
MODULE3	9Hrs
INTRODUCTION TO SEQUENTIAL CIRCUITS: Introduction to Sequential Circuits. Combinational Vs sequential circuits, Clock, Clock Triggering, Memory elements and their excitation functions — Latches, T flip-flop, D flip-flop, R-S flip-flop. JK flip-flop and their excitation requirements, State diagram, state table and state equation	
MODULE 4	6 Hrs
REGISTERS Registers-Types of Registers, Serial In - Serial Out, Serial In - Parallel out. Parallel In - Serial Out, Parallel In -Parallel Out, Universal Shift Register. Applications of Shift Registers	
MODULE 5	7 Hrs
COUNTERS, PROGRAMMABLE LOGIC: Ring, Johnson counters. Design of synchronous and asynchronous Counters Programmable Logic Arrays, Design of Combinational Circuits using Programmable Logic Devices (PLDs):	

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 6th Edition, N. Pearson Education, 2018
2. Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

REFERENCES:

1. D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
2. Charles H. Roth: Fundamentals of Logic Design, Jr., 7th Edition, Cengage Learning. 2014
3. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2304					
TITLE OF THE COURSE	FULL STACK DEVELOPMENT					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	2	-	39	3

Prerequisite Courses			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

1. Understand the major areas of web programming
2. To gain the skill into web applications and development.
3. To create website using HTML5. CSS3. JavaScript.
4. Server Side Scripting using Node.JS, Express JS and Mongo dB

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Know the fundamentals of front end web technologies using HTML 5 and CSS3	L1
CO2	Apply Cascading Style Sheets and XHTML to the idea of a web application.	L3
CO3	Comprehend the principles of client-side programming and understand how to use JavaScript to implement them in order to create dynamic web sites.	L3
CO4	Implementing the principles of server side programming using Node.js, Mongo dB	L3
CO5	Applying the Node.js framework -Express.JS to create web applications faster and smarter	L3

COURSE CONTENT:	
MODULE 1: Markup Language (HTML5)	4 Hrs
Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code — Anchors - Backgrounds — Images — Hyperlinks - Lists — Tables - HTML Forms, Audio ,Video Tag.	
MODULE 2: CSS3	
CSS3: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; Background images, Conflict Resolution, CSS Box Model .CSS3 features: Box Shadow, Opacity, Rounded corners, Attribute selector.	4 Hrs
MODULE 3 : JavaScript	6 Hrs
Overview of JavaScript; Object orientation and JavaScript; General syntactic, characteristics; Primitives, operations, and expressions; Screen output and keyboard input. Control statements; Arrays; Functions, Constructors; A brief introduction on pattern matching using regular expressions, DOM Events	
MODULE 4: Node JS	6 Hrs
Introduction to NodeJS, Set up Dev Environment, Node JS Modules, Node Package Manager, File System, Events, Database connectivity using Mongo DB.	
MODULE 5: Express.JS	6 Hrs
Introducing Express: Basics of Express, Express JS Middleware: Serving Static Pages ,Listing Directory Contents, Accepting JSON Requests and HTML Form Inputs, Handling Cookies.	

List of Laboratory/Practical Experiments activities to be conducted (13 Hrs)

HTML5

1. Design a web page depicting: -
 - How markup works, including the working of various basic HTML elements and attributes..
 - The basic structure of an HTML document.
 - The usage of table tag to format a web page
 - Use and <div> tags to provide a layout to the page instead of a table Layout.
 - The usage of lists to bring order to web pages
 - The usage of other various HTML tags like Image, anchor, links etc.
2. Design a web page and embed various multimedia features in the page.
3. Building of HTML Forms

CSS3:

4. Change the Look of a web page with a Style Sheet

JAVASCRIPT

5. Design of dynamic and Interactive web pages using Java script
 - Depicting the usage of declaring variables, running loops, if/then statements, and writing functions/Constructors using JavaScript
 - Depicting Event handling using Java script.
 - Depicting the Pattern matching using regular expressions.

NODE.JS

6. Demonstrate how to use Node.js http module to create a web server.
7. Create a Node.js file that depicts the usage of various File System Modules

EXPRESSES

8. Create an app that starts a server using Expresses. *
9. Demonstrate the usage of various Express JS Middleware.

TEXT BOOKS:

1. Robert W. Sebesta , "Programming the World Wide Web", 7th Edition, Pearson Education, 2008.
2. Basarat Ali Syed," Beginning Node.js ",Apress ,2014

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2305					
TITLE OF THE COURSE	COMPUTATIONAL THINKING WITH PYTHON					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	2	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand basic concepts of computational thinking.
- To introduce python programming for problem solving.
- To introduce different debugging and unit testing tools.
- To solve real world problems using python data structures.
- Learn to handle files and exception handling in python.
- To explore Python's object-oriented features.
- To build Web services and Networked programs in python.
- To train students to design an application as part of the course mini- project using computational thinking with python.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
coi	Understand basic concepts of computational thinking.	L2
CO2	Outline basic python programming for problem solving.	L2
CO3	Apply computational thinking to solve real world programs using Python	L3
CO4	Build python programs using core data structures like list, dictionaries and tuples	L3
CO5	Implement object oriented concepts using python	L3
CO6	Design applications related to web services and network Programming.	L3

COURSE CONTENT:	
MODULE 1	5Hrs
INTRODUCTION TO COMPUTATIONAL THINKING AND PYTHON: Introduction to computational thinking: Stages of Computational thinking, Basics: Values, expressions and statements, Conditional execution, Functions, Iterations	
MODULE 2	6Hrs
PYTHON DATA STRUCTURES: Python Data Structures: Strings, Arrays, Lists, Tuples, Sets and Dictionaries	
MODULE 3	5Hrs
PYTHON OBJECTS: Classes and Objects: Creating classes, Using Objects, Accessing attributes, Classes as Types, Introduction to Multiple Instances, Inheritance.	
MODULE 4	5Hrs
EXCEPTION HANDLING: Try-Except, Exception syntax, examples, Types of exception with except, multiple exceptions with except, Try-Finally, Raise exceptions with arguments, Python built-in exceptions, User-defined exceptions, Assertions	
MODULE 5	5Hrs
PYTHON FILES & LIBRARIES Files: File types, modes, File functions, File attributes, File positions, Looping over file. Basics of NumPy and Pandas	

<u>List of Laboratory/Practical Experiments activities to be conduct</u>
- Python program to evaluate Values, expressions, and statements. Conditional execution, and Functions Iterations - prompt the user to enter an integer and reverse it. And print the sum of the reversed integer. - Write a python program to find whether a number (num1) is a factor of 255. - Write a python program to find whether a number (num1) is a factor of 255. - Write a program to find the sum of the following series: $1 + 1/3 + 1/5 + 1/7 + \dots$ up to 'N' terms. $1 + x/1! + x^3/2! + x^5/3! + x^7/4 + \dots x^{2n-1}/n!$ - Python program to evaluate Python Collections - Write a Python Program to demonstrate the inbuilt functions of Strings, List, and sets. - Write a Python program for counting a specific letter 'o' in a given string; the number of times vowel 'o' appears. - Write a Python Program to find the frequency of each word in given strings/strings - Store the following for 'n' countries, using a dictionary: - Name of a country, country's capital, per capita income of the country.

- ii. Write a program to display details of the country with the highest and second lowest per capita income.
3. Write a python program to create two classes “Python” and “Java” having data members “Version” and “name” and a member function “displayO”. With the help of the object, print the appropriate messages.
4. Create a class “Employee” with initmethod to initialize data members: Name, Designation, Ph. No., and a member function display(). Create an instance for the class and display the details of the employee
5. Write an interactive calculator! User input is assumed to be a formula that consist of a number, an operator (at least + and -), and another number, separated by white space (e.g. 1 + 1). Split user input using str.split(), and check whether the resulting list is valid:
 - a. If the input does not consist of 3 elements, raise a FormulaError, which is a custom Exception.
 - b. Try to convert the first and third input to a float (like so: float_value = float(str_value)). Catch any ValueError that occurs, and instead raise a FormulaError
 - c. If the second input is not '+' or '-' again raise a FormulaError
 - d. If the input is valid, perform the calculation and print out the result. The user is then prompted to provide new input, and so on, until the user enters quit.
6. Write a Python program to count the number of lines in a text file and read the file line by line and store it into a list as well as find the longest word in the file.
7. Write a Python program to create a list of student details: usn, name dob and email {using dictionary} and write a list to a file.
8. Generate one-hot encodings for an array in numpy.
9. Write a Pandas program to import excel data into a Pandas dataframe and find a list of employees where hire date is between two specific month and year.

TEXT BOOKS:

1. “Python for Everybody-Exploring Data Using Python 3”, Dr. Charles R. Severance,
2. “Introduction to Computing & Problem Solving with Python”,Jeeva Jose,P.Sojan Lal, Khanna Book Publishing; First edition (2019).

REFERENCES:

1. “Computer Science Using Python: A Computational Problem- Solving Focus”, CharlesDierbach, Introduction John Wiley, 2012.
2. “Introduction to Computation and Programming Using Python”, John V Guttag,Prentice Hall of India, 2015.
3. "How to think like a Computer Scientist, Learning with Python", Allen Downey,JeffreyElkner and Chris Meyers, Green Tea Press, 2014.
4. “Learning to Program with Python”, Richard L. Halterman, 2011.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2306					
TITLE OF THE COURSE	INTRODUCTION TO NETWORKS AND CYBERSECURITY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- Understand the basic concepts of cyber security, how it has evolved, and some key techniques used today.
- Have an insight view of Security, Cryptography, Malware, IDS, Secure Programming etc
- Explore the subject through prescribed book, case studies, seminars and Assignments.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand and explore the basics of Computer Networks and working principles.	L2
CO2	Understand the concepts of Network security corresponding to various Internet Layers.	L2
CO3	Determine appropriate mechanisms for protecting the Network.	L2

COURSE CONTENT:	
MODULE 1	8Hrs
Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet Architecture; Comparison of the OSI and TCP/IP reference model. Top-down approach	

Cybersecurity: Basics of Cyber Security-Attacks, Vulnerabilities and Threats. Need for Networksecurity, Data Security and physical security.	
MODULE 2	8 Hrs
Application Layer- Introduction, providing services, Applications layer paradigms. Client server model. Standard client-server application-HTTP, DNS, SSH. Malware Detection System, Types of Malware, Viruses & Counter Measures, Worms, Bots. E-mail Security: PGP, S/MIME. Secure socketprogramming using UDP and TCP.	
MODULE 3	8 Hrs
Transport Level Security: Functionality and services, TCP and UDP basics. Principles of Cryptography, Web Security Considerations, Secure Sockets Layer (SSL), Transport Layer Security, Data/Message Integrity and Digital Signatures.	
MODULE 4	7 Hrs
Network Layer Security: Network Security and Services, IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Internet Key Exchange. Virtual Private Network(VPN), Wireless Networks Security.	
MODULE 5	8 Hrs
Data Link Layer: LLC and MAC Sublayer services, Error detection and correction Techniques. Physical Layer: Introduction to Guided transmission media and wireless transmission media. Transmission mode. Classification of networks. Firewall, Intrusion Detection System (IDS)	

TEXT BOOK:

1. Computer Networking- A top-down approach- James F Kurose and Keith W Ross,6th Edition,Pearson Education.
2. Computer Security- Principles and Practice, William Stalling, Laurie Brown 4th Edition. Pearson

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking -, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum. 4th Edition, Pearson Education.
3. James Graham. Richard Howard, Ryan Olson- Cyber Security Essentials CRC Press.

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2307					
TITLE OF THE COURSE	DATA STRUCTURES LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To introduce C language concepts required for data structures
- To design data structure operations to solve problems
- To introduce applications of data structures
- To implement linear data structures - stack, queue, linked list
- To implement non-linear data structures - trees and graphs

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Design and develop the programs in C to understand the different concepts of data structures.	L3
CO2	Implement stack & queue data structure and their applications. Analyse the output based on the given input data.	L3
CO3	Implement Conversions of Polish and reverse polish expressions and Record Experimental process and results	L4
CO4	Apply and implement concepts of dynamic memory allocation	L3
CO5	Use the concepts of file structures and communicate results effectively	L3

Sl. No.	List of Laboratory/Practical Experiments activities to be conduct
1.	Write a program to add, subtract, multiply and divide two integers using user defined function with return type.
2.	Write a program to find the sum of digits of the number and print the reverse of that number using Recursive Function.
3.	Write a program to add and multiply two ^trices using pointers

4.	Design, Develop and Implement a menu driven Program in C for the Searching Techniques on arrays i.e, 1. Linear search 2. Binary search. If unsorted array is given as input, your program must perform sorting (bubble sort) to use it as input for binary search algorithm.
5.	Write a C program to convert infix expression to prefix expression.
6.	Write a C program to convert infix expression to postfix expression.
7.	Write a C program to implement stack, queue and their variations using arrays.
8.	Write a C program to evaluate postfix expressions
9.	Write a C program to solve tower of hanoi using recursion
10.	Write a C program to implement stack, queue and their variations using linked lists.
11.	Write a C program to implement Binary search tree insertion, deletion and traversal.
12.	Write a C program to implement Graph insertion, and traversal.
13.	Write a C program to implement File operations a. Open a file b. Write c. Read d. close d. close

Open-Ended Experiments

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.
3. Mini-Project on applying suitable data structure to a given real-world problem

TEXTBOOKS:

1. AM Tannenbaum, Y Langsam, M J Augentien “Data Structures using C”, Pearson, 2013
2. R.L. Kruse, B.P. Leary, C.L. Tondo, “Data Structure and Program Design in C” PHI

REFERENCE BOOKS

1. Horowitz Anderson-Freed, and Sahni, “Fundamentals of Data structures in C”, 2nd Edition, Orient Longman, 2008
2. Data Structures and Algorithm analysis in C by Mark Allen Weiss, Published by Addison Wesley (3rd Indian Reprint 2000).
3. DE Knuth, The Art of Computer Programming, Volume 1, Addison-Wesley Publishing, 2013

SEMESTER	III					
YEAR	II					
COURSE CODE	21CS2308					
TITLE OF THE COURSE	DIGITAL ELECTRONICS & LOGIC DESIGN LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To design digital circuit for given Boolean expressions using logic gates.
- To verify the design of arithmetic circuits using logic gates and ICs.
- To test different code-conversion circuits.
- Applications of Multiplexer and De-multiplexers for implementation of different logic circuits.
- To test comparator circuits.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Build a logic circuit using basic gates after simplifying the given Boolean expression using Karnaugh map method	L3
CO2	Design and implementation of comparators	L3
CO3	Build logic circuits and realize the given Boolean expression using Multiplexers.	L3
CO4	Design of Combinational circuits like Encoder and Decoder using basic gates	L3
CO5	Design of Synchronous and Asynchronous Sequential circuits like registers and counters.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Study and verification of Basic gates with Truth Tables 2. Simplification of expressions using Karnaugh Maps and realizing circuits using Basic Gates 3. Realize binary to gray code converter and vice versa 4. Simplify the given expression using tabular method and to realize circuits using Multiplexers. 5. Design and implementation parallel adder and subtractor 6. Design and implementation of comparators 7. Design various combinational logic circuits like encoders, decoders 8. Design and implementation of shift register 20 9. Design and implementation synchronous counters 10. Design and implementation ring counter and Johnson counter 11. Study of 7490 BCD counter 12. Design and implementation of asynchronous counters

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 6th Edition, Pearson Education, 2018
2. Donald.P. Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

SEMESTER	III					
YEAR	II					
COURSE CODE	21CT2301					
TITLE OF THE COURSE	DESIGN TECHNOLOGY					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Proj ects Hours	Total Hours	Credits
	-	-	02	02	26	2

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Learn to use Fusion 360 and sketch designs.
- Understand the functioning of 3D printers.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the functionalities of Fusion 360	L1
CO2	Convert 2D Sketches into 3D Model	L3

COURSE CONTENT:	
MODULE 1	05 Hrs
Fusion 360 - Introduction. Applications, Basics and Advanced Sketching Functionalities of Fusion 360	
MODULE 2	05 Hrs
Part Modelling - Converting the 2D Sketches to 3D Parts. 3D Part Modelling tools, Edit the Features of Existing Parts	

MODULE 3	05 Hrs
Assembling Various Parts and Defining Relationships, Generate Drafts or Drawings of an Assembly for Manufacturing	
MODULE 4	06 Hrs
Practice 1 - Animation Environment - Introduction to Animation Environment, Creating Animations on Existing Assemblies, Finite Element Analysis, Simulation Environment, Rendering Tools, Photorealistic Renders	
MODULE 5	05 Hrs
Practice 2 - Prototyping & Rapid Manufacturing - Converting the Design to a Real-World Prototype, Additive Manufacturing, 3D Printing	

List of Laboratory/Practical Experiments activities to be conducted (if any) :
Based on choice of problem statement, students are required to design a solution for the chosen problem statement. They must use available resources to convert designs to prototypes.

TEXT BOOKS :

1. Gaurav Verma, Autodesk Fusion 360, 2nd Edition, CADAMCAE Works, 2018.
2. Autodesk Design Academy, Autodesk Fusion 360 Training: The Future of Making Things

SEMESTER	III					
YEAR	II					
COURSE CODE	21CT2302					
TITLE OF THE COURSE	INNOVATIVE BUSINESSES & BREAKTHROUGH TECHNOLOGIES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	02	02	26	2

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

Course Details

Course Aim & Summary

Firms must develop major innovations to prosper, but they do not know how to. However, recent research into the innovation process has made it possible to develop breakthroughs systematically. This course explores several practical idea generation development methods.

Course Objectives

The objectives of the course are.

- Briefly explain a chosen topic that interests you from the prescribed books.
- Expand the topic in your direction of interest.

Course Outcomes

After undergoing this course, students will be able to

Course Outcome No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Evaluation topics from the listed reference books that especially interests you	Evaluate
CO2	Briefly explain the pros and cons of the topic	Analyze
CO3	Expand the topic in your direction of interest	Apply

Course Content

The User Innovation Paradigm, Going for User Solutions Instead of User Needs — the Lead User Method, How Patents Discourage Innovation
User Innovation Communities, Exploring New Combinations of Customer Needs, Determine Users' Needs Ethnographically and Develop Solutions MIT Media Lab Approach, Design and Manufacture of Mass Customized Products with Toolkits/Platforms for User Innovation

Hands-on Component

1. Brainstorming as a Concept Generation Method
2. Case Studies on Problem-Solving about Analogical Thinking

References

1. Eric Von Hippel, Democratizing Innovation, The MIT Press, February 2006
2. Eric Von Hippel, Stefan Thomke and Mary Sonnack, Creating Breakthroughs at 3M, Harvard Business Review
3. Glen L. Urban, John R. Hauser, "Listening In" to Find & Explore New Combinations of Customer Needs, Journal of Marketing, Sage Journals, 2004
4. MIT Open Course Ware - How to Develop Breakthrough Products and Services

<https://ocw.mit.edu/courses/sloan-school-of-management/15-356-how-to-develop-breakthrough-products-and-services-spring-2012/index.htm>

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2401					
TITLE OF THE COURSE	PROBABILITY AND STATISTICS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.
- Calculate statistics related to Random variables and process such as mean, variance, etc.
- Evaluate standard distribution functions such as Poisson's, Normal distributions
- Apply functions of random variables such as characteristic function, moment generating function to calculate statistics.
- Understand probability, random variable and random process concepts and their importance in Computer Engineering course.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Compute and interpret descriptive statistics using numerical and graphical techniques.	L4
CO2	Understand the basic concepts of random variables and find an appropriate distribution for analyzing data specific to an experiment.	L2
CO3	Extend the concepts to multiple random variables and apply them to analyze practical problems.	L2
CO4	Make appropriate decisions using statistical inference that is the central to experimental research.	L4

COURSE CONTENT:	
MODULE 1: INTRODUCTION TO PROBABILITY THEORY:	6 Hrs
Basic Notions of Probability. Axiomatic definition, properties, Conditional Probability and Independence - Baye's Theorem.	
MODULE 2: DISCRETE PROBABILITY DISTRIBUTIONS:	7 Hrs

Discrete random variables and its properties - Bernoulli trials - Binomial Distribution and its properties - Poisson Distribution and its properties.	
MODULE 3	8 Hrs
CONTINUOUS PROBABILITY DISTRIBUTIONS Continuous random variables and its properties - Exponential Distribution and its properties - Normal Distribution and its properties. BIVARIATE DISTRIBUTIONS: Bivariate random variables - Joint - Marginal - Conditional distribution.	
MODULE 4: RANDOM PROCESS AND QUEUEING THEORY	9 Hrs
Classification - Stationary process — Markov process — Markov chain — Poisson process Auto correlation functions - Cross correlation functions - Properties - Power spectral density Queuing Models, Methods for generating random variables and Validation of random numbers	
MODULE 5: TESTING OF HYPOTHESIS	9 Hrs
Testing of hypothesis - Introduction-Types of errors, critical region, procedure of testing hypothesis- Large sample tests- Z test for Single Proportion - Difference of Proportion, mean and difference of mean - Small sample tests- Student's t-test.	

TEXT BOOKS:

1. A First Course in Probability, S. Ross, Pearson International Edition, 9th Edition.
2. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, 1st Edition.

REFERENCES:

1. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and L. Computer Science Applications, 2nd Ed., Wiley, 2001.
2. Robert V. Hogg, J.W. McKean, and Allen T. Craig: Introduction to Mathematical Statistics, Seventh Edition, Pearson Education, Asia.
3. Rohatgi, V K. and Saleh, A. K. Md. Ehsanes, "An Introduction to Probability and Statistics", (John Wiley and Sons), (2nd edition) (2000)
4. Higher Engineering Mathematics by B S Grewal, 42nd Edition, Khanna Publishers.
5. Probability and Statistics for engineers and scientists, R., E. Walpole, R.H. Myers, S.L. Myers and K. Ye, 9th Edition, Pearson Education (2012).
6. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2402					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Y ear	Course Code	Title of the Course
	**	**	***

COURSE OBJECTIVES:

- To introduce and implement various techniques for designing algorithms and advanced data structures
- To learn space and time complexity analysis of algorithms.
- To understand the Divide and conquer design strategy and the Greedy Technique
- To understand the concepts of Dynamic Programming Applications
- Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Outline the overview of Data structures and Algorithms	L1
CO2	Understand the different Algorithmic Design strategies	L2
CO3	Apply the Design principles and concepts to Algorithmic design	L3
CO4	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO5	Analyse the efficiency of Algorithms using Time and Space complexity theory	L4
CO6	Implement an existing algorithm to improve the run time efficiency	L3

COURSE CONTENT:	
MODULE 1: INTRODUCTION	6 Hrs
The role of Algorithms in Computing, Running time analysis — recall of asymptotic notation, big-oh, theta, big-omega, and introduce little-oh and little-omega. Worst case and average case complexity	
MODULE 2: DIVIDE AND CONQUER	9 Hrs
Recursive algorithms, Divide-and-Conquer recurrences. Methods for solving recurrences: substitution method, recursion tree method and the Master method. Examples-Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication. GREEDY METHOD Optimal substructure property- Minimum cost spanning tree, Knapsack problem, Single Source Shortest Path Algorithm. Fractional knapsack	
MODULE 3 : DYNAMIC PROGRAMMING	9 Hrs

Integral knapsack (contrasted with the fractional variant: 0/1 knapsack), longest increasing subsequence. All pair shortest path in graph. Matrix chain multiplication. Travelling salesman Problem	
MODULE 4: APPLICATION OF GRAPH TRAVERSAL TECHNIQUES	9 Hrs
Recall representation of graphs, BFS, DFS, connected components, Strongly-connected components of DAGs, Kosaraju's algorithm 1 and 2. Applications. Graph matching. String Matching: Boyer Moore algorithm.	
MODULE 5: REASONING ABOUT ALGORITHMS	6 Hrs
Complexity Analysis (Polynomial vs Non-Polynomial time complexity), P, NP-hard and NP-Completeness, Reductions.	

TEXT BOOK:

1. T. H. Cormen, Leiserson. Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. E. Horowitz, S. Sahni, and S. Rajsekaran, " Fundamentals of Computer Algorithms," Galgotia Publication, 2015.
2. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012
3. Sara Basse, A. V. Gelder. "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley.
4. J.E Hopcroft, J.D Ullman, "Design and analysis of Computer algorithms", PearsonEducation, 2009.
5. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2403					
TITLE OF THE COURSE	PRINCIPLES OF MICROPROCESSORS & COMPUTER ORGANIZATION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	4	-	-	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES:

- To introduce the architecture of 8086
- To understand the importance and function of each pin of 8086 Microprocessor
- To familiarize with the architecture of 8086 microprocessor and its operation
- To understand the various addressing modes required for assembly language
- Programming and to calculate the physical address.
- To learn the 8086 instruction set and write 8086 Assembly level programs
- To understand the importance of different peripheral devices and their interfacing to 8086
- Understand the concepts of Hardwired control and micro programmed control.
- To explain the current state of art in memory system design
- Discuss the concept of memory organization.
- Summarize the types of memory.
- Learn about various I/O devices and the I/O interface.
- Learn the different types of serial communication techniques.
- To understand DMA technique
- To provide the knowledge on Instruction Level Parallelism
- To understand the concepts of pipelining techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify the basic building blocks of 8086 microprocessor and use the addressing modes for executing programs efficiently	L2
CO2	Develop 8086 assembly language programs using modern assembler tools	L3
CO3	Discuss the computer arithmetic and design algorithms for various Arithmetic operations.	L2
CO4	Design data part and control part of a processor	L3
CO5	Analyze the performance of various types of Memories	L4
CO6	Understand pipeline & parallel processing	L2

COURSE CONTENT:	
MODULE 1: Introduction to Microprocessor & its Architecture:	8 Hrs
Introduction-Evolution of Microprocessor. The Microprocessor-Based Personal Computer Systems, Internal Microprocessor Architecture, Real mode memory addressing, 8086 pin diagram. Internal Architecture of 8086, Registers, Addressing Modes-Immediate addressing, Register addressing, direct addressing, indirect addressing, relative addressing. Instruction formats	
MODULE 2: Programming 8086	12 Hrs
Assembler directives. Data Movement Instructions, String Data Transfers, Miscellaneous Data Transfer Instructions, Arithmetic and Logic Instructions, BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group. Assembly language programming with 8086, macros, procedures	
MODULE 3: Processor Organization:	10 Hrs
Basic organization of computers, Block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle. Execution cycle in terms machine instructions. Information representation. Floating point representation (IEEE754), computer arithmetic and their implementation; Data Part Design: Fixed-Point Arithmetic-Addition. Subtraction, Multiplication and Division, Arithmetic Logic Units control and data path, data path components, design of ALU and data-path. Control Part Design: Control unit design; Hardwired and Micro programmed Control unit. Discussions about RISC versus CISC architectures.	
MODULE 4: Memory Technology, Input/Output Organization:	12 Hrs
Memory hierarchy, static and dynamic memory, RAM and ROM chips, Memory address map. Auxiliary Memory. Associative Memory, Cache Memory and organization. Peripheral devices, Input-Output Interface; I/O Bus and Interface Modules, Isolated versus Memory-Mapped I/O, Modes of Transfer; Programmed I/O, Interrupt-initiated I/O, Direct memory access (DMA)	
MODULE 5: Pipelining	10 Hrs
Basic Concepts, Arithmetic Pipeline, Instruction Pipeline; Four-Segment Instruction Pipeline, Pipeline hazards and their resolution. Parallel Processing; Flynn's classification. Multicore architectures, Introduction to Graphics Processing Units, Example: NVIDIA GPU Architecture	

TEXT BOOK:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009
2. Mano, Morris M. Computer system architecture. Dorling Kindesley Pearson, 2005.

REFERENCES:

1. Douglas V Hall, "MICROPROCESSORS AND INTERFACING, PROGRAMMING AND HARDWARE" TMH, 2006.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers. 2007
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi. Danny Causey. The x86 PC Assembly Language Design and Interfacing. 5th Edition, Pearson, 2013.
4. V. Carl Hamacher, Safwat G. Zaky and Zvonko G. Vranesic , Computer Organization .McGraw-Hill series 2002
5. Hayes, J.P , Computer Architecture and Organization, McGraw-Hill, 1998
6. David Patterson and John Hennessey. Computer Organization and Design. Elsevier. 2008
7. Comer. Douglas. Essentials of computer architecture. Chapman and Hall/CRC, 2017.
8. Hord. R. Michael. Parallel supercomputing in MIMD architectures. CRC press, 2018.
9. Tanenbaum, Andrew S. Structured computer organization. Pearson Education India. 2016.
10. William Stallings-Computer Organization and Architecture, Seventh Edition, Pearson Education

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2404					
TITLE OF THE COURSE	FINITE AUTOMATA AND FORMAL LANGUAGES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	2	-	52	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	*	**	***

COURSE OBJECTIVES:

- To learn general theory of automata, properties of regular sets and regular expressions.
- To understand basics of formal languages.
- To know push-down automata, context- free languages, Turing machines.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the basic concepts of formal languages of finite automata techniques such as DFA, NFA and E-NFA	L2
CO2	Design Finite Automata for different Regular Expressions and Languages Demonstrate the properties of regular grammar, regular language, regular expression & their relationship with finite automata	L3
CO3	Construct context free grammar for various languages. Interpret and design different PDA for a given language	L3
CO4	Construct context free, regular, Chomsky normal form grammars to design computer languages	L3
CO5	Design Turing machine to solve problems	L3

COURSE CONTENT:	
MODULE 1	8Hrs
Introduction to Finite Automata: Study and Central concepts of automata theory. An informal picture of finite automata, deterministic and non-deterministic finite automata, applications of finite automata, finite automata with epsilon - transitions.	
MODULE 2	8Hrs
Regular expression and languages: Regular expressions, finite automata and regular expressions, algebraic laws of regular expressions. Properties of Regular Languages: closure properties of regular languages, Pumping Lemma, equivalence and minimization of automata	

MODULE 3	9Hrs
Context-free Grammars and Languages: Context free grammars, Context-free languages, Parse trees, Ambiguity in grammars and languages, Pushdown Automata: Pushdown automation (PDA), the language of PDA, equivalence of PDA's and CFG's, Deterministic Pushdown Automata	
MODULE 4	8Hrs
Properties of Context - Free Languages: Normal forms of context free grammars, pumping lemma for context free languages, closure properties of context free languages. Applications of CFG - such as spec of programming languages, parsing techniques, and Yacc	
MODULE 5	6Hrs
Introduction to Turing Machine- The Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine, Chomsky hierarchy	

List of Laboratory/Practical Experiments activities to be conducted (13 Hrs)

1. Design a Program for creating machine that accepts three consecutive one.
2. Design a Program for creating machine that accepts the string always ending with 101.
3. Design a Program for Mode 3 Machine
4. Design a program for accepting decimal number divisible by 2.
5. Design a program for creating a machine which accepts string having equal no. of 1's and 0's.
6. Design a program for creating a machine which count number of 1's and 0's in a given string.
7. Design a Program to find 2's complement of a given binary number.
8. Design a Program which will increment the given binary number by 1.
9. Design a Program to convert NDFA to DFA.
10. Design a Program to create PDA machine that accept the well-formed parenthesis.
11. Design a PDA to accept WCWR where w is any string and WR is reverse of that string and C is a Special symbol.
12. Design a Turing machine that's accepts the following language $anbnc^n$ where $n > 0$.

TEXT BOOKS:

1. Daniel I. A. Cohen, Introduction to Computer Theory, 2nd Edition, Wiley India Student Edition, 2008.
2. J.E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edn. Pearson Education, New Delhi 2008

REFERENCES:

1. K.L.P. Misra and N. Chandrashekar. Theory of Computer Science- Automata, Languages and Computation, 3rd Edn. PHI, New Delhi, 2007
2. C. Martin - Introduction to Languages and the Theory of Computation 2nd Edn, TMH, New Delhi, 2000.

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2405					
TITLE OF THE COURSE	SOFTWARE ENGINEER!* 1G AND PRO. IECT MANAGEMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- This course is introduced to give the students necessary knowledge.
- Understanding and Design aspects in Software Engineering
- To understand the Software Project Planning and Evaluation techniques

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand software development life cycle models, process models, and various design engineering techniques	L2
CO2	Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development	L3
CO3	Analyze a problem, and identify and define the computing requirements appropriate to its solution	L4
CO4	Apply a wide variety of testing techniques in an effective and efficient manner.	L3
CO5	Understand Project Management principles while developing software.	L2

COURSE CONTENT:	
MODULE 1	8Hrs
Introduction to Software Engineering: FAQs about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties, Organizations, people and computer systems; Legacy systems, the evolving role of software, Changing Nature of Software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. Software Cost Estimation: Productivity; Estimation techniques	
MODULE 2	8Hrs
Process models: A simple safety- critical system; System dependability; Availability and reliability, the waterfall model, Incremental process models, Evolutionary process models, The Unified process. Agile Development: Agile Tech, Extreme Programming, and other Agile Process Models: Scrum Methodology.	
MODULE 3	8Hrs
Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.	
MODULE 4	8Hrs
Testing Strategies: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. A strategic approach to software testing, System testing, the art of Debugging; Component testing; Test case design; Test automation - Selenium, Test strategies for conventional software: Black-Box and White-Box testing. Validation tests. System testing.	
MODULE 5	7Hrs
Software Project Management Introduction to Software Project Management - all life cycle activities — Methodologies — Categorization of Software Projects - Setting objectives - Management Principles - Management Control - Project portfolio Management - Cost-benefit evaluation technology — Risk evaluation — Strategic program Management - Stepwise Project Planning.	

TEXT BOOKS:

1. Software Engineering, by Ian Sommerville Eighth edition, International Computer Science Series.
2. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGraw Hill International Edition.

REFERENCES:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management — Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Software Engineering-K.K.Agarwal&Yogesh Singh, New Age International Publishers
3. Software Engineering, an Engineering approach-James F. Peters, Witold Percy, John Wiley.
4. Systems Analysis and Design—Shelly Cashman Rosenblatt, Thomson Publications.
5. Software Engineering principles and practice-Waman Jawadekar, The McGraw-Hill Companies

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2406					
TITLE OF THE COURSE	LINUX PROGRAMMING AND SCRIPTING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2	-	2	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn the fundamentals of OS
- To Know the features of Linux OS and learn the Linux commands
- To gain knowledge about the Linux networking and Linux administration
- To Understand the fundamentals of shell scripting/programming.
- To discuss about the Inter Process Communication.
To understand the concept of client server communication by using sockets

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Describe the operating system fundamentals, Linux architecture and features of Linux OS	L2
CO2	Demonstrate proficiency with Linux utilities, networking and administration	L2
CO3	Develop Shell Scripts for automation of various tasks	L3
CO4	Implement Inter-Process communication between processes	L3
CO5	Design various client server applications using TCP or UDP protocols	L3

COURSE CONTENT:	
MODULE 1: INTRODUCTION TO OS	
Operating System Objectives and Functions, The Evolution of Operating Systems developments Leading to Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore architectures, Modern UNIX Systems, Linux, Booting Process of Linux operating system	5Hrs
MODULE 2: INTRODUCTION TO LINUX	6Hrs

LINUX BASICS: File System of the Linux, basic commands, Linux users and group, Permissions for file, directory and users, Filters: cut, tr, grep. Find Command with various options, Filters using Regular Expression: grep & sed

Networking Tools: TCP/IP basics, Resolving IP addresses, ping, telnet and ftp, cron commands

MODULE 3: SHELL PROGRAMMING

5Hrs

Types of Shells, Shell Meta Characters - \$#, \$*, \$?, Shell Variables, Shell Scripts, read, operators, Integer Arithmetic and String Manipulation, Decision Making: if-else-elif-fi, case-esac. Loop Control; while, for, until, break & continue, Functions, I/O Redirection and Piping

MODULE 4: INTERPROCESS COMMUNICATION

5Hrs

Introduction to IPC, Pipes, FIFOs, Introduction to three types of IPC-message queues, semaphores and shared memory, Message Queues- Kernel support for messages, Unix system V APIs for messages, client/server example.

MODULE 5: SOCKETS

5Hrs

Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example client/server programs.

List of Laboratory/Practical Experiments activities to be conduct (13 Hrs)

1. Study and Practice on various commands like man, passwd, tty, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who
2. Study and Practice on various commands like cat, tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, tar, cpio
3. Implement in C the following Unix commands using System calls
A.cat B.ls C.mv
4. Creating shell programs for automating tasks, file handling, trapping signals
5. Implement the following IPC forms
a) FIFO b) PIPE
6. Write a C program (sender.c) to create a message queue with read and write permissions to write 3 messages to it with different priority numbers.
7. Write a C program (receiver.c) that receives the messages (from the above message queue as specified and displays them
8. Write client and server programs (using c) for interaction between server and client processes using TCP Elementary functions.
9. Write client and server programs (using c) for interaction between server and client processes using UDP Elementary functions

TEXT BOOKS:

1. Unix System Programming using C++, T.Chan, PHI.
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.

REFERENCES:

1. Unix Network Programming ,W.R.Stevens,PHI.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004.

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2407					
TITLE OF THE COURSE	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
\$	****	****	****

COURSE OBJECTIVES:

- To learn mathematical background for analysis of algorithm
- To understand the concept of designing an algorithm.
- To analyze the algorithms using space and time complexity.
- To learn dynamic programming and greedy method.
- To acquire knowledge of various applied algorithms.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
coi	Design and develop the Algorithms to understand the different concepts.	L3
CO2	Apply the Design principles and concepts to Algorithmic design	L3
CO3	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L6
CO4	Analyse worst-case and best - case running times of algorithms using asymptotic analysis.	L4
CO5	Implement an existing algorithm to improve the run time efficiency	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design a C program to solve the Tower of Hanoi. Compute the time complexity. 2. Apply divide and conquer method and Design a C program to search an element in a given array and Compute the time complexity. Binary search - recursive method

3. Apply Divide and Conquer method Design a C program to sort an array using Merge sort algorithm and compute its time complexity
4. Apply Divide and Conquer method Design a C program to sort an array using Quick sort algorithm and compute its time complexity.
5. Apply Greedy method and Design a C program to find the minimum cost spanning tree using Prim's and Kruskal's Algorithm and compute its complexity
6. Apply Dynamic Programming Technique and Design a C program to find the all pairs shortest path using Dijkstra's Algorithm and computes its complexity
7. Design a C program to find the optimal solution of 0-1 knapsack problem using dynamic programming and Compute the time complexity
8. Design a C program to solve the Travelling Salesman Problem using dynamic programming and compute its time complexity.
9. Design a C program to find the longest common subsequence using dynamic programming and compute its time complexity
10. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

TEXT BOOK:

1. Levitin A, "Introduction to the Design And Analysis of Algorithms", Pearson Education, 2008.
2. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer algorithm," , 3rd Edition, The MIT Press, 2015

REFERENCES:

1. E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication, 2015.
2. Goodrich M.T., R Tomassia, "Algorithm Design foundations Analysis and Internet Examples", John Wiley and Sons, 2006.
3. Sara Basse, A. V. Gelder, "Computer Algorithms : Introduction Design & Analysis", 3rd Edition, Addison Wesley.

SEMESTER	IV					
YEAR	II					
COURSE CODE	21CS2408					
TITLE OF THE COURSE	MICROPROCESSORS LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	13	1

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	****

COURSE OBJECTIVES:

- To develop and execute variety of assembly language programs of Intel 8086 including arithmetic and logical, sorting, searching, and string manipulation operations
- To develop and execute the assembly language programs for interfacing Intel 8086 with peripheral devices.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
C01	Implement 8086 assembly language programs for microprocessor application using 8086 training boards	L3
C02	Implement 8086 assembly language programs for microprocessor application using assembler and debuggers	L3
CO3	Design interfacing of various peripherals with 8086 microprocessor for simple applications	L3
C04	Use Macros and Procedures in 8086 Programs	L3
C05	Use assembly language and debugging tools when writing programs for a microprocessor	L3
C06	Communicate effectively on the work done in the laboratory using formal report	L3

List of Laboratory/Practical Experiments activities to be conducted**Part-A:** Software Programs Using Microprocessor Trainer Kit

- i) Programs involving : arithmetic operations, sorting
- ii) Programs on : code conversion (BCD TO HEX, Binary to ASCII, Binary to Gray)
- iii) Programs involving - Bit manipulation like checking:
 - 1. Whether given data is positive or negative
 - 2. Whether given data is odd or even
 - 3. Logical 1's and 0's in a given data

Part- B: Software Programs Using MASM/TASM software

- i) Programs on : searching and sorting
- ii) Programs on : palindrome, string comparison
- iii) Programs on : current time display. Decimal up-counter display

Part-C: Hardware Programs to interface microprocessor with various peripherals Using Microprocessor Trainer Kit

- i) DC Motor Interface
- ii) Stepper Motor Interface
- iii) Matrix Keypad Interface
- iv) 7 Segment Display Interface

TEXT BOOKS:

1. Microprocessor and Interfacing - Douglas V Hall. SSSP Rao, 3rd edition TMH, 2012.
2. The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

SEMESTER	IV					
YEAR	II					
COURSE CODE	20CT2401					
TITLE OF THE COURSE	SMALL E-BUSINESS LAUNCH					
	Lecture	Tutorial	Practical	Seminar/ Project	Total Hours	Credits
	-	2	-	2	26	02

Course Objectives:

- Experience with a set of tools and methods for setting up an online service.
- Knowledge of the role of multiple functions in creating a small business.
- Ability to coordinate multiple, interdisciplinary tasks to achieve a common objective.
- Emphasis of specific knowledge from other courses through practice and reflection in an action-oriented setting.

Course Outcomes

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify customer needs and pain points	L1
CO2	Generate concept & validate idea	L3
CO3	Use design thinking to create a wireframe of your online service	L3
CO4	Launch your App/Website	L3
CO5	Register your small business	L2

Course Content	
Module 1	07 Hrs
Introduction, Identifying Customer Needs, Opportunity Identification & Planning, Idea Generation and Validation, Entrepreneurial Culture, Digital Business Opportunity	
Module 2	07 Hrs
Business Plan & its Components, Business Model and Strategies, Selection of Appropriate Business Model, Business Model Canvas, Feasibility Study	
Module 3	06 Hrs
Lean Thinking, Specifications, Wireframe Generation & Validation	
Module 4	06 Hrs
Service-Market Fit, legal Aspects & Entrepreneurial Law, Logistics of goods delivery, Virtual Trade Shows	

PROJECT DELIVERABLES

1. Proposal Handout & Presentation
 - a. The Problem
 - b. Need
 - c. Existing Alternatives
 - d. Potential Market
2. Wireframe Sketches, Target Specifications

- a. List Critical Customer Needs
- b. For a., Prepare a List of Target Specifications
- c. Prepare Wireframe

TEXTBOOKS

1. Fisher, Steven, Duane, Ja-Nae (2016). Start-up Equation —A Visual Guidebook for Building your Start-up, New Delhi: Tata McGraw-Hill
2. Ulrich, K. T. (2019). *Product design and development*. Tata McGraw-Hill Education, 7th edition

REFERENCE BOOKS

1. Holt H., David (2017). Entrepreneurship: New Venture Creation, New Delhi: Pearson Education
2. Zimmerer, W. Thomas and Scarborough, M. Norman and Doug Wilson (2009). Essentials of Entrepreneurship and Small Business Management, 5/e; New Delhi: Prentice Hall India

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3501					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To learn data models, conceptualize and depict a database system using ER diagram
- To understand the internal storage structures in a physical DB design
- To know the fundamental concepts of transaction processing techniques

COURSE OUTCOMES

CO No.	Outcomes	Bloom's Taxonomy Level
coi	Demonstrate the basic elements of a relational database management system	L2
CO2	Identify the data models for relevant problems	L2
CO3	Apply normalization for the development of application software's	L3
CO4	Use Structured Query Language (SQL) for database manipulation.	L3
CO5	Understand transactions and their properties (ACID)	L2
CO6	Design and develop a large database with optimal query processing	L6

COURSE CONTENT:

MODULE 1

8Hrs

Introduction: Purpose of Database System—Views of data-data models, database management system, three-schema architecture of DBMS, components of DBMS. E/R Model - Conceptual data modeling - motivation,

entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.	
MODULE 2	8Hrs
Relational Model: Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL -Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses.	
MODULE 3	8Hrs
Database Design: Dependencies and Normal forms, dependency theory —functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF	
MODULE 4	8 Hrs
Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.	
MODULE 5	7Hrs
Embedded SQL: triggers, procedures and database connectivity. Introduction to NoSQL	

TEXT BOOKS:

1. Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", 5thEd, Tata McGraw Hill, 2006.
2. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", 8thed, Pearson Education, 2006.

REFERENCES :

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson/Addison Wesley, 2007
2. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003
3. S. K. Singh, "Database Systems Concepts, Design and Applications", First T. Edition, Pearson Education, 2006

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3502					
TITLE OF THE COURSE	OPERATING SYSTEMS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	1	-	-	39	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	***	***	****

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various Memory and Virtual memory management, File system and storage techniques.
- To discuss the goals and principles of protection in a modern computer system.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Interpret the different structures, functions, services of operating system and use operating system level virtualization to improve security, manageability and availability of today's complex software environment with small runtime and resource overhead & with minimal changes to the existing computing infrastructure	L2
CO 2	Infer the performance of various CPU scheduling algorithms to make the system more efficient, faster & fairer	L4
CO 3	Use the knowledge of synchronization hardware, semaphores, monitors to resolve process synchronization problems	L3
CO4	Identify the deadlocks using resource allocation graph & resolve the deadlocks using roll back & abort algorithm, bankers algorithm to ensure system is free from dead locks	L2, L3
CO 5	Compare & Contrast various memory management schemes to implement the virtual address & provide the memory protection	L4
CO 6	Examine the various file management techniques, disk scheduling methods for efficient resource utilization & Interpret the system, network, program threats & employ protection principles to safeguard the system resources	L2,L5

COURSE CONTENT:	
MODULE 1: OS Overview and System Structure	8 Hrs
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Computing environments. Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines;	
MODULE 2: Process Management	8 Hrs
Process Management: Process concept; Process scheduling; Operations on processes. Multi-threaded Programming: Overview; Multithreading models; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms.	
MODULE 3: Process Coordination	8 Hrs
Process Synchronization: The critical section problem; Peterson's solution; Synchronization Hardware; Semaphores; Classical problems of synchronization; Monitors Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	
MODULE 4: Memory Management	7 Hrs
Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.	
MODULE 5: File System and Secondary Storage Structure	8 Hrs
File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing. Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection and Security: Protection: Goals of protection, Principles of protection, System Security: The Security Problem, Program Threats, System and Network Threats.	

TEXT BOOKS:

- I. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.
2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3503					
TITLE OF THE COURSE	MACHINE LEARNING					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	3	-	-	2	39+13	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	****

COURSE OBJECTIVES:

- Define machine learning and understand the basic theory underlying machine learning.
- To understand the working principle of Machine Learning Algorithms
- To apply various techniques of Machine Learning Algorithms
- Perform statistical analysis of machine learning techniques.

COURSE OUTCOMES:

CO No.	Outcomes	Taxonomy Level
CO1	Outline the basic concepts of Supervised, unsupervised and reinforcement machine learning algorithms.	L2
CO2	Employ probability density functions, the basics of the sampling theorem and estimating the maximum likelihood to develop new predictive models.	L4
CO3	Implement supervised learning algorithms for regression and classification problems using Machine learning tools.	L3
CO4	Apply Unsupervised Machine Learning algorithms and feature engineering techniques to develop machine learning models.	L3
CO5	Evaluate the performance of machine learning algorithms based on Accuracy, precision, sensitivity, specificity and F1 score.	L5

COURSE CONTENT:

MODULE 1: Introduction to Machine Learning	7Hrs
Well posed learning problems, Designing a Learning system. Introduction to AI, Machine learning and Deep learning with applications. Types of learning: supervised, unsupervised and reinforcement learning. Perspective and Issues in Machine Learning.	
Classical paradigm of solving learning problems, The learning problems—classes and types of learning, fundamental of statistical learning and its framework. Introduction to feature representation and extraction.	
MODULE 2: Mathematics for Machine Learning	8Hrs
Introduction to Statics Probability (joint probability, conditional probability, Bayes theorem, different distributions, univariate and multivariate Gaussian distribution, PDF, MLE, Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.	
MODULE 3: Supervised Learning	9Hrs
Introduction to Supervised Learning, Introduction to Perceptron model and its adaptive learning algorithms (gradient Decent and Stochastic Gradient Decent), Introduction to classification, Naive Bayes classification Binary and multi class Classification, decision trees and random forest, Regression (methods of function estimation) —Linear regression and Non-linear regression, logistic regression, Introduction To Kernel Based Methods of machine learning: K-Nearest neighbourhood , kernel functions, SVM, Introduction to ensemble based learning methods	
MODULE 4: Unsupervised Learning	8 Hrs
Introduction to Unsupervised Learning, Clustering (hard and soft clustering) Hierarchal clustering: K-means, Fuzzy C-Means (FCM) algorithm, Gaussian mixture models (GMM), Expectation Maximization algorithm, feature Engineering in Machine Learning, Dimensionality reduction, Linear Discriminant Analysis and Principle Component Analysis.	
MODULE 5: Model Selection	7Hrs
Machine Learning model validation - Confusion Matrix, Accuracy, Precision, F score, Cost function, Machine Learning Optimization algorithms: Gradient descent, stochastic GD. Regularization: Normalization and Standardization overfitting, underfitting, optimal fit, bias, variance, cross-validation.	
List of Laboratory/Practical Experiments activities to be conducted	
1. Implementation of linear and logistic regression 2. Implementation of SVM, KNN, Naive Bayes ML algorithms 3. Implementation of Decision trees, Random Forest classifiers 4. Implement ensemble algorithms. 5. Implementation of different clustering algorithms and PCA Implementation of different neural networks	
Capstone project in specific domains (Health care, Transportation, Telecom etc.)	

TEXT BOOKS;

1. Thomas M. Mitchell, Machine Learning, McGraw- Hill, Inc. New York, ISBN: 0070428077 9780070428072.
2. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press

book in preparation. (2015).

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009.
2. V. N. Vapnik “ The Nature of statistical Learning”

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3504					
TITLE OF THE COURSE	PRODUCT DESIGN & DEVELOPMENT					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	-	--	02	39	03

COURSE OBJECTIVES:

- Experience with a set of tools and methods for product engineering
- Knowledge of the role of multiple functions in creating a new product
- Ability to coordinate multiple, interdisciplinary tasks to achieve a common objective.
- Emphasis of specific knowledge from other courses through practice and reflection in an action-oriented setting

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Identify customer needs and pain points in product design	L2
CO2	Classify product specifications and ensure efficient resource utilization, delivering high- value products while minimizing wasteful practices.	L2
CO3	Utilize design thinking to architect a product	L3
CO4	Implement robust designs, and navigate the legal aspects of patents and intellectual property to foster innovation and product development.	L3
CO5	Apply service design principles, leverage product development economies, and implement effective product management strategies to deliver innovative and customer-centric solutions.	L3

COURSE CONTENT:	
MODULE-I	5 Hrs
Introduction, Product Development Process and Organization, Opportunity Identification, Product Planning, Identifying Customer Needs	

MODULE-2	5 Hrs
Product Specifications, Concept Generation, Lean Thinking, Concept Selection, Concept Testing, Value on Product Development, Waste in Product Development	
MODULE-3	6 Hrs
Product Architecture, Industrial Design, Design for Environment, Design for Manufacturing and Supply Chain	
MODULE-4	5 Hrs
Prototyping, Robust Design, Patents and Intellectual Property,	
MODULE-5	5 Hrs
Service Design, Product Development Economies, Product Management	

PROJECT DELIVERABLES	13 Hours
1. Proposal Handout & Presentation a. The Problem b. Need c. Existing Alternatives d. Potential Market 1. PoC / Prototype a. Expecations b. Features c. Target Specifications d. Prepare PoC / Prototype 2. Create App/Product 3. Business Model 4. Register your business	

TEXT BOOKS:

1.	Ulrich Karl T, Eppinger Steve D., and Yang, Maria C., Product Design and Development, 7th Edition, McGraw-Hill Education 2020
2.	Robin McKenzie, Design Theory: An Introduction for Product Design and Engineering, 1st Edition, July 2014

REFERENCE BOOKS

1.	Product Design and Development, MIT Open Courseware https://ocw.mit.edu/courses/sloanschoolofmanagement/15-783j-product-design-anddevelopment-spring-2006/index.htm

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3508					
TITLE OF THE COURSE	VR AND GAME-THEORETIC SIMULATION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	-	-	02	39	03

COURSE OBJECTIVES:

- Develop professional VR apps using Unity 3D
- Run Unity 3D applications in VR on a smartphone
- Build tools to help users navigate 3D environments
- Learn key usability goals and pitfalls for Virtual Reality

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Explain the basic components of virtual reality (VR), including its advantages, 3D computer graphics, and the factors that should be taken into account when designing immersive VR experiences.	L2
CO2	Utilizing virtual world generators, integrating perceptual psychology and human senses, using geometric modelling and psychophysics, and creating game-theoretic systems for interactive experiences.	L3
CO3	Implement interactive and user-friendly 3D experiences by the adoption of 3D User Interfaces (UI) and locomotion.	L3
CO4	classify 3D interaction design, selection and manipulation techniques, building manipulation systems, and graphical rendering techniques to produce engaging and attractive 3D user interfaces and experiences.	L2
CO5	Classify wayfinding tools, addressing VR usability challenges, pitfalls, velocities, tracking systems, mitigating drift errors, utilizing camera-feature detection models, solving the perspective-n point problem and brain-machine interfaces for enhanced virtual reality interaction experiences.	L2

COURSE CONTENT:	
MODULE 1	8Hrs
INTRODUCTION:	

Introduction to VR- Definition, Difference between VR & AR, Applications versus Games, Types of VR Experiences, Types of Head-Mounted Displays, How Virtual Reality Works? The Benefits of VR, 3D Computer Graphics, Human Factors	
MODULE 2	8Hrs
VR & Game Engines — Overview, Unity3D, VR and 3D Environments, Physics and Gaze Interaction, Virtual World Generator, Human Senses, Perceptual Psychology, Psychophysics, Geometric Modelling, Transforming Rigid Bodies, Game-Theoretic Systems	
MODULE 3	8Hrs
3D UI and Locomotion - Overview, 3D Menus, Locomotion, Building Interfaces and Locomotion Systems, 3D Rotation Inverses and Conversions, Look-at & Eye Transforms, Canonical View and Perspective Transforms, Viewport Transforms	
MODULE 4	8Hrs
3D User Interaction — Overview, 3D Interaction Design, Selection and Manipulation, Building Manipulation Systems, Graphical Rendering, Ray Tracing, Rasterization, Barycentric Coordinates, Anti- Aliasing, Image Warping, Panoramic Rendering	
MODULE 5	7Hrs
Wayfinding and VR Input - Overview, Implementing Wayfinding, Building Wayfinding Tools, VR Usability and Pitfalls, Velocities, Tracking Systems, Drift Errors, Camera-Feature Detection Model, Perspective n point Problem, Brain-Machine Interfaces	

TEXT BOOKS:	
1.	Virtual Reality - Steven M. LaValle, Cambridge University Press
2.	Complete Virtual Reality and Augmented Reality Development with Unity - Jesse Glover, Jonathan Linowes, Packt Publishing (April 17, 2019)

REFERENCE BOOKS:	
1.	Understanding Virtual Reality: Interface, Application and Design - William R. Sherman, Alan B. Craig, 1 st Edition, September 2002

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3509					
TITLE OF THE COURSE	CREATIVE CODING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	-	-	02	39	03

COURSE OBJECTIVES:

- The fundamentals of computational thinking applied through p5.js
- Best practices for designing software within an event-driven, object-oriented, real- time framework
- How to ideate, conceptualize, and design original creative works in the medium of software

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Examine fundamentals of computational thinking	L2
CO2	Implement applications in creative graphics and interactive experiences using the p5.js Web Editor and integrating p5.js	L3
CO3	Explore the capabilities of 3D and WebGL while implementing the integration of p5.js with Node.js and Socket.io for real-time communication.	L3
CO4	Discuss how to connect p5.js sketches to HTML files for seamless web deployment and presentation, and learning about extended functionalities.	L2
CO5	Utilize p5.ble.js with Arduino for seamless integration, and explore Bluetooth Low Energy (LE) capabilities in p5.js	L3

COURSE CONTENT:	
MODULE 1	7Hrs
Computational Thinking: Overview, Stages, Cornerstones. Pillars, Expressing and Analyzing Algorithms, Concepts of Computational Thinking, Techniques Associated with Computational Thinking, Computational Thinking in a Classroom	
MODULE 2	7Hrs

p5.js: Overview, Creative Graphics & Interactive Experiences, p5.js Web Editor, p5.js and Processing, Using a Local Server, First Sketch, Color, Constants, DOM, Data, Environment, Events, Foundation, I/O, Image, Lights, Camera, Math, Rendering, Shape	
MODULE 3	7Hrs
p5.js-contd: node.js and socket.io, 3D/WebGL, Coordinate System and Shapes, Structure, Transform, Typography, Anatomy of Functions, Built-in p5.js Functions, Touch, Unit Testing and Test-Driven Development	
MODULE 4	6Hrs
p5.js-Advanced Data, Sound, Mobile-Acceleration Ball Bounce, Simple Draw, Acceleration Color, Shake Ball Bounce, Titled 3D Box, p5.js libraries, Linking p5.js to HTML file	
MODULE 5	6Hrs
p5.ble.js — Overview, Introduction to Arduino and Bluetooth, Usage, p5.ble.js using Arduino, Bluetooth Le and p5.blep5.bots — Overview, APIs, Servers, Functions. p5.clickable — Overview, Creating, Moving & Resizing a Clickable, Clickable Events.	

Seminar/Projects (if any):	6 Hrs
1. Download and install sketch.js and setup a sketch to handle mouse/touch input. 2. Setup a sketch to spawn particles with your mouse. 3. Create a web-based VR application made with three.js. 4. How do you update an object's transformation using three.js? 5. Design an animation system using three.js	

TEXT BOOKS:

1.	Lauren McCarthy, Casey Reas, Ben Fry, Getting Started with p5.js: Making Interactive Graphics in JavaScript and Processing, Maker Media Inc.
2.	Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and Programming, The Chartered Institute for IT

REFERENCES:

1.	Creative Coding and Data Visualization with p5.js", Scott Muray, O'Reilly (13 January 2017)
2.	"Processing: Creative Coding and Computational Art", Ira Greenberg Apress; 2nd Printing Edition (June 1, 2007)

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3510					
TITLE OF THE COURSE	CLOUD SECURITY SERVICES					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	02	-	-	02	39	03

COURSE OBJECTIVES:

- Explain basics concepts of Cloud Computing.
- Evaluate security issues with cloud infrastructure
- Implement cloud features to secure and harden the infrastructure
- Use tools to analyze system logs to detect possible security or performance problems

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Classify cloud computing fundamentals, models, types, infrastructure design, deployment, configuration, security measures, and risk mitigation strategies.	L2
CO2	Demonstrate the shared responsibility model, security compliance, identification and access services, directory services, as well as network isolation encompassing Fort and Beehive Theft mechanisms.	L3
CO3	Interpret network isolation concepts using Virtual Private Cloud (VPC), comprehend VPC endpoints and Private Link mechanisms, demonstrate proficiency in detective controls, auditing practices, and utilization of CloudWatch and CloudWatch Logs, as well as employing GuardDuty for enhanced security.	L3
CO4	Apply concepts including Security Hub, encryption in transit, encryption at rest, database encryption, safeguarding compute resources, and securing endpoints to enhance data protection and system security.	L3
CO5	utilize cloud security managed services, devise comprehensive security strategies, implement intelligent log management, leverage security intelligence, offer operations consulting, and apply threat insights for robust cloud security management.	L3

COURSE CONTENT:	
MODULE 1	8 Hrs
Basics of Cloud Computing - Foundations and Models, Types, Designing a Cloud Computing Infrastructure or Service, Deployment and Configuration, Insuring Cloud Security and Mitigating Risks	
MODULE 2	8 Hrs
Shared Responsibility Model, Security Compliance, Identify and Access Services, Directory Services, Network Isolation-Fort and Beehive Theft	
MODULE 3	7 Hrs
Network Isolation VPC, VPC Endpoints and Private Link, Detective Controls, Auditing, CloudWatch and CloudWatch Logs, Guard Duty	
MODULE 4	8 Hrs
Security Hub, Encryption in Transit, Encryption at Rest, Database Encryption, Protecting Compute Resources, Protecting & Securing Endpoints	
MODULE 5	8 Hrs
Cloud Security Managed Services, Security Strategy, Intelligent Log Management, Security Intelligence, Operations Consulting, Threat Insights	

TEXT BOOKS:	
1.	Ronald L. Krutz, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, 30 July 2010
2.	John R. Vacca, Cloud Computing Security: Foundations and Challenges, 30 August 2016
3.	Chris Dotson, Practical Cloud Security: A Guide for Secure Design and Deployment, 31 March 2019

REFERENCES:	
1.	Vic (J.R.) Winkler, Securing the Cloud: Cloud Computer Security Techniques and Tactics Paperback - 1 June 2011
2.	Adrian Pruteanu and Zeal Vora, Enterprise Cloud Security and Governance: Efficiently set data protection and privacy principles Paperback — Import, 29 December 2017
3.	Routavaara, Ilkka. "Security monitoring in AWS public cloud." (2020)
4.	NIST Special Publication 500-292, NIST Cloud Computing Reference Architecture, September 2011

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3505					
TITLE OF THE COURSE	DATABASE MANAGEMENT SYSTEMS LAB					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	30	1

Pertquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
\$	**	**	*****

COURSE OBJECTIVES :

- Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
- To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
- To learn the SQL and NoSQL database system.
- To learn and understand various Database Architectures and its use for application development.
- To programme PL/SQL including stored procedures, stored functions, cursors and packages

COURSE OUTCOMES :

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Install and configure database systems.	L3
CO2	Analyze database models & entity relationship models.	L3
CO3	Design and implement a database schema for a given problem-domain	L3
CO4	Understand the relational and document type database systems.	L2
CO5	Populate and query a database using SQL DML/DDDL commands.	L3

List of Laboratory/Practical Experiments activities to be conducted
1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.
2. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and

LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary.
3. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Make use of built in functions according to the need of the database chosen. Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. Use group by and having clauses.
4. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique).
5. Write and execute suitable database triggers .Consider row level and statement level triggers.
6. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
7. Write a PL/SQL block to implement all types of cursor.
8. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
9. Mini project.

TEXT BOOKS :

1. Ramon A. Mata-Toledo. Pauline Cushman, Database management systems, TMGH, ISBN: IS978-0-07-063456-5, 5th Edition.

REFERENCES:

1. Dr. P. S. Deshpande. SQL and PL/SQL for Oracle lOg Black Book, DreamTech.
2. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.
3. Dalton Patrik, SQL Server — Black Book, DreamTech Press.

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3506					
TITLE OF THE COURSE	OPERATING SYSTEMS LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
#	Sem/Y ear	Course Code	Title of the Course
*	**	***	****

COURSE OBJECTIVES:

- To learn creating process and Threads
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Implement system calls to expose the operating system's services to user programs.	L3
CO2	Develop multi-threading and CPU Scheduling algorithms to make the system more efficient, faster, and fairer.	L3
CO3	Implement process synchronization problem using semaphores for the coordination of the process interactions in an Operating System.	L3
CO4	Implement bankers algorithm for the purpose of deadlock avoidance to ensure system is in safe state.	L3
CO5	Develop the page replacement algorithms for effective management of virtual memory.	L3
CO6	Implement file organization and file allocation strategies for efficient disk space utilization.	L3

List of Laboratory/Practical Experiments activities to be conducted		
Exp. No	Division of Experiments	List of Experiments
1	System Calls	Write a C program to create a new process that exec a new program using system calls fork(), execlp() & wait()
2		Write a C program to display PID and PPID using system calls getpid () & getppid ()
3		Write a C program using I/O system calls open(), read() & write() to copy contents of one file to another file
4	Process Management	Write a C program to implement multithreaded program using pthreads
5		Write C program to simulate the following CPU scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin
6	Process synchronization	Write a C program to simulate producer-consumer problem using semaphores
7	Deadlock	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
8		Write a C program to simulate deadlock detection.
9	Memory Management	Write a C program to simulate paging technique of memory management
10		Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
11	I/O System	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory
12		Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2010

REFERENCES:

1. Operating Systems-Internals and Design Principles, William Stallings, 6th Edition, Pearson Education, 2009.

SEMESTER	V					
YEAR	III					
COURSE CODE	21CT3507					
TITLE OF THE COURSE	MOOC					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Proj ects Hours	Total Hours	Credits
	02	--	--	-	26	2

Course Outcomes:

1. Enabling students to obtain certificates to make students employable in the industry or pursue a higher education program.
2. Relevant exposure to tools and technologies are being offered.

Guideline Policy & Credit Transfer against Technology Elective

1. The MOOCs courses available on the NPTEL/SWAYAM (Swayam.gov.in) platform is allowed for enrolling. The SWAYAM shall notify in June and November every year.
2. The list of NPTEL/SWAYAM courses related to Computer Science & Technology that is in line with the students interest will be announced at the departmental level for enrollment.
3. The interested student has to enroll as per the guidelines of the NPTEL course within Enrollment end date.
4. The credits assigned would depend on the number of weeks (12 weeks may be assigned as 3 Credits)
5. A faculty member is appointed as SPOC to keep a track of students undertaking courses and collect certificates from students
6. Student has to pursue and acquire a certificate for a MOOC course
7. After successfully completion of MOOCs courses of 3 Credit, the student shall submit the certificate to the Department
8. The fee for obtaining the certificate shall be paid by the student himself.
9. In case a student fails to complete the MOOC successfully with a certificate, Then the student will get 'F' grade in the grade card. However, the student is permitted to register for the same course in the next semester when it is scheduled on the NPTEL portal. In case both are not possible then the student may opt for department elective
10. Proposed ranges for the award of grades for credit transfer of MOOC

Consolidated MOOC Score (assignment+ proctored exam)	Proposed Grade Point	Grade
90-100	10	O
80-89	9	A+
70-79	8	A
60-69	7	B+
55-59	6	B
50-54	5	C
40-49	4	P

Less than 40	0	F

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3601					
TITLE OF THE COURSE	COMPILER DESIGN AND SYSTEMS SOFTWARE					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	1	-	-	39	4

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

1. To explain the basic system software components such as assembler, loader, linkers, compilers.
2. Provide an understanding of the fundamental principles in compiler design
3. To discuss the techniques of scanning, parsing & semantic elaboration well enough to build or modify front end.
4. To illustrate the various optimization techniques for designing various optimizing compilers.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
coi	Identify the data structures, algorithm, machine dependent Assembler features and build the object code for Simplified Instructional Computer program	L2
CO2	Infer how linker and loader builds an executable program from an object module generated by assembler	L4
CO3	Interpret the major phases of compilation and to apply the knowledge of Lex tool & YACC tool to build the appropriate parsing application	L2
CO4	Compare and Contrast various top down and bottom up parsing techniques to analyze grammatical structures involved in compiler construction.	L2
CO5	Use formal attributed grammars for specifying the syntax and semantics of programming languages.	L3
CO6	Select various optimization techniques used for dataflow analysis and build machine code from the source code of a novel language.	L2

COURSE CONTENT:	
MODULE 1: Introduction to System Software, ASSEMBLERS	9Hrs
Introduction to System Software, Machine Architecture of SIC and SIC/XE. ASSEMBLERS: Basic assembler functions: A simple assembler, Assembler algorithm and data structures, Machine dependent assembler features: Instruction formats and addressing modes - Program relocation, Machine independent assembler features: Literals, Symbol-defining statements, Expressions, Program blocks	
MODULE 2 : LOADERS AND LINKERS:	7 Hrs
Basic loader functions: Design of an Absolute Loader, A Simple Bootstrap Loader, Machine dependent loader features: Relocation, Program Linking, Algorithm and Data Structures for Linking Loader, Machine-independent loader features: Automatic Library Search, Loader Options, Loader design options: Linkage Editors, Dynamic Linking	
MODULE 3: COMPILERS	8Hrs
Introduction: Language Processors, Structure of compiler, The science of building a compiler, Applications of compiler technology. LEXICAL AND SYNTAX ANALYSIS: Role of lexical Analyzer, Specification of Tokens, Lexical Analyzer generator Lex. SYNTAX ANALYSIS I: Role of Parser, Syntax error handling, Error recovery strategies, Writing a grammar: Lexical vs Syntactic Analysis, Eliminating ambiguity, Left recursion, Left factoring.	
MODULE 4: SYNTAX ANALYSIS II	8 Hrs
Top down parsing: Recursive Descent Parsing, First and follow, LL (1), -Bottom up parsing: Shift Reduce Parsing, Introduction to LR parsing Simple LR: Why LR Parsers, Items and LRO Automaton, The LR Parsing Algorithm. SYNTAX-DIRECTED TRANSLATION: Syntax-Directed Definitions: Inherited and Synthesized Attributes, Evaluation orders for SDDs: Dependency graphs, Ordering the evaluation of Attributes, S-Attributed Definition, L-Attributed Definition, Application: Construction of Syntax Trees.	
MODULE 5: INTERMEDIATE CODE GENERATION	7 Hrs
Three Address Code: Addresses and Instructions, Quadruples, Triples, indirect triples. CODE GENERATION: Issues in the design of code generator, Basic Blocks, Optimization of Basic Blocks, The Code Generation Algorithm, Peephole optimization. MACHINE INDEPENDENT OPTIMIZATION: The Principal Sources of Optimization	

TEXT BOOKS:

1. Leland L. Beck, "System Software - An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2006.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers - Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.

REFERENCES:

1. V. Raghavan, Principles of Compiler Design!, Tata McGraw Hill Education Publishers, 2010.
2. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
3. D.M.Dhamdhare, Systems Programming and operating systems, Second Revised edition, Tata McGraw Hill.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3602					
TITLE OF THE COURSE	COMPUTER NETWORKS					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem /Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To introduce the fundamental aspects of various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits.
- To Understand the working principle of layering structure and basic network components
- To explore the features of each layer by various approach and methods

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify and compare among different layers of networking and associated components.	L3
CO2	Implement error control and error detection mechanisms (CRC, Hamming Code) using the concept of the data link layer.	L3
CO3	Differentiate IP addressing modes, implement routing algorithms, and determine the range of congestion in any network.	L3
CO4	Identify the issues of the Transport layer to analyze the congestion control mechanism	L3
CO5	Compare application layer protocols (WEB and HTTP, FTP, E-MAIL (SMTP, POP3), TELNET, DNS, SNMP).	L4

COURSE CONTENT	
MODULE 1: Overview of Networks	9 Hrs

Network Components- Network Physical Structure, Classification of networks (LAN-MAN-WAN), Protocols and Standards, Data representation and data flow, Layered Architecture — Comparison of the OSI and TCP/IP reference model. Physical Layer: Introduction to wired and wireless transmission media. Transmission mode (Serial/Parallel signals, Analog/Digital Signals and Periodic/Aperiodic Signals), Line coding Schemes.	
MODULE 2: Data Link Layer	9 Hrs
Data Link Layer - MAC (Media Access Control) and LLC (Logical Link Control) sublayer Functionalities— Design Issues: Framing — Flow control (Simplest protocol, Stop and wait, sliding window) — Error control (CRC, Flammig code) — Ethernet Basics-Multi Access Protocols: ALOHA, CSMA/CD, Connecting Devices: Hubs, Bridges, Switches, Routers, and Gateways	
MODULE 3: Network Layer	8 Hrs
Network Layer Design issues, Routing Protocol Basics, Routing Algorithm (Distance Vector Routing, Link State Routing and Hierarchical Routing). IP addressing, IP Packet format IPV4, IPV6 and IP Tunneling. Congestion control algorithms, QoS (Traffic Shaping, Packet Scheduling).	
MODULE 4: Transport Layer	7 Hrs
Transport Layer functions- Multiplexing and Demultiplexing. Introduction to TCP and UDP, The TCP Service Model, The TCP Segment Header, The TCP Connection Management, TCP Flow Control- Sliding Window, TCP Congestion Control, User Datagram Protocol	
MODULE 5: Application Layer	6 Hrs
Principles of Network Applications, WEB and HTTP, FTP, E-MAIL (SMTP, POP3), TELNET, DNS, SNMP	

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition, Pearson Education.

REFERENCES:

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Seventh Edition, Pearson Education, 2017.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
3. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2014.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3603					
TITLE OF THE COURSE	CLOUD COMPUTING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	3	-	-	-	39	3

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Understand various basic concepts related to cloud computing technologies
- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Understand the applications of Cloud Computing
- Get exposure to Microsoft Azure, Google Cloud Platform, Amazon Web Services

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Illustrate the main concepts, models, strengths, and limitations of cloud computing and make use of NIST cloud computing architecture to solve architecture design challenges	L3
CO2	Outline the key technologies and approaches for implementation of the cloud and also analyze the authentication, confidentiality, and privacy issues in cloud computing	L4
CO3	Evaluate the relative advantages and disadvantages of Virtualization technology and the taxonomy of Virtualization	L5
CO4	Infer the key and enabling technologies that help in the development of the cloud and the steps involved in migration to the cloud	L2
CO5	Utilize the main dimensions of current cloud platforms and identify the appropriate cloud services for a given application	L6

COURSE CONTENT:	
MODULE 1: INTRODUCTION	8Hrs
Basics of cloud computing, Cloud Computing Models (PaaS, SaaS, IaaS), Understanding Public Clouds, Private Clouds, Community Cloud and Hybrid Clouds, Cloud Computing Benefits and risks, Cloud Computing Challenges, Cloud Computing Architecture and Virtualization	

MODULE 2: CLOUD Technologies	7 Hrs
Overview of Cloud Computing techniques (Grid Computing, Cloud Computing, Utility Computing, Fog Computing, Edge computing), Introduction to Cloud security.	
MODULE 3: CLOUD VIRTUALIZATION TECHNOLOGY	8Hrs
Introduction, why virtualization, virtualization benefits, Types of Virtualization- Storage, Application & Network Virtualization, implementing virtualization, Hypervisor.	
MODULE 4: ACCESSING THE CLOUD AND MIGRATING TO THE CLOUD	8Hrs
Accessing the Cloud: Cloud Web access technologies (SOAP, REST), Platforms, Web applications framework, web hosting service, web APIs, web browsers. Migrating to the Cloud: Broad approaches to migrating into the cloud, the seven-step model of migration in to a cloud.	
MODULE 5: CLOUD APPLICATIONS	8Hrs
Cloud Platforms in Industry: Amazon Web Services, Google Cloud Platform, Microsoft Azure. Cloud Applications: Scientific Applications (Healthcare: ECG Analysis in the Cloud) and Business and Consumer Applications (Social Networking, Smart Grids)	

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education
2. Cloud Computing, Dr. Kumar Saurabh, Wiley Publications, 2012

REFERENCES:

1. Guide to Cloud Computing, Richard hill, Springer Publications, 2013
2. Cloud Computing A Practical Approach, Anthony T Velte et.al, MC Graw Hill publications, 2014
3. Cloud Computing Principles and Paradigms, Rajkumar Buyya et.al, Wiley Publications, 2015
4. Cloud Computing Technologies and Strategies of the Ubiquitous data center, Brain J.S et.al, CRC Press, 2014

SEMESTER	VI					
YEAR	III					
COURSE CODE	2ICT3604					
TITLE OF THE COURSE	LEAN STARTUP METHODOLOGY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	-	-	02	02	26	02

COURSE OBJECTIVES:

- Use the Business Model Canvas innovation tool to approach either a personal or corporate challenge or opportunity.
- Identify and communicate the nine key elements of a business model.
- Explain how to develop a strategic business plan

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Discuss distribution channels and methods of reaching customers.	L1
CO2	Utilize business canvas tools to map out their business model defining key elements such as customer segments, value propositions, revenue streams, and cost structure in a concise and visual manner.	L3

COURSE CONTENT:	13 Hrs
Exposure to Business Model Techniques like, Channels, Customer Segments, Relationships, Key Resources, Key Activities, Cost structures, Pain, and Gain Relief of Core Customers.	

Seminar/ Projects (if any) :	13 Hrs
Build the various elements of the lean model canvas to your business proposition with inputs and data from field survey	
Develop key hypothesis for your proposed solution	
Work with founders to finalize the business model	

TEXT BOOKS:

1.	Timmons, Jeffry A. and Spinelli, Stephen Jr. (2009). New Venture Creation: Entrepreneurship for the 21st Century, 8th edition. McGraw-Hill Irwin, Boston. Chapter 3

REFERENCE BOOKS:

1.	Lindsay, Noel (2010). Business Plan Template

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3608					
TITLE OF THE COURSE	HUMAN COMPUTER INTERACTION					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practica 1 Hours	Seminar/Projects Hours	Total Hours	Credits
	02	-	-	02	39	03

COURSE OBJECTIVES:

- Illustrate overall goals of human-computer interaction.
- Map relationship between HCI, user experience design, human factors engineering, and psychology.
- Discuss trends in HCI technology including virtual reality, augmented reality, and robotics.
- Elaborate the role of design principles and heuristics in user interface design.

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	classify relationship between HCI, user experience design, human factors engineering, and psychology.	L2
CO2	Analyze the use of HCI to domains like healthcare, education, and cybersecurity.	L4
CO3	Utilise Unity 3D for Human-Computer Interaction (HCI) applications, asset workflow, gameplay creation, model import, input management using the Input Manager, mobile device input, and Unity XR input, and more to create interactive and immersive experiences.	L2
CO4	Apply physics principles to object-oriented projects to create realistic interactions and simulations iin Unity applications.	L3
CO5	Interpret Graphical User Interfaces (GUI) and sound implementation for building immersive and engaging user interfaces, auditory experiences that improve the overall quality of Unity projects.	L3

COURSE CONTENT:	
MODULE 1	8 Hrs
Introduction, Design Principles and Feedback Cycles, Direct Manipulation & Invisible Interfaces, Human Abilities, Design Principles and Heuristics.	
MODULE 2	8 Hrs

Characteristics of Interaction Design, Digital Materials and Interaction Design, Contextual Design - Overview, Key Principles, Process, Task-Artifact Cycle, GOMS Model.	
MODULE 3	8Hrs
Unity 3D - Basics of C#, Variables, Functions, Logic & Operators, Inheritance, Class, Constructors, Arrays, Overview, Unity 3D for HCI, Asset Workflow, Creating Gameplay, Importing Models, Input - Input Manager, Mobile Device Input, Unity XR Input.	
MODULE 4	8 Hrs
Graphics - Render Pipelines, Visual Effects Components, Optimizing Graphics Performance, Animation - Clips and Controllers, Performance and Optimization, User-Interfaces — Unity UI, Immediate Mode GUI, Navigation and Pathfinding, 3D Physics for Object-Oriented Projects.	
MODULE 5	7 Hrs
Overview of JavaScript for Unity, Starting with Coding Physics, Using Advanced Physics Concepts, Particle Emitters and Special Effects, Enhancing User Experience: GUI & Sound.	

TEXT BOOKS:

1	Andrew Monk, Fundamentals of Human-Computer Interaction, 1st Edition, Academic Press, 28th January 1985
2	Alan DIX, Janet Finlay, Gregory D. Abowd, Russell Beale, Human-Computer Interaction.

REFERENCES:

1	Learning C# Programming with Unity 3D, Alex Okita, 1st Edition, CRC Press, Routledge; 1 Edition
2	Learning Unity 3D Programming with Unity Script: Unity's JavaScript for Beginners, Janine Suvak, Technology in Action, Apress; 1st ed. edition

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3609					
TITLE OF THE COURSE	DATA-DRIVEN DECISION MAKING					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	--	-	02	39	03

COURSE OBJECTIVES:

- To perform data cleaning & pre-processing on real-time datasets
- To work on live projects on modeling data
- To visualize data

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Discuss how to combine multiple models to improve predictive accuracy and make better data-driven decisions.	L3
CO2	Apply data cleaning and data pre-processing using Scrappy, NumPy, and Pandas.	L3
CO3	Implement Statsmodels for data processing, including performing Linear Regression, Correlation, Ordinary Least Squares, Survival Analysis, Generalized Linear Models, Bayesian Models, Univariate and Bivariate Analysis, and Hypothesis Testing to derive valuable insights and make data-driven decisions.	L3
CO4	Use predictive modelling and pattern recognition to construct powerful machine learning models for real-world applications.	L3
CO5	Execute Seaborn to study Correlation. Aggregate Statistics. Uni-Variate and Bi-Variate Distributions, Linear Regression Models, and Multi-Plot Grids to clearly communicate insights and patterns from data.	L3

COURSE CONTENT:	
MODULE 1	7 Hrs
Overview, Data Science Lifecycle and Process, Types of Analytics, Making Business- Defined Decisions using Data Analytics, Steps to Clean and Pre-process Data, Data Processing Techniques, Data Modelling, Ensemble Models	
MODULE 2	8 Hrs
Cleaning and Data Pre-processing Scrapy - Linear Algebra, Integration, Calculus, Ordinary Differential Equations, Signal Processing NumPy - Basic Array Operations (Multiply Slice, Flatten, Reshape, Index Arrays), Advanced Array Operations (Stack, Split, Broadcast), Linear Algebra Pandas - Indexing, Manipulating, Renaming, Sorting, Merging Data Frame, Impute Missing Files, Handle Missing Data	
MODULE 3	8 Hrs
Data Processing - Statsmodels - Linear Regression, Correlation, Ordinary Least Squares, Survival Analysis, Generalized Linear Models, Bayesian Models, Univariate and Bi-variate Analysis, Hypothesis Testing.	
MODULE 4	8 Hrs
Modelling Scikit-Learn - Classification (Spam Detection, Image Recognition), Clustering (Drug Response, Stock Price), Regression (Customer Segmentation, Grouping Experiment Outcomes), Decision Tree, K- NN and Naïve Bayes	
MODULE 5	8 Hrs
Data Visualization Matplotlib - Line Plots, Scatter Plots, Area Plots, Bar Charts & Histograms, Pie Charts, Stem Plots, Contour plots, Quiver Plots, Spectrograms Seaborn — Correlation, Aggregate Statistics, Uni-Variate & Bi-Variate Distributions, Linear Regression Models, Multi-Plot Grids	

Seminar/ Projects (if any) :
Considering any data set apply the functionalities of pandas like merging sorting, indexing, and manipulating.
Consider any data set and apply data pre-processing methods like identifying missing data and filling missing data.
Sales prediction using linear regression analysis using Dataset.
Demonstrate the working of the decision tree based 1D3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify anew sample.

Apply the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
Assuming a set of documents that need to be classified, use the naive Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
Apply k-means clustering algorithm to predict iris flower species.

TEXT BOOKS:

1	Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Publications, 2014.
2	Han, Kambar and Pei, Data Mining Concepts and Techniques, MK Publications, 3 rd Edition.

REFERENCES:

1	Data Pre-Processing https://scikit-learn.org/stable/moduleIndex.html
2	Python Data Science Handbook: https://tanthiamhuat.files.wordpress.com/2018/04/python-datascience-handbook.pdf

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3610					
TITLE OF THE COURSE	BLOCKCHAIN & CRYPTOCURRENCY					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	02	-	-	02	39	03

COURSE OBJECTIVES:

- The alternative consensus mechanisms to Bitcoin's Proof-of-work, including Proof-of-Stake, voting based consensus algorithms, and federated consensus.
- The various enterprise-level blockchain implementations, such as JP Morgan's Quorum, Ripple, Tender Mint, and Hyperledger, including the industry use cases for blockchain, ICOs, and the increasing regulations surrounding blockchain.
- The challenges with scaling and obstacles to widespread blockchain adoption, as well as the possible solutions within vertical scaling (e.g. block size increases, Segregated Witness, and the Lightning Network) and horizontal scaling (e.g. sidechains, sharding).

COURSE OUTCOMES:

CO No.	Course Outcomes	Bloom's Taxonomy Level
CO1	Describe distributed systems and the various consensus mechanisms that underpin decentralized technologies like blockchain.	L2
CO2	Describe the properties of crypto economics as it relates to its two compositional fields: cryptography and economics, as well as the goals for crypto economics with respect to distributed systems fundamentals	L2
CO3	Analyse enterprise-level blockchain implementations, such as JP Morgan's Quorum, Ripple, Tender Mint, and Hyperledger	L4
CO4	Utilise blockchain-based tools and methods to build decentralised applications and tokenized systems.	L3
CO5	Interpret JP Morgan's Quorum, Ripple, Tendermint, and Hyperledger, exploring their unique features ,use cases and their relevance in modern business environments.	L3

COURSE CONTENT:	
MODULE 1	6Hrs
Distributed Systems and Alternative Consensus — Overview, Blockchain Architecture, CAP Theorem, Byzantine General Problem, Alternative Consensus Mechanisms of Bitcoin's Proof-of- Work, Proof-of-Stake, Voting based Consensus Algorithms, Federated Consensus.	
MODULE 2	6Hrs
Crypto economics - Overview, Properties, Attacks, Enterprise Blockchain Overview, Platforms, Getting Started with Bitcoin — Setting up a Regtest Environment, Building a Payment Gateway, Bitcoin Smart Contracts, Rootstock, Building your own Cryptocurrency, Readercoin, Peer-to-Peer Auctions in Ethereum, Building an Auction DApp - Ganache	
MODULE 3	6Hrs
Scaling Blockchain - Vertical Scaling on-Chain, Vertical Scaling Off-Chain, Horizontal Scaling, Advanced Scaling and Generalizations, Tontine Game with Truffle and Drizzle, Tontine Contract, Cplayer as a CRUD Contract, Tontine Interfaces, Ctontine Contract, Truffle Unit Tests, Frontend with Drizzle,	
MODULE 4	6Hrs
Use Cases and Industries, Regulation and Caveats, Anonymity through Altcoins, Advanced Anonymity & Generalizations, Connecting Ganache to MetaMask, Blockchain-Based Futures System, Futures Smart Contract, Web3j, Initial Coin Offering, Token Contracts	
MODULE 5	6Hrs
Enterprise Blockchain Implementations - JP Morgan's Quorum, Ripple, Tender mint, and Hyperledger, Blockchains in Business - Public versus Private and Permissioned versus Permission less Blockchains, The Ethereum Enterprise Alliance, Blockchain-as-a-Service, Quorum	

S.No	Seminar/Project (id any):	HOURS
1	Interpret Voting based algorithm in blockchain using solidity.	9 Hrs
2	Generate your own blocks in blockchain regtest environment, consider the mining rule, that one can spend a block reward only if it has 100 blocks mined before it. So, generate 101 blocks to make 50 regtest BTC spendable.	
3	Introduction to Ethereum Blockchain Development with DApps and Ethereum VM	
4	Building Auction DApp With Ethereum and Solidity Programming Language	
5	Working with Ethereum Blockchain Applications through Remix IDE	
6	Building Bidding Form in Web3js for Ethereum Auction DApp	
7	Working with web3js API and JSON to Build Ethereum Blockchain Applications	
8	Deployment Environments for Managing Ethereum Smart Contracts	

9	Work with Ethereum Private Network with Golang with Geth	
10	Compiling and Deploying Ethereum Contracts Using Solidity Compiler	

TEXT BOOKS:

1.	Mastering Bitcoin: Unlocking Digital Crypto-Currencies- Andreas M. Antonopoulos, O'Reilly Media Inc. 2020
2.	Mastering Blockchain — Expert Insight- Imran Bashir, Second Edition, Packt, 2018

REFERNCE BOOKS:

1.	Blockchain: Ultimate guide to understanding Blockchain, Bitcoin, Cryptocurrencies, Smart Contracts- Mark Gates, Wise Fox Publishing, June 2017
2.	Programming Bitcoin: Learn How to Program Bitcoin from Scratch, Jimmy Song, O'Reilly Media Inc.
3.	Blockchain for Dummies, Manav Gupta, IBM Limited Edition, John Wiley & Sons, Inc. 2017

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3605					
TITLE OF THE COURSE	SPECIAL TOPIC -I					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	—	—	—	02	13	01

Guidelines on Special Topics

All the students will do research on current technologies and publish a research paper as the special topic for this semester. A research paper is an academic writing assignment that offers analysis, explanation, and justification based on extensive, independent study.

Students have to go through a hands-on workshop as training for writing and publishing the research paper in SCOPUS indexed journals or Conferences or UGC High Impact Factor journals. The research paper can either be based on the Project work or any other research work. Students will be divided into teams and under the supervision of the project guide, they will draft and publish the paper.

The objective of a Special Topic as a Research paper:

- Students will be able to Formalize and produce Descriptive research studies.
- To apply methodologies, concepts, and research findings.
- To compare existing results with proposed ones with unique features.
- Students will be able to write research papers on their major project/ research carried out and undergo the process of publishing quality work in various SCOPUS-indexed journals or conferences.

The outcome of the Special Topic:

- Students will publish research papers in SCOPUS-indexed journals or Conferences or UGC High impact Factor journals by the end of the semester.

The guidelines for evaluation of a special topic are as follows (50 Marks):

Guidelines	MARKS
Literature survey and Design	15 Marks
Implementation, methodology, results and diagrams	15 Marks
Submission	10 Marks
Acceptance notification	10 Marks

Note: Published paper will get 10 Marks in Phase-1 Review-1 of Project in next semester.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3606					
TITLE OF THE COURSE	COMPILER DESIGN AND SYSTEM SOFTWARE LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

Perquisite Courses (if any)			
# ***	Sem/Year ***	Course Code ***	Title of the Course ***

COURSE OBJECTIVES:

- Experiment on the basic techniques of compiler construction and tools that can be used to perform syntax-directed translation of a high-level programming language into an executable code.
- Know the implementation of assemblers, loaders and various parsing techniques.
- Learn how to optimize and effectively generate machine codes.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
coi	Identify patterns, tokens & regular expressions for lexical analysis.	L2
CO2	Develop LEX and YACC programs for lexical and syntax analysis phases of Compiler.	L3
CO3	Implement the two-pass assembler and absolute loader to translate assembly language into machine code and load the machine code into RAM for execution	L3
CO4	Implement the bottom-up parsing applied in the syntax analysis phase of the compiler	L3
CO5	Develop first sets of Context free grammar to generate a predictive parser used to check whether the input source code follows the syntax of the programming language.	L3

List of Laboratory/Practical Experiments activities to be conducted
I a. Program to count the number of characters, words, spaces and lines in a given input file.
Ib. Program to recognize and count the number of identifiers in a file.

2a. Program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.
2b. Program to recognize whether a given sentence is simple or compound.
3a. Program to count no of: i. +ve and -ve integers ii. +ve and -ve fractions
3b. Program to count the no of „scanf“ and „printf“ statements in a C program. Replace them with “readf” and “writef” statements respectively.
4. Program to evaluate arithmetic expression involving operators +, -, *, /
5. Program to recognize a valid variable which starts with a letter, followed by any number of letters or digits.
6. Program to recognize the strings using the grammar ($a^n b^n ; n \geq 0$)
7. C Program to implement Pass1 of Assembler
8. C Program to implement Absolute Loader
9. C program to find the FIRST in context free grammar.
10. C Program to implement Shift Reduce Parser for the given grammar $E \rightarrow E + E$ $E \rightarrow E * E$ $E \rightarrow (E)$ $E \rightarrow id$
11. C Program to implement intermediate code generation for simple expression

TEXT BOOKS:

1. Leland L. Beck, “System Software-An Introduction to Systems Programming”, 3rd Edition, Pearson Education Asia, 2006.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers — Principles, Techniques and Tools”, 2nd Edition, Pearson Education, 2007.

SEMESTER	VI					
YEAR	III					
COURSE CODE	21CT3607					
TITLE OF THE COURSE	COMPUTER NETWORKS LAB					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	-	2	-	26	1

COURSE CONTENT

List of Laboratory/Practical Experiments activities to be conducted

PART A

1. Implement three nodes point - to - point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent Environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PARTB

Implement the following in Java:

7. Write a program for error detecting code using CRC.
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client - server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using as message queues or FIFOs as IPC channels.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using a leaky bucket algorithm.

V SEM - OPEN ELECTIVE -1

SEMESTER	V					
YEAR	III					
COURSE CODE	210E0036					
TITLE OF THE COURSE	SMALL E-BUSINESS LAUNCH					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	-	--	-	39	03

COURSE OBJECTIVES:

- Experience with a set of tools and methods for setting up an online service.
- Knowledge of the role of multiple functions in creating a small business.
- Ability to coordinate multiple, interdisciplinary tasks to achieve a common objective.
- Emphasis of specific knowledge from other courses through practice and reflection in an action-oriented setting.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify customer needs and pain points	L1
CO2	Generate concept & validate idea	L3
CO3	Use design thinking to create a wire frame of your online service.	L3
CO4	Launch your app/website.	L3
CO5	Register your small business	L3

COURSE CONTENT:

MODULE 1	9 Hrs
Introduction, Identifying Customer Needs, Opportunity Identification & Planning, Idea Generation and Validation, Entrepreneurial Culture, Digital Business Opportunity.	
MODULE 2	10 Hrs

Business Plan & its Components, Business Model and Strategies, Selection of Appropriate Business Model, Business Model Canvas, Feasibility.	
MODULE 3	10 Hrs
Lean thinking, Specifications, Wireframe Generation and Validation.	
MODULE 4	10 Hrs
Service-Market Fit, legal Aspects & Entrepreneurial Law, Logistics of goods delivery, Virtual Trade Shows.	

TEXT BOOKS:	
1	Fisher, Steven, Duane, Ja-Nae (2016). Start-up Equation —A Visual Guidebook for Building your Start-up, New Delhi: Tata McGraw-Hill.
2	Ulrich, K. T. (2019). Product design and development. Tata McGraw-Hill Education, 7th edition.

REFERENCE BOOKS:	
1	Holt H., David (2017). Entrepreneurship: New Venture Creation, New Delhi: Pearson Education.
2	Zimmerer, W. Thomas and Scarborough, M. Norman and Doug Wilson (2009). Essentials of Entrepreneurship and Small Business Management, 5/e; New Delhi: Prentice Hall India.

VI SEM - OPEN ELECTIVE - II

SEMESTER	VI					
YEAR	III					
COURSE CODE	210E0021					
TITLE OF THE COURSE	PRODUCT ENGINEERING & ENTREPRENEURSHIP					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Project s Hours	Total Hours	Credits
	03	-	--	-	39	03

COURSE OBJECTIVES:

- Experience with a set of tools and methods for product engineering.
- Knowledge of the role of multiple functions in creating a new product.
- Ability to coordinate multiple, interdisciplinary tasks to achieve a common objective.
- Emphasis of specific knowledge from other courses through practice and reflection in an action-oriented setting.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Identify opportunities, product planning, customer needs, and stages and steps in the product development process.	L1
CO2	Describe the knowledge and tools required to effectively manage the product development process, from idea generation to concept selection, testing, and customer value delivery.	L3
CO3	Explain the basics of product development, supply chain considerations, environmental sustainability, and manufacturing efficiency.	L3
CO4	Interpret Prototyping, robust design, intellectual property considerations, service design, and product development economies to create successful and innovative products that meet customer needs and drive business growth.	L3
CO5	Use a strategic vision for a business, including defining its mission, objectives, and long-term goals and demonstrate different building blocks that comprise a business model, such as customer segments, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure.	L2

COURSE CONTENT:	
MODULE 1	8Hrs
Introduction, Product Development Process and Organization, Opportunity Identification, Product Planning, Identifying Customer Needs.	
MODULE 2	8Hrs
Product Specifications, Concept Generation, Lean Thinking, Concept Selection, Concept Testing, Value on Product Development, Waste in Product Development.	
MODULE 3	8Hrs
Product Architecture, Industrial Design, Design for Environment, Design for Manufacturing and Supply Chain.	
MODULE 4	8Hrs
Prototyping, Robust Design, Patents and Intellectual Property, Service Design, Product Development Economies, Product Management.	
MODULE 5	7Hrs
Business Plan, Business Model Canvas.	

TEXT BOOKS:	
1.	Ulrich Karl T, Eppinger Steve D., and Yang, Maria C., Product Design and Development, 7th Edition, McGraw-Hill Education 2020.
2.	Robin McKenzie, Design Theory: An Introduction for Product Design and Engineering, 1st Edition, July 2014.

REFERENCE BOOKS:	
1	Pessoa, Marcus, Trabasso, Luis Gonzaga, The Lean Product Design and Development Journey— A Practical View, Springer International Publishing, 2017.
2	Ali Jamnia, Introduction to Product Design and Development for Engineers, 1st Edition, CRC Press, June 2018.
3	Product Design and Development, MIT Open Courseware - https://ocw.mit.edu/courses/sloanschool-ofmanagement/15-783j-product-design-and-development-spring-2006/index.htm .