DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS
FOR
BACHELOR OF TECHNOLOGY (B.Tech.) – 2020

COMPUTER SCIENCE & ENGINEERING

(Data Science)

(WITH EFFECT FROM 2020-21)

(I to VIII SEMESTERS)

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 – I	CR	03	01	--	--	04	*	***
2	101-105 & 1 121-123	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

I SEM - 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	--	--	--	--	*	***

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SCHEME - B.TECH – 2020-21 ONWARDS

II SEM - 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	--	--	--	--	*	***

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SCHEME - B.TECH – 2020 -21 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	--	--	--	--	*	***

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SCHEME - B.TECH – 2020-21 ONWARDS

III SEM - COMPUTER SCIENCE & ENGINEERING

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	103	20CS2301	DISCRETE MATHEMATICAL STRUCTURES	CR	3	-	-	-	3	*	***
2	103	20CS2302	DATA STRUCTURES	CR	3	-	-	-	3	I/II	20EN1103
3	103	20CS2303	DIGITAL ELECTRONICS & LOGIC DESIGN	CR	3	-	-	2	4	*	***
4	103	20CS2304	DATABASE MANAGEMENT SYSTEMS	CR	3	-	-	-	3	*	***
5	103	20CS2305	COMPUTATIONAL THINKING WITH PYTHON	CR	3	-	-	-	3	*	***
6	103	20CS2306	AGILE SOFTWARE ENGINEERING	CR	2	-	-	2	3	*	***
7	103	20CS2307	DATA STRUCTURES LAB	CR	-	-	2	-	1	*	***
8	103	20CS2308	DATABASE MANAGEMENT SYSTEMS LAB	CR	-	-	2	-	1	*	***
9	103	20CS2309	MANAGEMENT AND ENTREPRENEURSHIP	CR	2	-	-	-	2	*	***
10	103	20CS2310	LIBERAL STUDIES – I	CR	1	-	-	-	1	*	***
					20	**-**	**04**	**04**	**24**		

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SCHEME - B.TECH – 2020-21 ONWARDS

IV SEM -CSE (DATA SCIENCE)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	122	20CS2401	PROBABILITY AND STATISTICS	CR	3	-	-	-	3	*	***
2	122	20CS2402	OBJECT ORIENTED DESIGN AND PROGRAMMING	CR	3	-	-	-	3	*	***
3	122	20CS2403	PRINCIPLES OF MICROPROCESSORS AND COMPUTER ORGANIZATION	CR	4	-	-	-	4	*	***
4	122	20CS2404	FINITE AUTOMATA & FORMAL LANGUAGES	CR	3	-	-	2	4	*	***
5	122	20CS2405	INTRODUCTION TO NETWORKS & CYBERSECURITY	CR	3	-	-	-	3	*	***
6	122	20DS2401	DATA SCIENCE – I	CR	3	-	-	-	3	*	***
7	122	20CS2407	OBJECT ORIENTED PROGRAMMING LAB	CR	-	-	2	-	1	*	***
8	122	20CS2408	MICROPROCESSORS LABORATORY	CR	-	-	2	-	1	*	***
9	122	20CS2409	SPECIAL TOPICS - I	CR	-	-	-	4	2	*	***
10	122	20CS2410	LIBERAL STUDIES – II	CR	1	-	-	-	1	*	***
					20	-	04	06	25		

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SCHEME - B.TECH – 2020-21 ONWARDS

V SEM -CSE (DATA SCIENCE)

SL	PROGRAM CODE	COURSE CO DE	COURSE TITLE	CR/ AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/ P	C	SEM	COURSE CODE
1	122	20CS3501	COMPUTER NETWORKS	CR	3	-	2	-	4	*	***
2	122	20CS3502	DESIGN AND ANALYSIS OF ALGORITHMS	CR	3	-	-	-	3	*	***
3	122	20CS3503	OPERATING SYSTEMS	CR	3	1	-	-	4	*	***
4	122	20CS3504	MACHINE LEARNING	CR	3	-	2	-	4	*	***
5	122	20DS35XX	PROFESSIONAL ELECTIVE-1	CR	3	-	-	-	3	*	As Indicated in Elective List
6	122	20OE00XX	OPEN ELECTIVE-1	CR	3	-	-	-	3	*	As Indicated in open List
7	122	20CS3505	DESIGN AND ANALYSIS OF ALGORITHMS LAB	CR	-	-	2	-	1	*	***
8	122	20CS3506	OPERATING SYSTEMS LAB	CR	-	-	2	-	1	*	***
9	122	20CS3507	SPECIAL TOPICS -II	CR		-	-	4	2	*	***
					18	1	8	4	25		

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V SEM-PROFESSIONAL ELECTIVE – I

	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
									COURSE CODE
1	20DS3501	DATA WAREHOUSE AND KNOWLEDGE MINING	03	-	-	-	03		
2	20DS3502	FULL STACK DEVELOPMENT	03	-	-	-	03		

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SCHEME - B.TECH – 2020-21 ONWARDS

VI SEM -CSE (DATA SCIENCE)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	122	20CS3601	COMPILER DESIGN AND SYSTEM SOFTWARE	CR	3	1	-	-	4	*	***
2	122	20DS3601	DATA ANALYTICS WITH HADOOP	CR	3	-	-	-	3	*	***
3	122	20DS3602	DATA SCIENCE II	CR	3	-	-	-	3	IV	Data Science I
4	122	20DS3603	PROFESSIONAL ELECTIVE-2	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
5	122	20DS3604	PROFESSIONAL ELECTIVE-3	CR	3	-	-	-	3	*	
6	122	20OE00XX	OPEN ELECTIVE-2	CR	3	-	-	-	3	*	***
7	122	20CS3604	COMPILER DESIGN AND SYSTEM SOFTWARE LAB	CR	-	-	2	-	1	*	***
8	122	20DS3605	DATA SCIENCE LAB	CR	-	-	2	-	1		
					17	01	06	-	21		

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VI SEM-PROFESSIONAL ELECTIVE – II

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	20DS3606	PATTERN ANALYSIS IN DATA SCIENCE	03	-	-	-	03		
2	20DS3607	BUSINESS INTELLIGENCE	03	-	-	-	03		

VI SEM-PROFESSIONAL ELECTIVE – III

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	20CS3606	SOFT COMPUTING	03	-	-	-	03		
2	20DS3608	NATURAL LANGUAGE PROCESSING TOOLS & TECHNIQUES	03	-	-	-	03		

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SCHEME - B.TECH – 2020-21 ONWARDS

VII SEM -CSE (DATA SCIENCE)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/ AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	122	20DS47XX	PROFESSIONAL ELECTIVE – 4	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
2	122	20DS47XX	PROFESSIONAL ELECTIVE – 5	CR	3	-	-	-	3	*	
3	122	20OEXXXX	OPEN ELECTIVE-3	CR	3	-	-	-	3	*	***
4	122	20DS4701	PROJECT PHASE – I	CR	-	-	-	6	3	*	***
					09			06	12		

VII SEM-PROFESSIONAL ELECTIVE – IV

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	20DS4702	Artificial Intelligence	3	-	-	-	03	*	***
2	20DS4703	Image Processing and Computer Vision	3	-	-	-	03	*	***
3	20DS4704	Embedded IOT	3	-	-	-	03	*	***

VII SEM-PROFESSIONAL ELECTIVE – V

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	20DS4705	Deep Learning	3	-	-	-	03	*	***
2	20DS4706	Cloud Computing	3	-	-	-	03	*	***
3	20DS4707	Social Network Analysis	3	-	-	-	03	*	***

SCHEME - B.TECH – 2020-21 ONWARDS

VIII SEM -CSE (DATA SCIENCE)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR/ AU	SCHEME OF TEACHING					PREREQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	122	20DS48XX	PROFESSIONAL ELECTIVE – 6	CR	3	-	-	-	3	*	AS INDICATED IN ELECTIVE LIST
2	122	20DS4801	PROJECT PHASE – II	CR	-	-	-	12	6	*	***
3	122	20DS4802	INTERNSHIP		-	-	-	6	3		
					03	**-**	**-**	**12**	**12**		

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VIII SEM-PROFESSIONAL ELECTIVE – VI

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S/P	C	SEM	COURSE CODE
1	20DS4803	Data Privacy and Cyber Security	3	-	-	-	3	*	***
2	20DS4804	Block Chain & Crypto Currency	3	-	-	-	3	*	***
3	20DS4805	High Performance Computing	3	-	-	-	3	*	***

SEMESTER/YEAR : I SEM

COURSE CODE : 20EN1101

TITLE OF THE COURSE : ENGINEERING MATHEMATICS – IL:

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 amatrix 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 Eigen vectors

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. D C Lay, S R Lay and JJMcDonald, 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

SEMESTER/YEAR : II SEM

COURSE CODE : 20EN1201

TITLE OF THE COURSE : ENGINEERING MATHEMATICS – IIL:

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 problemsin engineering and find the maxima and minima of functions
2. evaluate partial derivatives, limits, total differentials, Jacobians, Taylor seriesand 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 atriple 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 theoerem, Initial and Final value theorems, Some basic transforms, Inverse Laplace transform, Convolution theorem, Applications to differentialequations**.**

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, 6 th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8 th edition, Cengage Learning.
4. Engineering Mathematics, K.A.Stroud and Dexter J. Booth, 2013, 7 th 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

SEMESTER/YEAR : I/II SEM

COURSE CODE : 20EN1102

TITLE OF THE COURSE : ENGINEERING CHEMISTRYL:

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 suchas 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 hydrocarbonsas 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

(i) Fractional distillation of crude petroleum

(ii) Biogas

(iii) Biodiesel

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 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. Electroplatingof Chromium. Electroless Plating. Distinction between electroplating and Electrolessplating, 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 conductingPolyaniline.
- **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. Alkanity. 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 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) 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 Complexometic 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 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 PROGRAMMINGL:

T/A: P: C : 3: 0: 4: 5

Course objective: To develop student competence in writing clear, correct, andmaintainable 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 softwareusing 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-teamcode 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 constarray 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", 2ndEdition, PHI.

SEMESTER/YEAR : I/II SEM

COURSE CODE : 20EN1108

TITLE OF THE COURSE : BASIC ELECTRONICSL:

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 circuitsfor a given application.
4. Identify the applications and significance of electronics in interdisciplinaryengineering 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, practicaloscillator 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 a n d 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 ProblemsText book(s)

1. Electronic Circuits: Fundamentals and Applications by Michael Tooley BA ElsevierLtd., 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 & INNOVATIONL:

T/A: P: C : 1: 0: 0: 1

Course Summary

The course 'Design Thinking and Innovation' gives an overview of design thinking to helps 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 Fusion360.
- 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 & decisionmaking.

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 toResearch Complex Problems, Develop Innovative Ideas, and Design Effective Solutions

SEMESTER/YEAR : I/II SEM

COURSE CODE : 20EN1106

TITLE OF THE COURSE : ELEMENTS OF MECHANICAL ENGINEERINGL:

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 tomechanical 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 manufacturingprocesses 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 & Nuclearpower 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 andsoldering
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 PHYSICSL:

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 muchessential 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 thecourse 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 Scienceand 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, ionicand 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, Solarcell 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 engineeringmaterials: Hardness Tests: Brinell, Rockwell and Vickers hardness test-Numericals **Dielectrics:** polar and non-polar dielectrics, internal fields in a solid, Different Polarizationtechniques. 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 valance 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-raydiffraction, 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 evaporationtechnique, 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)-Numiricals

Lab component

1. I-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 ENGINEERINGL:
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 wireand 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 andits 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, 3RDEdition.

SEMESTER/YEAR	: I/II SEM
COURSE CODE	**: 20EN1109**
TITLE OF THE COURSE	: BIOLOGICAL SCIENCESL:
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 inbiology. 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. Emergingtrends 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, geneexpression 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, Ist 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 COMMUNICATIONL:

T/A: P: C : 2: 0:2:3

Course Aim and Summary

The course 'Technical Communication Skills' aims at enhancing Communication skillsof the students in dimensions of - Listening, Speaking, Reading, Writing, Grammar and Vocabulary. The course introduces Communication and types of Communication anddeals 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 managingskills 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 & DESIGNL:

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 CADsoftware for modelling and assembly of simple engineering components from various engineering domains. They work in teams to develop conceptual designs for an identifiedneed.

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, scalingof 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 boththe 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 throughmodifying 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., Panchal 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 Drawingwith 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 STUDIESL:

T/A: P: C : 2: 0:0:2

Course Aim

This course aims at creating awareness regarding preservation of environment for providingsafe 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 WaterHarvesting, 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 LearningPvt. 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 ETHICSL : 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 Muncipalities, Panchayats and Cooperative Societies,
- Understand Engineering ethics and responsibilities of Engineers

Introduction to the Constitution of India, The Making of the Constitution and Sailent 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 – IIL :
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, Interrogativewords.
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 – illa, 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 theirnegation.
Lesson 15: About Halebid, Belur. Relative participle, negation.
Lesson 16: Discussing about examination and future plan. Simple conditional and negativeLesson 17: Karnataka (Lesson for reading)
Lesson 18: Kannada Bhaashe (Lesson for reading) Lesson 19: Mana taruva Sangati alla (Lesson for reading)Lesson 20: bEku bEDagaLu (lesson for reading)

1. Kannada Kali (ಕನ್ನಡ ಕಲಿ) – ಲಿಂಗದೇವರು ಹಳೆಮನೆ. A Text Book to Learn Kannada by Non – Kannadigas who come to study Diploma, Engineering and Health Sciences in Karnataka, ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. Spoken Kannada – ಮಾತಾಡುವ ಕನ್ನಡ, ಪ್ರಕಟಣೆ – ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ ಬೆಂಗಳೂರು.
3. Kannada Kirana - ಕನ್ನಡ ಕಿರಣ, ಪ್ರಕಟಣೆ – ಬೆಂಗಳೂರು ಇನ್ಸ್ಟಿಟ್ಯೂಟ್ ಅಫ್ ಲಾಂಗ್ವೇಜಸ್, ಬೆಂಗಳೂರು .

SEMESTER/YEAR : I SEM / I YEAR

COURSE CODE : 20AU0025

TITLE OF THE COURSE : KANNADA MANASU – IIL :

T : P : S/P : C : 2 : 0 : 0 : 0 : 0

COURSE OBJECTIVES:

1. To equip the native Kannada speaking students with advanced skills in Kannada communication and understanding
2. To enrich the students with creative writing

COURSE OUTCOMES:

1. Students will have better speaking and writing communication skills in Kannada

ಕನ್ನಡ ಭಾಷಾ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಒಲವು ಮತ್ತು ಆಸಕ್ತಿಯನ್ನು ಬೆಳೆಸುವುದು

1. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ
2. ವಿವಿಧ ರೀತಿಯ ಅರ್ಜಿ ಸಮೂಸೆಗಳು
3. ಪತ್ರ ವ್ಯವಹಾರ – ಸರ್ಕಾರಿ ಅರೆಸರ್ಕಾರಿ ಪತ್ರಗಳು – ಆಹ್ವಾನ ಪತ್ರಿಕೆ, ಜಾಹೀರಾತು, ಪತ್ರಿಕಾ ಪ್ರಕಟಣೆ ಇತ್ಯಾದಿ ಪತ್ರಗಳು
4. ಭಾಷೆ ಮತ್ತು ಬರಹ – ಡಾ. ಎಂ ಚಿದಾನಂದ ಮೂರ್ತಿ ರವರ ಭಾಷಾ ವಿಜ್ಞಾನದ ಮೂಲ ತತ್ವಗಳು ಪುಸ್ತಕದಿಂದ
5. ಭಾಷಾಭ್ಯಾಸ – ತತ್ಸಮ ತದ್ಭವ, ಸಮಾನಾರ್ಥಕ ಪದಗಳು, ವಿರುದ್ಧಾರ್ಥಕ ಪದಗಳು, ನಾನಾರ್ಥ ಪದಗಳು, ನುಡಿಗಟ್ಟುಗಳು, ಅನುಕರಣಾವ್ಯಯಗಳು (ದ್ವಿರುಕ್ತಿ) ಮತ್ತು ಜೋಡು ನುಡಿಗಳು, ಕನ್ನಡದ ದೇಶ್ಯ ಪದಗಳು, ಅನ್ಯದೇಶ್ಯ ಪದಗಳು.
6. ಭಾಷಾ ರಚನೆ – ವಾಕ್ಯ ಪದ್ಧತಿ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಪತ್ರ ಲೇಖನ, ವರದಿ ಲೇಖನ, ಪ್ರಬಂಧ ಲೇಖನ.
7. ಶ್ರಾವಣ (ಕವನ) – ದ ರಾ ಬೇಂದ್ರೆ
8. ಡಾ. ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ (ವ್ಯಕ್ತಿ ಚಿತ್ರ) – ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
9. ದೋಣಿ ಹರಿಗೋಲುಗಳಲ್ಲಿ (ಪ್ರವಾಸ ಕಥನ) – ಶಿವರಾಮ ಕಾರಂತ
10. ಅಣ್ಣಪ್ಪನ ರೇಷ್ಮೆ ಕಾರ್ಖಾನೆ (ಪ್ರಬಂಧ) – ಕುವೆಂಪು
11. ನಮ್ಮ ಎಮ್ಮೆಗೆ ಮಾತು ತಿಳಿಯುವುದೆ? (ವಿನೋದ) – ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ್
12. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು (ವಿಜ್ಞಾನ ಲೇಖನ) – ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
13. ಬೆಡ್ ನಂಬರ್ ಏಳು (ಕತೆ) – ತ್ರಿವೇಣಿ
14. ರೊಟ್ಟಿ ಮತ್ತು ಕೋವಿ (ಕವನ) – ಸು ರಂ ಎಕ್ಕುಂಡಿ
15. ಗುಬ್ಬಚ್ಚಿಯ ಗೂಡು (ಅಂಕಣ ಬರಹ) – ಪಿ ಲಂಕೇಶ್

16. ಚೀಂಕ್ರ ಮೇಸ್ತ್ರಿ ಮತ್ತು ಅರಿಸ್ಟಾಟಲ್ (ಪರಿಸರ ಲೇಖನ) – ಕೆ ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
17. ಗಾಂಧಿ (ಕತೆ) – ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
18. ಬೆಲ್ಚಿಯ ಹಾಡು (ಕವನ) – ಸಿದ್ಧಲಿಂಗಯ್ಯ
19. ಎಲ್ಲ ಹುಡುಗಿಯರ ಕನಸು (ಕವನ) – ಸವಿತಾ ನಾಗಭೂಷಣ
20. ನೀರು (ಕತೆ) – ಬಸವರಾಜ ಕುಕ್ಕರಹಳ್ಳಿ
21. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿಯ ಒಂದು ಚಿತ್ರಣ (ಪರಿಚಯ ಲೇಖನ) – ರಹಮತ್ ತರೀಕೆರೆ
22. ವೃತ್ತಿ ಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ (ತಂತ್ರಜ್ಞಾನ ಬರಹ) – ಎಸ್ ಸುಂದರ್
23. ಕೊಣಪೇಗೌಡ (ಕಾವ್ಯ) – ಜಾನಪದ

ಪಠ್ಯಪುಸ್ತಕಗಳು

1. ಕನ್ನಡ ಮನಸು – ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ತರಗತಿ ಕನ್ನಡ ಪಠ್ಯ. ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಕನ್ನಡ – ಆಡಳಿತ ಕನ್ನಡ (ಪತ್ರಿಕೆ – 1, ಬ್ಲಾಕ್ 4) ಪ್ರಕಟಣೆ: ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೈಸೂರು.
3. ಕರ್ನಾಟಕ ರಾಜ್ಯ ಪಟ್ಟದ ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಉತ್ತಮ ಪುಸ್ತಕಗಳು.

SEMESTER	**III**					
YEAR	**II**					
COURSE CODE	**20CS2301**					
TITLE OF THE COURSE	**DISCRETE MATHEMATICAL 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**
CO 1	Classify functions, basic set theory relations.	L4
CO 2	Demonstrate the correctness of an argument using propositional and predicate logic, laws and truth tables.	L2
CO 3	Compare and differentiate graphs in different geometries related to edges.	L4
CO 4	Apply mathematical induction, counting principles, recursion, elementary number theory.	L3
CO	Apply and solve Euclidean Division Algorithm and Chinese Remainder Theorem.	L3

5		

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 Reminder 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-color theorem- 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. A M 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	**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 Mclusky
- 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	n sequential systems composed of standard sequential les, such as couners 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.	
MODULE3	**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
* * *	***	* * *	***

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.	
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/Addision 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 PYTHON**					
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,	L3

	dictionaries and tuples	
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 (2018).

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;	

ODULE 3	9**Hrs**
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 SAFe), 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;	
MODULE 5	**8Hrs**
DEVOPS: DevOps: Continuous Integration and Continuous Delivery; CI/CD: Jenkins, Git/Github Creating pipelines, Setting up runners Containers and container orchestration (Dockers 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 (if any) :
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. Containerization 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, Shelli Friess,Springer

SEMESTER	**III**					
YEAR	**II**					
COURSE CODE	**20CS2309**					
TITLE OF THE COURSE	**MANAGEMENT & ENTREPRENEURSHIP**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	2		**-**	**-**	**30**	**2**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES :

- Identify and analyze the factors that contribute to the process of successfully launching an entrepreneurial venture and managing a new business.
- Learn the entrepreneurial process from idea generation to implementation.
- Acquaint with special problems of starting new ventures, finding products and services, which can support new enterprises, and raising capital.
- Discuss how to start own business and also to work in or with small business or are involved with entrepreneurship.

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Demonstrate knowledge of the key elements of the entrepreneurial process	L2
CO2	Employ strategies to generate new ideas for startups	L2
CO3	Outline how to protect IP legally	L2
CO4	Examine different ways of generating funding	L2
CO5	Explain organizing managing people, finance and customers	L2

COURSE CONTENT:

MODULE 1	**6Hrs**
OVERVIEW OF ENTREPRENEURSHIP: THE ENTREPRENEURIAL PERSPECTIVE : Nature and Development of Entrepreneurship. Defining Manager, Entrepreneur, Entrepreneurship and Entrepreneurship. Key Elements of Entrepreneurship. Personality Characteristics of Successful Entrepreneurs. Common Myths about Entrepreneurs. Ethics and Social Responsibility of Entrepreneurs. Types of Start-Up Firms. Process of New Venture Creation. Role of Entrepreneurship in Economic Development. Emerging Trends and Issues in Entrepreneurship. **Case Study: Successful Entrepreneurs Narayana Murthy Infosys**	
MODULE 2	**6Hrs**
THE ENTREPRENEURIAL AND ENTREPRENEURIAL MIND: The Entrepreneurial Process: Identify and Evaluate the Opportunity, Develop a Business Plan, Determine the Resources Required, Manage the Enterprise. Managerial Versus Entrepreneurial Decision Making: Strategic Orientation, Commitment to Opportunity, Commitment of Resources, Control of Resources, Management Structure, Entrepreneurial Venturing inside a Corporation, Causes for Interest in Entrepreneurship, Climate for Entrepreneurship, Entrepreneurial Leadership Characteristics. **Case study: How to develop effective Business Plan**	
MODULE 3	**6Hrs**
CREATIVITY AND BUSINESS IDEA : Identify and Recognizing Opportunities: Observing Trends and Solving Problems. Creativity: Concept, Components and Types of Creativity, Stages of Creative Process. Sources of New Venture Ideas. Techniques for Generating Ideas. Stages of Analyzing and Selecting the Best Ideas. Protecting the Idea: Intellectual Property Rights and its Components. Linking Creativity, Innovation and Entrepreneurship. **Case study : Application of Design Thinking in New business ideas generation in particular sector** **(Health care, Water Saving, Energy saving)**	
MODULE 4	**6Hrs**
PREPARING THE PROPER ETHICAL AND LEGAL FOUNDATION: Initial Ethical and Legal Issues Facing a New Firm, Establishing a Strong Ethical Culture, Choosing an attorney (Lawyer), Drafting a founder's agreement, Avoiding legal disputes, Choosing a form of business organization, Obtaining business licenses and permits, Choosing a Form of Business Ownership (Sole, Proprietorship, Partnership, Corporation & Limited Liability Company) **Case study: Startup Law A to Z IP** https://techcrunch.com/2019/02/25/startup-law-a-to-z-intellectual-property/	
MODULE 5	**6Hrs**

MANAGING EARLY GROWTH AND CHALLENGES

Recruiting and Selecting Key Employees. Lenders and Investors. Funding Requirements: Sources of Personal Financing. Venture Capital. Commercial Banks. Sources of Debt Financing. Key Marketing Issues for New Ventures. Why marketing is critical for Entrepreneurs. Entrepreneurs face unique Marketing Challenges. Guerrilla Marketing. Business Growth: Nature of Business Growth, Planning for Growth, Reasons for Growth. Managing Growth: Knowing and Managing the Stages of Growth, Challenges of Growing a Firm. Strategies for Firms Growth: Internal and External Growth Strategies. Implications of Growth for the Firm and Entrepreneur. Entrepreneurial Skills and Strategies to Overcome Pressures On: Financial Resources (Financial Control, Managing Inventory and Maintaining Good Records). Human Resources, Management of Employees, Time Management.

Case study: 9 ways to get startups funded

https://www.quicksprout.com/how-to-get-your-startup-funded/

TEXT BOOKS :

1. Barringer, Ireland, "Entrepreneurship: Successfully Learning New Ventures", Pearson, Latest Edition.
2. Hisrich, Peters, Shepherd, "Entrepreneurship", Mc Graw Hill, Sixth Edition.

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. A M 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. D E 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 10g 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	**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	L2

	to analyze practical problems.	
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	
MODULE 5	**10 Hrs**
TESTING OF HYPOTHESIS 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, 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; JLabel; JTextField; JButton	
64	
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
1	III	20CSXXXX	DELD

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	**8Hrs**
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 l/0 interface unit, keyboard interface, Modes of Transfer; Programmed I/O, Interrupt-initiated I/O, Direct memory access (DMA)	
MODULE 5	**10Hrs**
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 Kindesley 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. 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. Chandrashekaran. 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 & CYBERSECURITY**					
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.
- 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.	
MODULE 5	**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	**20DS2401**					
TITLE OF THE COURSE	**DATA SCIENCE - I**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	-	-	-	42	03

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
*	**	**	***

COURSE OBJECTIVES:

- To study and understand the use of High dimensional space in modelling data and the use of geometry and linear algebra to model the multi-dimensional data
- To study and understand the mathematics required for SVD applications such as centering data, PCA, clustering and ranking
- To deal with situations involving enormous amount of data and different models
- To understand randomized graph algorithms to model real life applications (WWW, internet, social networks, journal citations)

COURSE OUTCOMES :

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand High dimensional space in modelling data and apply the concepts of geometry and linear algebra to model the multi-dimensional data.	L2
CO2	Design the mathematical model required for SVD applications.	L3
CO3	Analyze the applications involving enormous amount of data and different models and deal with them	L4
CO4	Understand randomized graph algorithms	L2
CO5	Apply randomized graph algorithms to model real life applications (WWW, internet, social networks, journal citations)	L3

COURSE CONTENT:	
MODULE 1	**08 Hrs**
High Dimensional Space: Introduction, The Law of Large Numbers, The Geometry of High Dimensions, Properties of the Unit Ball, Volume of the Unit Ball, Volume Near the Equator, Generating Points Uniformly at Random from a Ball, Gaussians in High Dimension, Random Projection and Johnson-Lindenstrauss Lemma, Separating Gaussians, Fitting a Spherical Gaussian to Data.	
MODULE 2	**10Hrs**
Best-Fit Subspaces and Singular Value Decomposition (SVD): Introduction, Singular Vectors, Singular Value Decomposition (SVD), Best Rank-k Approximations, Left Singular Vectors, Power Method for Singular Value Decomposition, A Faster Method, Singular Vectors and Eigenvectors, Centering Data, Principal Component Analysis, Clustering a Mixture of Spherical Gaussians, Ranking Documents and Web Pages, An Application of SVD to a Discrete Optimization Problem.	
MODULE 3	**08Hrs**
Algorithms for Massive Data Problems: Streaming, Sketching, and Sampling: Introduction, Frequency Moments of Data Streams, Number of Distinct Elements in a Data Stream, Number of Occurrences of a Given Element, Frequent Elements, The Second Moment, Matrix Algorithms using Sampling, Matrix Multiplication using Sampling, Implementing Length Squared Sampling in Two Passes, Sketch of a Large Matrix, Sketches of Documents.	
MODULE 4	**08Hrs**
Random Graphs-1: The G(n, p) Model, Degree Distribution, Existence of Triangles in G(n, d/n), Phase Transitions, Giant Component, Existence of a giant component, No other large components, The case of p < 1/n, Cycles and Full Connectivity, Emergence of Cycles, Full Connectivity, Threshold for O(ln n) Diameter, Phase Transitions for Increasing Properties,	
MODULE 5	**08Hrs**
Random Graphs-2: Branching Processes, CNF-SAT, SAT-solvers in practice, Phase Transitions for CNF-SAT, Non uniform Models of Random Graphs, Giant Component in Graphs with Given Degree Distribution, Growth Models, Growth Model Without Preferential Attachment, Growth Model With Preferential Attachment, Small World Graphs, Case Studies	

TEXT BOOKS :

1. Foundations of Data Science, Avrim Blum, John Hopcroft, and Ravindran Kannan, January, 2018

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: 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	**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**	**-**	**39+26**	**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 (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, 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

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.

PART B

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.

Write a program for simple RSA algorithm to encryptand decryptthe data.

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/Year**	**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**
ntegral 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", PearsonEducation, 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 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:

- 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
CO 4	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[84]	**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.
2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

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	Credits
	3	**-**	**2**	**-**	**39+26**	**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	Describe the basic concepts and different types of Machine Learning	L 2
CO2	Explore and analyse the mathematics behind Machine Learning algorithms	L 2
CO3	Apply the design principles and concepts of Machine Learning Algorithms	L 3
CO4	Apply effectively Unsupervised Machine Learning algorithms and various learning techniques for appropriate applications.	L 3
CO5	Explore, analyse and validate the different Machine Learning algorithms	L 3

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 Descent and Stochastic Gradient Descent), 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 neighborhood , kernel functions, SVM, Introduction to ensemble based learning methods	
MODULE 4: Unsupervised Learning	**8 Hrs**
Introduction to Unsupervised Learning, Clustering (hard and soft clustering) Hierarchical 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	**7 Hrs**
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, 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;

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	**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**	**-**	**26**	**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.	L 3
CO2	Apply the Design principles and concepts to Algorithmic design	L 3
CO3	Describe the DAA paradigms and when an Algorithmic Design situation calls for it.	L 6
CO4	Analyse worst-case and best – case running times of algorithms using asymptotic analysis.	L 4
CO5	Implement an existing algorithm to improve the run time efficiency	L 3

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.
1. 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
2. Apply Dynamic Programming Technique and Design a C program to find the all pairs shortest path using Dijkstra's Algorithm and computes its complexity
3. Design a C program to find the optimal solution of 0-1 knapsack problem using dynamic programming and Compute the time complexity
4. Design a C program to solve the Travelling Salesman Problem using dynamic programming and compute its time complexity.
5. Design a C program to find the longest common subsequence using dynamic programming and compute its time complexity
6. 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 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/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. 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.

2. Operating Systems: A Modern Perspective, Gary J. Nutt, Addison-Wesley, 1997

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**20DS3501**					
TITLE OF THE COURSE	**DATA WAREHOUSE AND KNOWLEDGE MINING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
* * *	***	***	***

COURSE OBJECTIVES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	This course will emphasize the study of data warehousing.	L 2
CO2	Understanding the data mining applications	L 2
CO3	Apply mining techniques and algorithms to real life problems	L 2
CO4	Describing Classification and Clustering algorithms for various applications	L 2
CO5	Special emphasis will be given on the recent trends in mining text data, mining graphs, mining, spatio-temporal data, using Weka and R	L 2

COURSE CONTENT	
MODULE 1	**9 Hrs**
Data Warehousing, Business Analysis And On-Line Analytical Processing (OLAP)-Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP, Data Cube.	

MODULE 2	**8 Hrs**
Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.	
MODULE 3	**7 Hrs**
Data Mining - Frequent Pattern Analysis-Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns	

MODULE 4	**8 Hrs**
Classification and Clustering- Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by BackPropagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis- Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods	
MODULE 5	**7 Hrs**
Introduction to WEKA and R programming for the data mining applications: Special data mining, multimedia data mining, text mining and mining the www.	

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.
2. Amitesh Sinha, "Data Warehousing", Thomson Learning, 2007.

REFERENCES:

1. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education
2. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann
3. Margaret H Dunham, "Data Mining Introductory and Advanced Topics", 2e, Pearson Education, 2006.
4. https://www.tutorialspoint.com/weka/index.htm

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**20DS3502**					
TITLE OF THE COURSE	**FULL STACK DEVELOPMENT**					
SCHEME OF Instruction	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	TotalHours	Credits
	3	**-**	**-**	**-**	**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	**4 Hrs**
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 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.	

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	**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 & YAAC 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	**10Hrs**
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 **11Hrs**
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.Dhamdhere, Systems Programming and operating systems, Second Revised edition, Tata McGraw Hill.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**20DS3601**					
TITLE OF THE COURSE	**DATA ANALYTICS WITH HADOOP**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Projects Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

Perquisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
1	I, II/I	20EN1103	FUNDAMENTALS OF PROGRAMMING

COURSE OBJECTIVES:

- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Describe big data and use cases from selected business domains	L1
CO2	Explain NoSQL big data management	L2
CO3	Install, configure, and run Hadoop and HDFS	L3
CO4	Perform map-reduce analytics using Hadoop	L4
CO5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics	L5

COURSE CONTENT:	
MODULE 1	**9 Hrs**
UNDERSTANDING BIG DATA: What is big data – why big data – Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data –big data and healthcare – big data in medicine – advertising and big data.	
MODULE 2	**7 Hrs**
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships –graph databases – schema less databases – materialized views – distribution models – sharding — version – Map reduce –partitioning and combining – composing	
map-reduce calculations	
MODULE 3	**7 Hrs**
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression– serialization – Avro – file-based data structures.	
MODULE 4	**8 Hrs**
MAP REDUCE APPLICATIONS: MapReduce workflows – unit tests with MR Unit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution –MapReduce types – input formats – output formats	
MODULE 5	**8 Hrs**
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model –cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation –HiveQL queries.	

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

REFERENCES:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**20DS3602**					
TITLE OF THE COURSE	**DATA SCIENCE-II**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

Prerequisite Courses (if any)			
#	**Sem/Year**	**Course Code**	**Title of the Course**
***	4th /2nd	20DS2401	DATA SCIENCE-1

COURSE OBJECTIVES:

- To use the statistical and computational techniques to Discover, Analyze, Visualize and Present the Data.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	To Summarize the data using visual & summary analytics and common probability distributions	L2
CO 2	To make inference about a sample & population using hypothesis test.	L2
CO 3	To fit, interpret, and assess regression models and classification with one or more predictors.	L6
CO 4	To assess the data integrity and data relevancy to a specific application	L3
CO 5	To understand the significance of clustering and classification	L3

COURSE CONTENT:	
MODULE 1	**8 Hrs**

Overview of the Data Science process. Different types of data, Data Preprocessing: Data Cleaning- Missing values, Noisy data, Data cleaning as process, Data Reduction: Principal Components Analysis, Data Transformation: Strategies Overview, Data Transformation by normalization, Discretization by binning. Introducing Python Libraries (Pycharm)
MODULE 2 **9 Hrs**
Exploratory Data Analysis: Central Tendency, Dispersions, Five number Distributions, Cross Tabulations. Data Visualization: Histogram, Box Plot, Correlation Plot, Scatter Plot, Line Chart, Bar Chart, Pie Chart, Bubble Chart, Decision Tree, Cluster Charts.Hypothesis Testing: Confidence Intervals,Constructing a hypothesis, Null Hypothesis & Alternative Hypothesis, Type I and Type II errors, Power Value
MODULE 3 **8 Hrs**
Parametric test: Z test, One Sample T-TEST, Paired T-TEST, Independent Sample T-TEST, ANOVA, MANOVA, Level of significance, Power of a test. Non parametric test: Chi Square Test, Fisher's Test, Mann-Whitney U test, Kruskal-Wallis Rank Test, Wilcoxon sign rank.
MODULE 4 **7 Hrs**
Classification Models: Logistic Regression, Discriminate Regression Analysis, Test of Associations, Chi-square strength of association, Maximum likelihood estimation, Confusion matrix, Support Vector Machines (SVM), Naive Bayes, Random Forests: Bagging & Boosting, CHAID Analysis, Decision trees, k-Nearest Neighbors, Neural Network.
MODULE 5 **7 Hrs**
Unsupervised Learning: Principal component analysis, Reliability Test, KMO tests, EigenValue Interpretation, Rotation and Extraction steps. Clustering Methods: K Means clustering, Agglomerative Clustering

Textbooks:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services,Wiley
2. Jiawei Han, Micheline Kember and Jian Pei, Data Mining Concepts and Techniques, 3rd edition, Elsevier, 2012
3. Statistics for Managers Using Microsoft Excel , 8th Edition, by David M. Levine , David F. Stephan , and Kathryn A. Szabat , Publisher: Pearson

Reference Books:

1. Data Mining in excel: Lecture Notes and cases by Galit Shmueli, Publisher: Wiley
2. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning" (2nd ed)., Springer, 2008.

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**	**-**	**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 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**
CO 1	Identify patterns, tokens & regular expressions for lexical analysis.	L2
CO 2	Develop LEX and YACC programs for lexical and syntax analysis phases of Compiler.	L3
CO 3	Implement the pass 1 of two pass assembler and absolute loader algorithm	L3

CO 4	Analyze and Implement the bottom up parsing technique	L4
CO 5	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>=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 →E+E E→E*E E→(E) E → id
11. C Program to implement intermediate code generation for simple expression

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**20DS3605**					
TITLE OF THE COURSE	**DATA SCIENCE LAB**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	-	**-**	**2**	**-**	**26**	**01**

Prerequisite Courses (if any)			
#	**Sem/Year**	**Course Code**	**Title of the Course**
***	4th /2nd	20DS2401	DATA SCIENCE-1

COURSE OBJECTIVES:

- To use the statistical and computational techniques to Discover, Analyze, Visualize and Present the Data.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	To Summarize the data using visual & summary analytics and common probability distributions	L2
CO 2	To make inference about a sample & population using hypothesis test.	L2
CO 3	To fit, interpret, and assess regression models and classification with one or more predictors.	L6
CO 4	To assess the data integrity and data relevancy to a specific application	L3
CO 5	To understand the significance of clustering and classification	L3

List of Experiments activities to be conducted

1. R AS CALCULATOR APPLICATION

a. Using with and without Python/R objects on console

b. Using Python/R mathematical functions on console

2. DESCRIPTIVE STATISTICS IN R

a. Write an Python/R script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets.

b. Write an Python/R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

3. READING AND WRITING DIFFERENT TYPES OF DATASETS

a. Reading types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location. different

b. Reading Excel data sheet in Python/R.

c. Reading XML dataset in Python/R.

4. VISUALIZATIONS USING PYTHON/R

a. Find the data distributions using box and scatter plot.

b. Find the outliers using plot.

c. Plot the histogram, bar chart and pie chart on sample data

5. CORRELATION AND COVARIANCE USING Python/R

a. Find the correlation matrix.

b. Plot the correlation plot on the dataset and visualize giving an overview of relationships among data on iris data.

c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

6. REGRESSION MODEL using Python/R

Import data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in an institute based on his

or her GRE score, GPA obtained and rank of the student. Also check if the model is fit or not.

7. MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset

8. REGRESSION MODEL FOR PREDICTION Apply regression Model techniques to predict the data on above dataset.
9. CLASSIFICATION MODEL a. Install relevant package for classification. b. Choose classifier for a classification problem. c. Evaluate the performance of classifier.
10. CLUSTERING MODEL a. Clustering algorithms for unsupervised classification. b. d. Plot the cluster data using R visualizations.

Textbooks:Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services,Wiley

1. Jiawei Han, Micheline Kember and Jian Pei, Data Mining Concepts and Techniques, 3rd edition, Elsevier, 2012

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**20DS3607**					
TITLE OF THE COURSE	**BUSINESS INTELLIGENCE**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- To understand the fundamentals of Business Intelligence
- To identify the appropriateness and need Analysis the data
- To learn the preprocessing, mining and post processing of the data
- To understand various methods, techniques and algorithms in Business Intelligence

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Apply basic, intermediate and advanced techniques to analysis the data	L2
CO2	Analyze the output generated by the process of Business Intelligence	L2
CO3	Explore the hidden patterns in the data	L6
CO4	Optimize the mining process by choosing best Business Intelligence technique	L3
CO5	Applying the BI techniques in different applications	L3

COURSE CONTENT:	
Module 1	**9Hrs**

Business Intelligence: Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.
Module 2 **8 Hrs**
Knowledge Delivery: The business intelligence user types, Standard reports, Interactive Analysis and Ad
Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis. Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization
Module 3 **8 Hrs**
Decision Making Concepts: Concepts of Decision Making, Techniques of Decision Support System (DSS), Types of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS
Module 4 **7 Hrs**
Classification: Classification Problem, Classification Models, Classification Trees, Bayesian Method; Association Rule: Structure of Association Rule, Apriori Algorithm, General Association; Clustering: Clustering Methods, Partition Methods, Hierarchical Methods**.**
Module 5 **7 Hrs**
Business Intelligence Applications: Data analytics, business analytics, ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications

Textbooks:

1. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015.ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4;
2. Business Process Automation, Sanjay Mohapatra, PHI.

Reference Books:

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager‟s Guide”, Second Edition, 2012.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, McGraw-Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley Publication Inc.,2007.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**20DS3606**					
TITLE OF THE COURSE	**PATTERN ANALYSIS FOR DATA SCIENCE**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

Prerequisite Courses (if any)			
#	Sem/Year	Course Code	Title of the Course
***	***	***	***

COURSE OBJECTIVES:

- Numerous examples from machine vision, speech recognition and movement recognition have been discussed as applications.
- Unsupervised classification or clustering techniques have also been addressed in this course.
- Analytical aspects have been adequately stressed so that on completion of the course the students can apply the concepts learnt in real life problems

COURSE OUTCOMES:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Know feature extraction techniques and representation of patterns in feature space.	L2
CO2	Measure of similarity between two patterns. Statistical, nonparametric and neural network techniques for pattern recognition.	L2
CO3	Understand Techniques for recognition of time varying patterns.	L6
CO4	Analyzing the unsupervised learning algorithms for pattern recognition	L3
CO5	Understanding the significance of neural network in pattern analysis	L6

COURSE CONTENT:	
Module 1	**9Hrs**
Introduction: Feature extraction and Pattern Representation, Concept of Supervised and Unsupervised Classification, Introduction to Application Areas. Statistical Pattern Recognition: Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary, Normal Density, Discriminant Function for Discrete Features, Parameter Estimation.	
Module 2	**8 Hrs**
Dimensionality Problem**:** Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Linear Discriminant, Multiple Discriminant Analysis. Nonparametric Pattern Classification: Density Estimation, Nearest Neighbour Rule, Fuzzy Classification.	
Module 3	**8 Hrs**
Linear Discriminant Functions: Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure Kesler's Construction	
Module 4	**7 Hrs**
Neural Network Classifier: Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network. Time Varying Pattern Recognition: First Order Hidden Markov Model, Evaluation, Decoding, Learning.	
Module 5	**7 Hrs**
Unsupervised Classification: Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error Technique, Iterative Optimization	

Textbooks:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", John Wiley & Sons, 2001.
2. Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

Reference Books:

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**20DS3608**					
TITLE OF THE COURSE	**NATURAL LANGUAGE PROCESSING TOOLS & TECHNIQUES**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/Projects Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

Perquisite Courses(if any)			
#	Sem/Year	Course Code	Title of the Course
*	**		** **

Course Objectives:

1. To understand the algorithms available for the processing of linguistic information and computational properties of natural languages
2. To conceive basic knowledge on various morphological, syntactic and semantic NLP task
3. To understand machine learning techniques used in NLP,
4. To write programs in Python to carry out natural language processing

Course Outcomes:

CO No.	Outcomes	Bloom's Taxonomy Level
CO 1	Analyzing information from text automatically using concepts and methods from natural language processing (NLP)	L2
CO 2	Understanding the stemming and n-grams through data processing in Python programming language to carry out exercises.	L2
CO 3	Apply RNNs and learning algorithms for NLP with transformer architectures.	L3

CO 4	Understand existing Natural Language Processing (NLP) applications	L2
CO 5	Demonstrate the Hidden Markov models in NLP	L3

COURSE CONTENT	
MODULE1	**7 Hrs**
Introduction: Past, present and future of NLP; Classical problems on text processing; Necessary Math concepts for NLP; Regular expressions in NLP; Basic text processing: lemmatization, stop word, tokenisation, stemming etc; Spelling errors corrections– Minimum edit distance, Bayesian method;	
MODULE 2	**8 Hrs**
Words & Sentences: N-grams: Simple unsmoothed n-grams; smoothing, backoff, spelling correction using N-grams, Metrics to evaluate N-grams; Parts of Speech tagging: Word classes, POST using Brill's Tagger and HMMs; Information Extraction: Introduction to Named Entity Recognition and Relation Extraction WordNet and WordNet based similarity measures, Concept Mining using Latent Semantic Analysis	
MODULE 3	**7 Hrs**
Sequence to sequence & Language Modelling : Word embedding: skip-gram model, CBOW, GloVe, BERT; Sequence to sequence theory and applications, Attention theory and teacher forcing; Language Modelling: Basic ideas, smoothing techniques, Language modelling with RNN and LSTM;	
MODULE 4	**8 Hrs**
ML for NLP : Classification- binary and multiclass, clustering, regression for text data processing; Machine translation: rule-based techniques, Statistical Machine Translation (SMT); Spam detection, consumer complaint classification.	
MODULE 5	**9 Hrs**
Hidden Markov models: Morkov chains, likelihood Computation, Semantic Analyzer, Text summarization. Self-Learn & Hands on practice: Python libraries supporting NLP; Hands on Data collection - from social network platforms, pdfs, wordfiles, json, html, Parsing text using regular expression; scraping data from web; Text processing: convert to lowercase, remove punctuation, remove stop words, standardising text, tokenising, stemming, lemmatising.	

TEXT BOOKS

1. aniel Jurafsky and James H. Martin. 2009. Speech and Language Processing: An Introduction to Natural
   Language Processing, Speech Recognition, and Computational Linguistics. 2nd edition. PrenticeHall.
1. Christopher D. Manning and Hinrich Schütze. 1999. Foundations of Statistical Natural Language
   Processing. MIT Press.

REFERENCES:

1. Jurafsky and Martin, "Speech and Language Processing", 2 nd Edition, Prentice Hall, 2008. Manning and Schutze, "Statistical Natural Language Processing", MIT Press, 2001.

2. James Allen, “Natural Language Understanding”, The Benajmins/Cummings Publishing Company,1998. Cover, T. M. and J. A. Thomas, “Elements of Information Theory”, 2nd Edition, Wiley, 2006.

	VI					
YEAR	**III**					
COURSE CODE	**20CS3606**					
TITLE OF THE COURSE	**SOFT COMPUTING**					
SCHEME	Lectur Hours	Tutoria Hours	Practica Hours	Seminar/Projec Hours	Total Hours	Credits
O F INSTRUCTION	**0 3**	**-**	**-**	**-**	**39**	**0 3**

Perquisite Courses (if any)

#	Sem/Year	Course Code	Title of the Course
1	IV	19CS2403	Design & Analysis of Algorithms

COURSE OBJECTIVES:

1. Learn the various soft computing frameworks
2. Be familiar with various neural network frameworks
3. Learn Genetic programming
4. Be exposed to hybrid systems

COURSE OUTCOMES

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Explain the principal components of soft computing that include ANN and genetic Algorithm	L2
CO2	Apply a suitable methods of soft computing to solve a particular problem	L3
CO3	Understanding the significance of neural network in soft computing	L4
CO4	Analyse the Gentic algorithms and fuzzy logic for solving the optimization problems	L2
CO5	Implementing the soft computing techniques in real life applications	L3

COURSE CONTENT:	
MODULE 1	**7 Hrs**
Introduction: Scope of soft computing, various components, description of Artificial neural networks, overview fuzzy logic, theory of genetic algorithms, theory of hybrid systems.	

MODULE 2	**8 Hrs**
Neural network: Fundamentals of neural network, basic models of ANN, learning and activation functions, basic fundamental McCulloch- Pitts neuron model	
MODULE 3	**8 Hrs**
Learning Models: Supervised learning networks, Adaline, Back propagation, Unsupervised learning network, Korhonen self-organizing feature maps networks.	
MODULE 4	**8 Hrs**
Fuzzy Logic: Introduction to fuzzy logic, classical sets and Fuzzy sets, Classical relations and Fuzzy relations, Membership functions, Fuzzy arithmetic and Fuzzy measures, fuzzy decision making.	
MODULE 5	**8 Hrs**
Genetic Algorithms: Introduction, Search space and optimization techniques, encoding, selection crossover, mutation. Application on either MATLAB environment or Python programming - Neural network algorithm, Fuzzy algorithm, Genetic algorithm	

TEXTBOOKS:

1. S.N Sivanandam and S N Deepa,"Principles of Soft Computing", Wiley India Pvt Ltd, 2011
2. J.S.R. Jang, CT Sun and E Mizutani, "Neuro Fuzzy and Soft Computing", PHI/Pearson Education 2004

REFERENCES:

1. George J Klir, Ute St Clair, Bo Yuan,"Fuzzy Set Theory: Foundations and Application" Prentice HAll, 1997
2. David E Goldberg,"Genetic Algorithm in Search Optimization and Machine Learning "Pearson Education India 2013

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**20DS4702**					
TITLE OF THE COURSE	**ARTIFICIAL INTELLIGENCE**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PREREQUISITE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
*	*	***	******

COURSE OBJECTIVES

- To acquire knowledge on intelligent systems and agents, various search strategies
- Formalization of knowledge, reasoning with and without uncertainty
- To understand the concepts of Game playing and learning
- To learn an expert system with applications at a basic level

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOM'S TAXONOMY LEVEL
CO 1	Comprehend different types of problem-solving agents and its applications.	**L3**
CO 2	Solve problems using informed and uninformed search strategies.	**L4**
CO 3	Compare various Knowledge Representation Logic using scripts and frames.	**L3**
CO 4	Identify the need of Production system	**L4.L5**
CO 5	Use expert system tools to realize the concepts and components of the expert system.	**L5**

COURSE CONTENTS

MODULE 1	**8 HRS**
Problem Solving: Introduction to AI - Agents and Environments – Problems, problem spaces, search: Informed search strategies, uninformed search strategies Heuristic search techniques	
MODULE 2	**9 HRS**
Knowledge Representation: Knowledge representation issues - Using predicate Logic - representing simple facts in logic - representing instance and ISA relationships - computable functions and predicates - Resolution -Representing knowledge using Rules	
MODULE 3	**8 HRS**
UNCERTAINTY: Symbolic reasoning under uncertainty, statistical reasoning ,weak slot and filler structures ,strong slot and filler structures	
MODULE 4	**7 HRS**
Game Playing, Learning: Overview - Minimax search procedure - alpha-beta cutoffs - iterative deepening , Learning	
MODULE 5	**7 HRS**
Expert System & Applications: Expert System- Architecture and Roles of Expert System-Typical Expert System-MYCIN-XOON-DART- Case Study-Construction of simple reflex agent with sensor and actuator using Arduino.	

TEXTBOOKS

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2010.
2. Elaine Rich, Kevin Knight, Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, TMH, 2010.

REFERENCE BOOKS

1. "Artificial Intelligence: Foundations of Computational Agents" by David L. Poole and Alan K. Mackworth

2. Joseph C. Giarratano , Gary D. Riley ,"Expert Systems : Principles and Programming",4th Edition, 2015

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**20DS4703**					
TITLE OF THE COURSE	**IMAGE PROCESSING AND COMPUTER VISION**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
*****	******	*******	*******

COURSE OBJECTIVES

- `To introduce various topics of computer vision with their applications.
- Combining the analytics with CV which helps in various Video Analytics processing

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOMS TAXONOMY LEVEL
CO 1	Apply linear algebra principles to solve computer vision problems	**L3**
CO 2	Analyze and evaluate the components and working principles of a digital camera	**L4**
CO 3	Apply segmentation algorithms to partition images into meaningful regions	**L3**
CO 4	Analyze and evaluate different parameters used in video analytics	**L4.L5**
CO 5	Evaluate different parameters used in video analytics	**L5**

COURSE CONTENTS

MODULE 1	**8 HRS**
COMPUTER VISION FOUNDATIONS:	

Image Processing - Colour - Linear Algebra Primer - Pixels and Filters - Edge Detection - Features and Fitting - Feature Descriptors - Image Resizing - Segmentation - Semantic Segmentation - Clustering - Object recognition - Dimensionality Reduction - Face Identification - Visual Bag of Words - Object Detection from Deformable Parts - Semantic Hierarchies and Fine Grained Recognition - Motion - Tracking - Deep Learning.)	
MODULE 2	**7 HRS**
IMAGE FORMATION: Geometric primitives and transformations – Photometric image formation – The digital camera – Point operators – Linear Filtering – More neighbourhood operators – Fourier transforms – Pyramids and wavelets – Geometric transformations – Global optimization..	
MODULE 3	**9 HRS**
3D VISION: Feature detection and matching – Segmentation – Edge detection - 2D and 3D feature based alignment – Pose estimation – Geometric intrinsic calibration – Triangulation Methods for 3D Vision - 3D reconstruction – Image based rendering, Image Recognition – Object Detection – Space, Instance and Category Recognition	
MODULE 4	**7 HRS**
VIDEO ANALYTICS AND ITS APPLICATIONS: Introduction to Video Analytics, Analysis Parameters-Real Time Security & User Insights, Storage analysis for Processed Video Data. Case Study: Analysis on Facial Surveillance, License Plate Recognition	
MODULE 5	**8 HRS**
APPLICATIONS OF COMPUTER VISION: Image Processing, Machine Learning – Information Retrieval – Neuroscience – Robotics – Speech Recognition – Cognitive Sciences – Graphics, Algorithms, Systems and Theory – Pattern Recognition – Computer Graphics.	

TEXTBOOKS

1. Forsyth, D. A. and Ponce, J., "Computer Vision: A Modern Approach", Prentice Hall, 2 ndEd. 2011.
2. Gonzalez, R. C. and Woods, R. E., "Digital Image Processing", Prentice Hall, 3rdEd, 2009.

REFFERENCE BOOKS

1. Trucco, E. and Verri, A., "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998.
2. Website Link: http://www.3vr.com/

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**20DS4704**					
TITLE OF THE COURSE	**EMBEDDED IOT**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
*****	*****	*******	**********

COURSE OBJECTIVES

- `To introduce various topics of computer vision with their applications.
- Combining the analytics with CV which helps in various Video Analytics processing

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOMS TAXONOMY LEVEL
CO 1	Demonstrating a foundational understanding of IoT concepts	**L2**
CO 2	Analyze the use of communication protocols in IOT and M2M technologies	**L3**
CO 3	Configure and interface Raspberry Pi with various components and demonstrating proficiency in hardware connectivity	**L3**
CO 4	Design and implement IoT solutions for specific domains	**L3**
CO 5	Explore the concepts of Industry 4.0 and technologies beyond traditional IoT	**L3**

COURSE CONTENTS

MODULE 1	**8 HRS**

Introduction-Definition & Characteristics of IoT, Physical Design of IoT- Things in IoT, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies- Wireless Sensor Networks, Embedded Systems, IoT Levels & Deployment Templates.	
MODULE 2	**9 HRS**
IoT and M2M- SPI, I2C communication, Introduction toM2, Difference between IoT and M2M, SDN Network Function Virtualization IoT Platforms Design Methodology IoT Design Methodology-Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, IoT Physical Devices & Endpoints	
MODULE 3	**8 HRS**
Raspberry Pi & Raspberry Pi Interfaces – Features of Raspberry Pi, Serial, , Interfacing of LED, Switch and Light Sensor (LDR) with Raspberry Pi	
MODULE 4	**7 HRS**
Domain Specific IoTs-Home Automation, Cities-Smart Parking, Environment-Weather Monitoring, Smart Grids, Smart Irrigation, Machine Diagnosis & Health & Lifestyle -Health & Fitness Monitoring, Wearable Electronics	
MODULE 5	**8 HRS**
IoT & Beyond: Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques, data- intensive IoT for continuous recognition applications, Internet of Everything	

TEXTBOOKS

1. "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz

REFFERENCE BOOKS

2. Internet of Things, A Hands on Approach, by Arshdeep Bahga & Vijay audisetti, UniversityPress
3. The Internet of Things, by Michael Millen,Pearson

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**20DS4705**					
TITLE OF THE COURSE	**DEEP LEARNING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
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COURSE OBJECTIVES

- To understand the basic building blocks and general principles that allows one to design Deep learning algorithms
- To become familiar with specific, widely used Deep learning networks
- To introduce building blocks of Convolution neural network architecture
- To learn to use deep learning tools and framework for solving real-life problems

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOMS TAXONOMY LEVEL
CO 1	Understanding the mathematical background for building various deep learning models	**L2**
CO 2	Designing and optimizing the different deep learning algorithms which are more appropriate for various types of learning tasks in various domains	**L3**
CO 3	Implement a CNN learning algorithms and solve real-world problems deep learning tools and framework	**L3**
CO 4	Apply RNN learning algorithm for various application	**L3**
CO 5	Designing the Deep generative models for the Image and video applications and analyzing the recent	**L3**

	advances in GANS	

COURSE CONTENTS

MODULE 1	**8 HRS**
Mathematical background for Deep learning- Introduction to ANN: ANN, Forward Propagation, Backward Propagation, Multilayer Perceptrons-hidden layers, activation functions, Model Selection, underfitting, overfitting, weight decay, dropout, Softmax Regression	
MODULE 2	**7 HRS**
Computational Graphs– Layers and Blocks, shallow neural network, deep neural network, Optimization for training Deep Models, self-organizing maps, . Case study	
MODULE	**9 HRS**
Foundations of Convolutional Neural Networks- Convolution operation, Convolutional Layers, Object Edge Detection in Images, Padding and Stride, Multiple Input and Multiple Output Channels, 1 × 1 Convolutional Layer, Pooling, Convolutional Neural Networks (LeNet), GoogleNet, AlexNet. Case study, Introduction to transformers.	
MODULE 4	**8 HRS**
Introduction to RNN: Basics of RNN, Rnns Computational Graph across Time, RNN's For Sequence Modeling- Language Modeling, Backpropagation Through Time, Standard RNN Gradient Flow, LSTM Network **Applications of RNN:** Music Generation, Sentiment Classification, Machine Translation, Environment Modeling, Stock Market Prediction, Next Word Prediction.	
MODULE 5	**8 HRS**
Deep Generative models: Generative Modelling, Autoencoders, Variational Autoencoders, Latent Perturbations, Image and Video Applications **GANs:** Generative Adversarial Networks – Intuition behind Gans, Training Gans, Recent Advances In Gans	

TEXTBOOKS

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, "Dive into Deep Learning", Amazon, 2020
2. François Chollet, "Deep Learning Python", Manning Publications, 2018

REFFERENCE BOOKS

1. Tom Mitchell, Machine Learning, McGraw-Hill, 1997
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", O'Reilly Media; 1 edition (April 9, 2017)

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**20DS4706**					
TITLE OF THE COURSE	**CLOUD COMPUTING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
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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.

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOMS TAXONOMY LEVEL
CO 1	Define Cloud computing and characteristics	**L3**
CO 2	Describe benefits and drawbacks of Cloud computing	**L3**
CO 3	Explain various types of virtualization and capacity planning metrics	**L3**
CO 4	Discuss various types of cloud services	**L3**
CO 5	Discuss Cloud Security and various challenges	**L3,L4**

COURSE CONTENTS

MODULE 1	**8 HRS**
Introduction: 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. Overview of Cloud Computing techniques (Grid Computing, Cloud Computing, Utility Computing, Fog Computing).	
MODULE 2	**7 HRS**
Cloud Virtualization Technology: Introduction, why virtualization, virtualization benefits, application virtualization, virtual machine, desktop virtualization, server virtualization, storage virtualization, implementing virtualization, Hypervisor.	
MODULE 3	**7 HRS**
Accessing the Cloud: 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 into a cloud.	
MODULE 4	**9 HRS**
CLOUD ISSUSES: Stability, quality, longevity, business continuity, service level agreements, security in the cloud, cloud authentication, cloud filtering, regulatory issues and accountability.	
MODULE 5	**8 HRS**
Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, Microsoft Azure. Cloud Applications: Scientific Applications (Healthcare: ECG Analysis in the Cloud) and Business and Consumer Applications (Social Networking, Media Applications)	

TEXTBOOKS

3. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

REFFERENCE BOOKS

4. Cloud Computing, Dr. Kumar Saurabh, Wiley Publications, 2012
5. Guide to Cloud Computing, Richard hill, Springer Publications, 2013

SEMESTER	**VII**					
YEAR	**IV**					
COURSE CODE	**20DS4707**					
TITLE OF THE COURSE	**SOCIAL NETWORK ANALYSIS**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE OF THEN**
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COURSE OBJECTIVES

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOMS TAXONOMY LEVEL
CO 1	Understand the foundational concepts and history of social network analysis, including network theory, sociometry, and the entry of social physicists in the field.	**L2**
CO 2	Analyze and interpret social networks using sociograms and matrices, identifying cliques and communities within the network.	**L3**
CO 3	Examine the dynamics of balance and group interactions within social networks, and explore the concepts of informal organization and community relations.	**L2**
CO 4	Apply formal models of community and kinship to analyze social networks, and recognize the role of formal methods in social network analysis.	**L2**
CO 5	Gain practical knowledge of data collection techniques for social network analysis, including	

	observation, document analysis, and using computer programs for network analysis.	

COURSE CONTENTS

MODULE 1	**8 HRS**
Introduction to Social Network Analysis: The data used in social network analysis, network theory, The History of Social Network Analysis, The sociogram and sociometry, Balance and group dynamics, Informal organisation and community relations, Matrices and cliques, Formal models of community and kinship, Formal methods triumphant, Entry of the social physicists	
MODULE 2	**9 HRS**
Data Collection for Social Network Analysis: Making observations, using documents, Boundaries in relational data, Positional and reputational approaches, Organising and Analysing Network Data, Matrices and relational data, Matrix conventions, An analysis of directorship data, Direction and value in relational data, Computer programs for social network analysis	
MODULE 3	**8 HRS**
Terminology for Network Analysis: The language of network analysis, joining up the lines, The flow of information and resources, Density of connections, Density in egonets, Problems in density measures, Popularity, Mediation and Exclusion, Local and overall centrality, Mediation and betweenness, Centrality boosts centrality, Centralisation and graph centres, The absolute centre of a graph, Bank centrality in corporate networks	
MODULE 4	**7 HRS**
Groups, Factions and Social Divisions: Identifying subgraphs, the components of a network, intersecting social circles, Components and citation circles, Structural Locations, Classes and Positions, The structural equivalence of points, Clusters and similarity, Divide and CONCOR, Divisions and equivalence, Regular equivalence in roles and functions, Corporate interlocks and participations.	
MODULE 5	**7 HRS**
Social Change and Development: Structural change and unintended consequences, Small-world networks, Modelling social change, Testing explanations, Visualizing and Modelling, Taking space seriously, Using multi-dimensional scaling, Principal components and factors, Non-metric methods, How many dimensions, Worth a thousand words, Elites, communities and influence, Business elites and bank power	

TEXT BOOKS:

1. John Scott-Social Networks Analysis, 2017.

2. Borko Furht, —Handbook of Social Network Technologies and Applications||, 1st Edition, Springer, 2010

REFFERENCE BOOKS:

1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications||, First Edition, Springer, 2011.

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**20DS4803**					
TITLE OF THE COURSE	**DATA PRIVACY AND CYBER SECURITY**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
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COURSE OBJECTIVES

- Understand the basic concepts of data security, how it has evolved, and some key techniques used today.
- Have 1st depth view of Perimeter Security, Authentication and Access management, Cryptography, Malware, Secure Programming etc
- Explore the subject through prescribed book, case studies, hands on experience, extra readings for alternate view or real time application.

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOMS TAXONOMY LEVEL
CO 1	Analyze and break monoalphabetic substitution ciphers and principles and components of public-key cryptography	**L4**
CO 2	Demonstrate knowledge of basic features of data hiding in text, apply data hiding techniques such as watermarking and mimic functions	**L2,L3**
CO 3	Apply techniques such as LSB encoding, BPCS steganography, spread spectrum steganography, and robust data hiding in JPEG images to hide information in images,	**L3**

CO 4	Apply watermarking techniques to protect music scores, detect malicious tampering, and hide data in binary and fax images	**L3**
CO 5	Apply advanced data hiding techniques such as audio watermarking, echo hiding, steganographic file systems	**L3**

COURSE CONTENTS

MODULE 1	**8 HRS**
Monoalphabetic Substitution Ciphers: Letter Distributions, Breaking a Monoalphabetic Cipher,The Pigpen Cipher. **Public-Key Cryptography**:- Diffie-HeIlman-Merkle Keys, Public-Key Cryptography, Rabin Public-Key Method, Sharing Secrets: Threshold Schemes, The Four Components, Authentication, Elliptic Curve Cryptography	
MODULE 2	**9 HRS**
Data Hiding in Text: Basic Features, Applications of Data Hiding, Watermarking, Intuitive Methods, Simple Digital Methods, Data Hiding in Text, Innocuous Text, Mimic Functions	
MODULE 3	**8 HRS**
Data Hiding in Images: LSB Encoding, BPCS Steganography, Lossless Data Hiding, Spread Spectrum Steganography, Data Hiding by Quantization, Signature Casting in Images, Robust Data Hiding in JPEG Images	
MODULE 4	**7 HRS**
INTRODUCTION TO CYBER SECURITY: Cyber Attacks, Défense Strategies, and Techniques, Guiding Principles, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls, Intrusion Prevention and Detection, DDoS Attacks Prevention/Detection, Web Service Security.	
MODULE 5	**7 HRS**
DIGITAL FORENSICS: Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation.	

TEXT BOOK:

1. Data Privacy and Security, David Salomon, 2003 Springer-Verlag New York, Inc.

2. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

3. Cyber Security: Understanding Cyber Crimes, Computer ForensicsaAnd Legal Perspectives,

Sunit Belapure and Nina Godbole, Wiley India Pvt Ltd, 2013.

REFERENCES:

1. William Stallings – Cryptography and Network Security 5th edition
2. Cryptography and Network Security : Atul Kahate, Mc Graw Hill Edition

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**20DS4804**					
TITLE OF THE COURSE	**BLOCKCHAIN AND CRYPTOCURRENCY**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
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COURSE OBJECTIVES

- Understand the basic concepts of data security, how it has evolved, and some key techniques used today.
- Have 1st depth view of Perimeter Security, Authentication and Access management, Cryptography, Malware, Secure Programming etc
- Explore the subject through prescribed book, case studies, hands on experience, extra readings for alternate view or real time application.

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOM'S TAXONOMY LEVEL
CO 1	Describe the basic concepts and technology used for blockchain	**L4**
CO 2	Explore the usage of merkle tree, cryptography and mining in Blockchain	**L2,L3**
CO 3	Usage of smart contracts in real world applications.	**L3**
CO 4	Understanding of cryptocurrency related concepts	**L2**
CO 5	Understanding Bitcoin system	**L3**

COURSE CONTENTS

MODULE 1	**8 HRS**
INTRODUCTION TO BLOCKCHAIN: Distributed systems, P2P network Architecture of Blockchain, Generic elements of a blockchain: How blockchain works, Benefits, features, and limitations of blockchain How blockchain accumulates blocks, types of blockchain, Distributed ledger, Consensus mechanisms-Proof of work, Proof of Stake, Proof of Authority, CAP theorem, Decentralization, Disintermediation, Ecosystem - Storage, Communication and Computation, Dapps	
MODULE 2	**9 HRS**
CRYPTOGRAPHY AND SMART CONTRACTS: Symmetric cryptography (DES, AES), Asymmetric cryptography, Public and Private keys, Algorithms - RSA, Hash functions, SHA, ECDSA Smart contracts - Benefits of Smart contracts, Solidity programming-Types, Literals, Enums, Function types, Reference types, mappings, Global variables, Control structures (Events, Inheritance, Libraries, Functions), Compile, verify and Deploy.	
MODULE 3	**8 HRS**
ETHEREUM BLOCKCHAIN: The Ethereum network, Components of the Ethereum ecosystem, Ethereum Virtual Machine – Execution Environment, Opcodes and their meaning, Structure of a Block, Genesis Block, Merkle tree, Geth, Transactions, Transaction receipts, Nonce, Gas - gasPrice, gasLimit, Ether, Mining, Wallets, Ethereum network (main net, test net)	
MODULE 4	**7 HRS**
INTRODUCTION TO CRYPTOCURRENCIES: cash, digital cash, electronic payment systems, stone money of yap, bitcoin blockchain, consensus mechanism, monetary policy, Bitcoin Transactions, transaction capability, legitimacy, consensus, outlook and risks	
MODULE 5	**7 HRS**
BITCOIN: Electronic cash system, Introduction, Transactions, Timestamp server, Proof of work, network, incentive, reclaiming disk space, simplified payment verification, privacy, Introduction to Bitcoin(BTC) Mining.	

TEXT BOOK:

1. Imran Bashir, "Mastering Blockchain", Third Edition, Published by Packt Publishing Ltd, 2020.
2. A Short Introduction to the World of Cryptocurrencies Berentsen and Fabian Schä
3. Bitcoin: A Peer-to-Peer Electronic Cash System, Satoshi Nakamoto, www.bitcoin.org

REFERENCES:

1. RiteshModi" Solidity Programming Essentials, First Edition, Published by Packt Publishing Ltd, April 2018
2. E-resources : https://github.com/chaincodelabs/bitcoin-curriculum.git

SEMESTER	**VIII**					
YEAR	**IV**					
COURSE CODE	**20DS4805**					
TITLE OF THE COURSE	**HIGH PERFORMANCE COMPUTING**					
SCHEME OF INSTRUCTION	Lecture Hours	Tutorial Hours	Practical Hours	Seminar/ Project Hours	Total Hours	Credits
	03	**-**	**-**	**-**	**39**	**03**

PRE REQUISTIE-COURSES (IF ANY)			
#	**SEM/YEAR**	**COURSE CODE**	**TITLE**
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COURSE OBJECTIVES

- Understand the fundamentals of parallel computing: Learn the principles and potential benefits of parallel computing and recognize the fundamental laws governing parallelism, including Gustafson-Barsis's Law.
- Plan for parallelization: Learn how to approach a new project for parallel computing, implement version control for code management, and use profiling to analyze the gap between system capabilities and application performance.
- Master parallel algorithms and patterns: Analyze parallel algorithms and performance models, comprehend the significance of hash functions and spatial hashing, and understand patterns like prefix sum (scan) for efficient parallel computing.
- Explore GPU architectures and concepts: Familiarize yourself with vectorization and single instruction, multiple data (SIMD) concepts, understand GPU architectures and their role in accelerated computational platforms, and explore different GPU memory spaces.
- Gain practical GPU programming skills: Learn about the GPU programming model, GPU parallelism, and data decomposition, understand how to optimize GPU resource usage, and apply these concepts to a real-world case study like D atmospheric simulation or unstructured mesh applications.

COURSE OUTCOMES

CO NO.	OUTCOMES	BLOOM'S TAXONOMY LEVEL
CO 1	Demonstrate a comprehensive understanding of parallel computing concepts, including the reasons for using parallelism and the potential benefits it offers in various computing applications.	**L2**
CO 2	Develop proficiency in planning for parallelization, including project preparation, version control implementation, and performance profiling to optimize application performance on parallel systems.	**L2,L3**
CO 3	Apply parallel algorithms and patterns to efficiently solve computing problems, analyzing algorithmic complexity, and choosing appropriate parallel approaches for specific tasks.	**L3**
CO 4	Gain practical knowledge of GPU architectures, vectorization methods, and programming models, enabling the utilization of GPU resources effectively to accelerate computational tasks.	**L2**
CO 5	Successfully implement GPU programming techniques to parallelize and optimize computational tasks, with hands-on experience working on a real-world case study, such as atmospheric simulation or unstructured mesh applications, using parallel computing methodologies.	**L3**

COURSE CONTENTS

MODULE 1	**8 HRS**
Introduction to parallel computing, Why parallel computing? the potential benefits of parallel computing, Parallel computing cautions, The fundamental laws of parallel computing Breaking through the parallel limit, Gustafson-Barsis's Law, How does parallel computing work, Categorizing parallel approaches	
MODULE 2	**9 HRS**
Planning for parallelization: Approaching a new project: The preparation Version control: Creating a safety vault, Profiling: Probing the gap between system capabilities and application performance, Planning: A foundation for success Implementation: Where it all happens, Commit: Wrapping it up with quality, Performance limits and profiling Characterizing your application: Profiling, Data design and performance models	
MODULE 3	**8 HRS**
Parallel algorithms and patterns: Algorithm analysis for parallel computing applications, Performance models versus algorithmic complexity, Parallel algorithms, What is a hash function? Spatial hashing: A highly-parallel algorithm Using perfect hashing for spatial mesh operations, Prefix sum (scan) pattern and its importance in parallel computing, Parallel global sum: Addressing the problem of associativity, Future of parallel algorithm research	
MODULE 4	**7 HRS**
Vectorization: FLOPs for free, Vectorization and single instruction, multiple data (SIMD) overview, Hardware trends for vectorization, Vectorization methods. GPU architectures and concepts, The CPU-GPU system as an accelerated computational platform, Integrated GPUs:	

An underused option on commodity-based systems, Dedicated GPUs: The workhorse option, The GPU and the thread engine, Characteristics of GPU memory spaces, Measuring the GPU stream benchmark, The PCI bus: CPU to GPU data transfer overhead, bandwidth, Multi-GPU platforms and MPI	
MODULE 5	**7 HRS**
GPU programming model, GPU programming abstractions, GPU parallelism, Data decomposition into independent units of work: An ND Range or grid Subgroups, warps, or wavefronts execute in lockstep, Work item: The basic unit of operation, The code structure for the GPU programming model, The concept of a parallel kernel, How to address memory resources in your GPU programming model, Optimizing GPU resource usage, Reduction pattern requires synchronization across work groups, Asynchronous computing through queues Case study: D atmospheric simulation, Unstructured mesh application	

TEXT BOOK:

1. Parallel and High Performance Computing by Robert Robey, Yuliana Zamora
2. Introduction-to-High-Performance-Computing-for-Scientists-and-Engineers/Hager-Wellein/p/book/9781439811924

REFERENCES:

1. "Introduction to High Performance Computing for Scientists and Engineers" by Georg Hager and Gerhard Wellein
2. "Parallel Programming: Concepts and Practice" by Barry Wilkinson and Michael