Academic Program - UG

(under NEP 2020)

I & II Semester B.E.

Stream: **Computer Science & Engineering**

Branch: **Computer Science & Engineering**

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institute approved by AICTE & Affiliated to VTU, Belagavi)

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Scheme of Teaching and Examination

Stream: Computer Science & Engineering

Branch: Computer Science & Engineering

I Semester (Chemistry Cycle)

Course Code	Course Category	Course Title	Teaching	Examination				Credits
			L-T-P (Hrs/Week)	Duration (in Hours)	CIE Marks	SEE Marks	Total Marks	
22MATS11	ASC (IC)	Mathematics - I for CSE Stream	**2-2-2**	3	50	50	100	4
22CHES12	ASC (IC)	Chemistry for CSE Stream	**2-2-2**	3	50	50	100	4
22POP13	ESC	Principles of Programming Using C	**2-0-2**	3	50	50	100	3
22ESC142	ESC – I	Introduction to Electrical Engineering	**3-0-0**	3	50	50	100	3
22ETC15I	ETC – I	Introduction to Cyber Security	**3-0-0**	3	50	50	100	3
22PWS16	AEC	Professional Writing Skills in English	**1-0-0**	1	50	50	100	1
22ICO17	HSMS	Indian Constitution	**1-0-0**	1	50	50	100	1
22SFH18	HSMS	Scientific Foundations of Health	**1-0-0**	1	50	50	100	1
Total			**15-4-6**		**400**	**400**	**800**	**20**

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Scheme of Teaching and Examination

Stream: Computer Science & Engineering

Branch: Computer Science & Engineering

II Semester (Physics Cycle)

Course Code	Course Category	Course Title	Teaching	Examination				Credits
			L-T-P (Hrs/Week)	Duration (in Hours)	CIE Marks	SEE Marks	Total Marks	
22MATS21	ASC (IC)	Mathematics - II for CSE Stream	**2-2-2**	3	50	50	100	4
22PHYS22	ASC (IC)	Physics for CSE Stream	**2-2-2**	3	50	50	100	4
22CED23	ESC	Computer Aided Engineering Drawing	**2-0-2**	3	50	50	100	3
22ESC243	ESC – II	Introduction to Electronics Engineering	**3-0-0**	3	50	50	100	3
22PLC25E	ETC – II	Advanced C Programming	**3-0-0**	3	50	50	100	3
22ENG26	AEC	Communicative English	**1-0-0**	1	50	50	100	1
22KSK27 / 22KBK27	HSMS	Samskrutika Kannada / Balake Kannada	**1-0-0**	1	50	50	100	1
22IDT28	HSMS	Innovation and Design Thinking	**1-0-0**	1	50	50	100	1
Total			**15-4-6**		**400**	**400**	**800**	**20**

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I Semester

22MATS11	Mathematics - I for CSE Stream	(2-2-2) 4

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Familiarize the importance of calculus associated with one variable and multivariable for computer science and engineering.
- Analyze computer science and engineering problems by applying Ordinary Differential Equations.
- Apply the knowledge of modular arithmetic to computer algorithms.
- Develop the knowledge of Linear Algebra to solve the system of equations.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** the knowledge of calculus to solve problems related to polar curves and learn the notion of partial differentiation to compute rate of change of multivariate functions	-	-	1,2,12
CO-2	**Analyze** the solution of linear and nonlinear ordinary differential equations	-	-	1,2,12
CO-3	**Get** acquainted and **apply** modular arithmetic to computer algorithms	-	-	1,2,12
CO-4	**Make** use of matrix theory for solving system of linear equations and **compute** eigenvalues and eigenvectors	-	1,2	12
CO-5	**Familiarize** with modern mathematical tools namely MATHEMATICA / MATLAB / PYTHON / SCILAB	-	-	1,2,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.2	1.2	-	-	-	-	-	-	-	-	-	1.0	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Calculus: Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems.

Self-study: Center and circle of curvature, evolutes and involutes.
Applications: Computer graphics, Image processing. **8Hrs**

Unit-II

Series Expansion and Multi variable Calculus: Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems.Indeterminate forms - L'Hospital's rule-Problems.Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.
Applications: Series expansion in computer programming, Errors and approximations, calculators. **8 Hrs**

Unit-III

Ordinary Differential Equations (ODE) of first Order: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations -Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}\right)-\frac{\partial M}{\partial y}$ Applications of ODEs - Orthogonal trajectories, Problems.

Non-linear differential equations: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems.

Self-Study: Applications of ODEs, Solvable for x and y.
Applications of ordinary differential equations: Rate of Growth or Decay, Conduction of heat. L-R & C-R circuits. **8 Hrs**

Unit-IV

Modular Arithmetic: Introduction to Congruences, Linear Congruences, The remainder theorem, Solving Polynomials, Linear Diophantine Equation, System of linear Congruences, Euler's Theorem, Wilson Theorem and Fermat's little theorem. Applications of Congruences-RSA algorithm.

Self-Study: Divisibility, GCD, Properties of Prime Numbers, Fundamental theorem of Arithmetic.
Applications: Cryptography, encoding and decoding, RSA applications in public key encryption. **8 Hrs**

Unit-V

Linear Algebra: Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Problems.

Self-Study: Solution of system of equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.
Applications: Boolean matrix, Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution. **8Hrs**

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1 2D plots for Cartesian and polar curves
2 Finding angle between polar curves, curvature and radius of curvature of a given curve
3 Finding partial derivatives, Jacobian and plotting the graph
4 Applications to Maxima and Minima of two variables
5 Solution of first-order differential equation and plotting the graphs
6 Finding GCD using Euclid's Algorithm
7 Applications of Wilson's theorem
8 Numerical solution of system of linear equations, test for consistency and graphicalrepresentation
9 Solution of system of linear equations using Gauss-Seidel iteration
10 Compute eigenvalues and eigenvectors and find the largest and smallest eigenvalue byRayleigh power method.

Suggested softwares: Mathematica/MatLab/Python/Scilab

Reference Books:

1 **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2 **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3 **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed. 2017
4 **Srimanta Pal &Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
5 **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
6 **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw –Hill Book Co., Newyork, 6th Ed., 2017.
7 **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for

Semester I and II", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
8 **H. K. Dass and Er. RajnishVerma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
9 **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
10 **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
11 **David M Burton:** "Elementary Number Theory" Mc Graw Hill, 7th Ed.,2010.

22CHES12 Chemistry for CSE Stream (2-2-2) 4

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To enable students to acquire knowledge on principles of chemistry for engineering applications.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To provide students with a solid foundation in analytical reasoning required to solve societal problems.
- To provide the student with an understanding of basic digital electronics abstractions on which analysis and design of electronic circuits/systems are based and the capability to model and analyze complex circuits.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the terms and processes involved in scientific and engineering applications.	-	1	3
CO-2	**Explain** the phenomena of chemistry to describe the methods of engineering processes.	1	-	-
CO-3	**Solve** for the problems in chemistry that are pertinent in engineering applications.	-	2	3
CO-4	**Apply** the basic concepts of	1	-	-

	chemistry to explain the chemical properties and processes.			
CO-5	**Analyze** properties and processes associated with chemical substances in multidisciplinary situations.	-	2	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.3	2.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Sensors: Introduction, working principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors, and Optical sensors. Sensors for the measurement of dissolved oxygen (DO). Electrochemical sensors for thepharmaceuticals, surfactants, hydrocarbons. Electrochemical gas sensors for SOx and NOx. Disposablesensors in the detection of biomolecules and pesticides.
Energy Systems: Introduction to batteries, construction, working and applications of Lithium ion and Sodium ion batteries. Quantum Dot Sensitized Solar Cells (QDSSC's)-Principle, Properties and Applications.

Self-study: Types of electrochemical sensor, Gas sensor - O2 sensor, Biosensor – Glucose sensors.

8 Hrs

Unit-II

Memory Devices: Introduction, Basic concepts of electronic memory, History of organic polymer electronic memory devices, Classification of electronic memory devices, types of organic memory devices (organic molecules, polymeric materials, organic and inorganic hybrid materials).
Display Systems: Photoactive and electroactive materials, Nanomaterials and organic materials used in optoelectronic devices. Liquid crystals (LC's) - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells.

Self-study: Properties and functions of Silicon (Si), Germanium (Ge), Copper (Cu), Aluminum (Al), and Brominated flame retardants in computers. **8 Hrs**

Unit-III

Corrosion Chemistry: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration. Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) –

Introduction and numerical problem.

Electrode System: Introduction, types of electrodes. Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode. Reference electrode - Introduction, calomel electrode – construction, working and applications of calomel electrode. Concentration cell– Definition, construction and Numerical problems.

Analytical Techniques: Introduction, principle and instrumentation of Conductometry; its application in the estimation of weak acid. Potentiometry; its application in the estimation of iron.

Self-study: IR and UV- Visible spectroscopy. **8 Hrs**

Unit-IV

Polymers: Introduction, Molecular weight - Number average, weight average and numerical problems. Conducting polymers – synthesis and conducting mechanism of polyacetylene and commercial applications. Preparation, properties, and commercial applications of graphene oxide.

Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages and disadvantages. Generation of energy (green hydrogen) by electrolysis of water and its advantages.

Self-study: Regenerative fuel cells **8 Hrs**

Unit-V

E-Waste: Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling (separation, thermal treatments, hydrometallurgical extraction, pyrometallurgical methods, direct recycling). Extraction of gold from E - waste. Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).

Self-study: Impact of heavy metals on environment and human health. **8 Hrs**

PRACTICAL MODULE

A – Demonstration (any two) offline/virtual:

A1. Chemical Structure drawing using software: ChemDraw or ACD/ChemSketch

A2. Determination of strength of an acid in Pb-acid battery

A3: Synthesis of Iron-oxide Nanoparticles

A4. Electrolysis of water

B – Exercise (compulsorily any 4 to be conducted):

B1. Conductometric estimation of acid mixture

B2. Potentiometric estimation of FAS using $K_2Cr_2O_7$

B3. Determination of pKa of vinegar using pH sensor (Glass electrode)

B4. Determination of rate of corrosion of mild steel by weight loss method

B5. Estimation of total hardness of water by EDTA method

C – Structured Enquiry (compulsorily any 4 to be conducted):

C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)
C2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)
C3. Estimation of iron in TMT bar by diphenyl amine/external indicator method
C4. Estimation of Sodium present in soil/effluent sample using flame photometry
C5. Determination of Chemical Oxygen Demand (COD) of industrial waste water sample

D – Open Ended Experiments (any two):

D1: Evaluation of acid content in beverages by using pH sensors and simulation.
D2. Construction of photovoltaic cell.
D3. Design an experiment to Identify the presence of proteins in given sample.
D4. Searching suitable PDB file and target for molecular docking

Reference Books:

1. Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash& Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. GrourKrishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12thEdition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin& A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rdEdition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, TakatoshiTsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, ElzbietaFrackowiak, Wiley-VCH; 1st edition, 2013.
15. "Handbook on Electroplating with Manufacture of Electrochemicals", ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, SunstarPublisher,Bengaluru, ISBN 978-93-85155-70-3, 2022

18 High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19 Instrumental Methods of Analysis, Dr. K. R. Mahadik and Dr. L. Sathiyanarayanan, NiraliPrakashan, 2020
20 Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
21 Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22 Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23 Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24 Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25 Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26 Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah&Pushpalyengar., Subash Publications, 5th Edition, 2014
27 "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28 Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt Ltd.,
29 Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

22POP13 Principles of Programming Using C (2-0-2) 3

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): The course focuses on the following learning results:

- Developing the problem solving skills that can be applied to problems in different areas which enables students to take-up subsequent course work and professionalcareer.
- Provides a comprehensive study of the features of C programming language.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design** a solution by analyzing thegiven problem scenario and	-	1,2,3	-

	represent it using algorithm / flowchart.			
CO-2	**Explain** the C language primitives, language principles and use themin writing simpleprograms.	-	1,2,3	-
CO-3	**Write** a C program using proper control structures to solvesimpleproblems.	-	1,2,3	-
CO-4	**Write** a C program using arrays and strings to solve simple problems.	-	2,6	-
CO-5	**Explain** the usage and the need for writing modular programs and demonstrate its use in writing programs.	-	-	1,2,3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.7	1.8	1.7	-	-	2.0	-	-	-	-	-	-	-	-	-	-

Pre-requisites: NIL

Contents:

Unit-I

Flow-Chart and Algorithm: Solving various scientific, engineering and business related problems of varying complexity.

Fundamentals of C Programming Language: Program structure and execution. Character set, data types, operators, type conversion, expression evaluation. Input and output statements. **8 Hrs**

Unit-II

Decision making and Branching: if statement and its different forms, switch statement. **8 Hrs**

Unit-III

Decision making and Looping: loops and their behavior – entry and exit controlled loops, conditional and unconditional jump statements, Nested loops. **8 Hrs**

Unit-IV

Arrays: Single and multidimensional arrays, advantages and disadvantages of arrays, searching and sorting

Strings: Definition, Different ways of reading and printing strings, string handling functions, applications. **8 Hrs**

Unit-V

Modular Programming: Declaration, definition and use of functions, passing parameters to function, Recursion. **8 Hrs**

Laboratory Component:

WorkingPlatform: Linux OperatingSystem

Expected Coding Practices:

1. Use of Good Programming practices: Declaration of variables, Indentation, Documentation, Simplicity of logic, Efficiency of logic, uniformity etc.
2. Generic and Reusable code.
3. Inclusions of exceptional cases.
4. Better usability

Course Contents:

Programming exercises of varying complexity, to meet the learning results stated in course outcomes for this course.

Reference Books:

1 E Balagurusamy, "Programming in ANSI C", 6th Edition, Tata McGraw Hill, 2012.

2 Brian W Kernighan & Dennis M Ritchie, "The C programming language", 2nd Edition, Prentice-Hall India,2004.

3 R.G. Dromey., "How to solve it by Computer", Prentice-Hall India,2008

4 B A Forouzan and R F Gilberg, "Computer Program: A structured programming approach using C", 3rd Edition, Thomson Learning,2005

5 Brain W. Kernighan and Rob Pike, "The Practice of Programming", Pearson Education Inc.2008.

22ESC142	Introduction to Electrical Engineering	(3-0-0) 3

Contact Hours: 40

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To explain the laws used in the analysis of DC and AC circuits.
- To explain the behavior of circuit elements in single-phase circuits.
- To explain the construction and operation of transformers, DC generators and motors and induction motors.
- To introduce concepts of circuit protecting devices and earthing.
- To explain electric power generation, transmission and distribution, electricity billing, equipment andpersonal safety measures.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Understand** the concepts of various energy sources and Electric circuits.	1	2	3, 5, 6,7,8,12
CO-2	**Apply** the basic Electrical laws to solve circuits.	1,2	3	4,5,6,12
CO-3	**Discuss** the construction and operation of various Electrical Machines.	1	2	3,4,5,6,7,8,12
CO-4	**Identify** suitable Electrical machine for practical implementation.	1	2,3	4,6,7,8,12
CO-5	**Explain** the concepts of electric power transmission and distribution, electricity billing, circuit protective devices and personal safety measures.	1	3,6	2,5,7,8,11,12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	3.0	2.0	1.6	1.0	1.0	1.2	1.0	1.0	-	-	1.0	1.0	-	-	-	-

Pre-requisites: None

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Contents:

Unit-I

Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach.

Power Generation: Hydel, Nuclear, Solar & wind power generation (Block Diagram approach).

DC Circuits: Ohm's Law and its limitations. KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical. **8 Hrs**

Unit-II

A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (only definitions), Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor. (Simple Numerical).

Three Phase Circuits: Generation of Three phase AC quantity, advantages and limitations; star and delta connection, relationship between line and phase quantities (excluding proof) **8 Hrs**

Unit-III

DC Machines - DC Generator: Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Simple numerical.

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and speed control (armature & field) of DC motors (series & shunt only). Applications of DC motors. Simple numerical. **8 Hrs**

Unit-IV

Transformers: Necessity of transformer, principle of operation, Types and construction of single phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and simple numerical.

Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance, Simple numerical. **8 Hrs**

Unit-V

Domestic Wiring: Requirements, Types of wiring: casing, capping. Two way and three way control of load.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of “unit” used for consumption of electrical energy, two-part electricity tariff calculation of electricity bill for domestic consumers.
Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.
Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock. **8 Hrs**

Reference Books:

1) Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2) A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014.
3) Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019.
4) Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and CompanyPublications, 2nd edition, 2015.
5) Fundamentals of Electrical Engineering by Rajendra Prasad, PHI, 3rd edition, 2014.

22ETC15I	Introduction to Cyber Security	(3-0-0) 3

Contact Hours: 40

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To familiarize cybercrime terminologies and perspectives.
- To understand Cyber offences and botnets.
- To gain knowledge on tools and methods used in cybercrimes
- To understand phishing and computer forensics.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the cybercrime terminologies.	-	1	8
CO-2	**Describe** Cyber offenses and Botnets.	-	1	8
CO-3	**Illustrate** Tools and methods used on Cybercrime.	-	5	8,14
CO-4	**Explain** Phishing and Identity Theft, encryption and decryption processes.	-	1,2	8
CO-5	**Justify** the need of computer forensics.	-	1,5	8
CO-6	**Explain** the procedure of distribution of public and private keys.	-	1,2	8,14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	-	-	2.0	-	-	1.0	-	-	-	-	-	1.0	-	-

Pre-requisites: None

Contents:

Unit-I

Cybercrime: Definitions and Origins of the word, Cybercrime and Information Security, Who are cybercriminals? Classifications of cybercrimes, An Indian perspective, Hacking and Indian laws, Global perspectives. **8 Hrs**

Unit-II

Cyber offenses: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber café and cybercrimes

Botnets: The fuel for cybercrime, attack vector. **8 Hrs**

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Unit-III

Tools and Methods used in Cybercrime: Introduction, Proxy Servers, Anonymizers, Phishing, Password cracking, Key loggers and Spyways, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS attacks, Attacks on Wireless networks. **8 Hrs**

Unit-IV

Phishing and Identity Theft: Introduction, methods of phishing, phishing techniques, spear phishing

Classical Encryption Techniques: Introduction, Symmetric Cipher Model – Cryptography, Cryptanalysis, Substitution Techniques. **8 Hrs**

Unit-V

Understanding Computer Forensics: Introduction, Historical background of Cyber forensics, Digital Forensics Science.

Key management and Distribution: Introduction, Keys – Private and Public, Keys distribution – Public and Private keys. **8 Hrs**

Reference Books:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cybercrimes, Computer Forensics and Legal Perspectives", Wiley India Pvt, Ltd, First Edition, 2011 (Reprinted 2018)
2 William Stallings, "Cryptography and Network Security", 8th Edition, Pearson Education, 2014.

22PWS16	Professional Writing Skills in English	(1-0-0) 1

Contact Hours: 15

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To Identify the Common Errors in Writing and Speaking of English.
- To achieve better Technical writing and Presentation skills for employment.
- To read Technical proposals properly and make them to write good technical reports.
- To acquire Employment and Workplace communication skills.
- To learn about Techniques of Information Transfer through presentation in different level.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** and **identify** the Common Errors in Writing and Speaking.	-	10	-
CO-2	**Achieve** better Technical writing and Presentation skills.	-	10	-
CO-3	**Read** Technical proposals properly and make them to Write good technical reports.	10	-	-
CO-4	**Acquire** Employment and Workplace communication skills.	-	10	-
CO-5	**Learn** about Techniques of Information Transfer through presentation in different level.	10	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	-	-	-	-	-	2.4	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Identifying Common Errors in Writing and Speaking English: Common errors identification in parts of speech, Use of verbs and phrasal verbs, Auxiliary verbs and their forms, Subject Verb Agreement (Concord Rules), Common errors in Subject-verb agreement, Sequence of Tenses and errors identification in Tenses. Words Confused/Misused. **3 Hrs**

Unit-II

Nature and Style of sensible writing: Organizing Principles of Paragraphs in Documents, Writing Introduction and Conclusion, Importance of Proper Punctuation, Precise writing and Techniques in Essay writing, Sentence arrangements and Corrections activities. Misplaced modifiers, Contractions, Collocations, Word Order, Errors due to the Confusion of words. **3 Hrs**

Unit-III

Technical Reading and Writing Practices: Technical writing process, Introduction to Technical Reports writing, Significance of Reports, Types of Reports. Introduction to Technical Proposals Writing, Types of Technical Proposals, Characteristics of Technical Proposals. Scientific Writing Process. Grammar – Voices and Reported Speech, Spotting Error & Sentence Improvement, Cloze Test and Theme Detection Exercises. **3 Hrs**

Unit-IV

Professional Communication for Employment: Listening Comprehension, Types of Listening, Listening Barriers, Improving Listening Skills. Reading Comprehension, Tips for effective reading. Job Applications, Types of official/employment/business Letters, Resume vs. Bio Data, Profile, CV. Writing effective resume for employment, Emails, Blog Writing and Memos. **3 Hrs**

Unit-V

Professional Communication at Workplace: Group Discussion and Professional Interviews, Characteristics and Strategies of a GD and PI's, Intra and Interpersonal Communication Skills at workplace, Non-Verbal Communication Skills and its importance in GD and Interview. Presentation skills and Formal Presentations by Students, Strategies of Presentation Skills. **3 Hrs**

Reference Books:

1. "Professional Writing Skills in English" published by Fillip Learning – Education (ILS), Bangalore – 2022.
2. "Functional English" (As per AICTE 2018 Model Curriculum) (ISBN-978-93-5350-047-4) Cengage learning India Pvt Limited [Latest Edition 2019].
3. English for Engineers by N.P.Sudharshana and C.Savitha, Cambridge University Press – 2018.
4. Technical Communication by Gajendra Singh Chauhan and Et al, (ISBN-978-93-5350-050-4),Cengage learning India Pvt Limited [Latest Revised Edition] - 2019.
5. Technical Communication – Principles and Practice, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2017.
6. High School English Grammar & Composition by Wren and Martin, S Chandh& Company Ltd – 2015.
7. Effective Technical Communication – Second Edition by M Ashraf Rizvi, McGraw Hill Education (India) Private

22ICO17	Indian Constitution	(1-0-0) 1

Contact Hours: 15

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To know about the basic structure of Indian Constitution.
- To know the Fundamental Rights (FR's), DPSP's and Fundamental Duties (FD's) of our constitution.
- To know about our Union Government, political structure & codes, procedures.
- To know the State Executive & Elections system of India.
- To learn the Amendments and Emergency Provisions, other important provisions given by the constitution.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the basic structure of Indian Constitution.	-	2	-
CO-2	**Remember** their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.	-	1	-
CO-3	**Know** about our Union Government, political structure & codes, procedures.	-	1	-
CO-4	**Understand** our State Executive & Elections system of India.	-	1	-
CO-5	**Remember** the Amendments and Emergency Provisions, other important provisions given by the constitution.	-	1	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Introduction: Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. **3 Hrs**

Unit-II

Salient features of India Constitution: Preamble of Indian Constitution & Key concepts of the Preamble. Fundamental Rights (FR's) and its Restriction and limitations in different Complex Situations. **3 Hrs**

Unit-III

Directive Principles of State Policy (DPSP's) and its present relevance in Indian society: Fundamental Duties and its Scope and significance in Nation, Union Executive, Parliamentary System, Union Executive –President, Prime Minister, Union Cabinet. **3 Hrs**

Unit-IV

Parliament: LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Judicial System of India, Supreme Court of India and other Courts, Judicial Reviews and Judicial Activism. **3 Hrs**

Unit-V

State Executive and Governor, CM, State Cabinet, Legislature:VS & VP, Election Commission, Elections & Electoral Process. Amendment to Constitution, and Important Constitutional Amendments till today. Emergency Provisions. **3 Hrs**

Reference Books:

1. "Constitution of India" (for Competitive Exams) - Published by NaidhruvaEdutech Learning Solutions, Bengaluru. – 2022.
2. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu): Prentice –Hall, 2008.
3. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, and et al: published by Cengage Learning India, Latest Edition – 2019.
4. "The Constitution of India" by Merunandan K B: published by Merugu Publication, Second Edition,Bengaluru.
5. "SamvidhanaOdu" - for Students & Youths by Justice HN NagamohanDhas, Sahayana, kerekon.
6. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall, 2004.

22SFH18	Scientific Foundations of Health	(1-0-0) 1

Contact Hours: 15

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To know about Health and wellness (and its Beliefs) & its balance for positive mindset.
- To build the healthy lifestyles for good health for their better future.
- To Create a Healthy and caring relationships to meet the requirements of good/social/positive life.
- To learn about Avoiding risks and harmful habits in their campus and outside the campus for their bright future
- To Prevent and fight against harmful diseases for good health through positive mindset

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** and **analyze** about Health and wellness (and its Beliefs) & its balance for positive mindset.	-	1,2	-
CO-2	**Develop** the healthy lifestyles for good health for their better future.	-	1,2	-
CO-3	**Build** a Healthy and caring relationships to meet the requirements of good/social/positive life.	-	1,2	-
CO-4	**Learn** about Avoiding risks and harmful habits in their campus and outside the campus for their bright future.	-	1,2	-
CO-5	**Prevent** and **fight** against harmful diseases for good health through positive mindset.	-	1,2	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Good Health & Its balance for positive mindset: Health -Importance of Health, Influencing factors of Health, Health beliefs, Advantages of good health, Health & Behavior, Health & Society, Health & family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health. **3 Hrs**

Unit-II

Building of healthy lifestyles for better future: Developing healthy diet for good health, Food & health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, Eating disorders, Fitness components for health, Wellness and physical function, How to avoid exercise injuries. **3 Hrs**

Unit-III

Creation of Healthy and caring relationships: Building communication skills, Friends and friendship - Education, the value of relationship and communication skills, Relationships for Better or worsening of life, understanding of basic instincts of life (more than a biology), Changing health behaviors through social engineering. **3 Hrs**

Unit-IV

Avoiding risks and harmful habits: Characteristics of health compromising behaviors, Recognizing and avoiding of addictions, How addiction develops, Types of addictions, influencing factors of addictions, Differences between addictive people and non-addictive people & their behaviors. Effects of addictions, how to recovery from addictions. **3 Hrs**

Unit-V

Preventing & fighting against diseases for good health: How to protect from different types of infections, How to reduce risks for good health, Reducing risks & coping with chronic conditions, Management of chronic illness for Quality of life, Health & Wellness of youth :a challenge for upcoming future, Measuring of health & wealth status. **3 Hrs**

Reference Books:

1. “Scientific Foundations of Health” – Study Material Prepared by Dr. L Thimmesha, Published in VTU - University Website.
2. “Scientific Foundations of Health”, (ISBN-978-81-955465-6-5) published by Infinite Learning Solutions, Bangalore – 2022.
3. Health Psychology - A Textbook, FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited - Open University Press.
4. Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O‟Connor – Published by Routledge 711 Third Avenue, New York, NY 10017.
5. HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR - University of California, Los Angeles, McGraw Hill Education (India) Private Limited - Open University Press.
6. SWAYAM / NPTEL/ MOOCS/ Web links/ Internet sources/ YouTube videos and other materials / notes.
7. Scientific Foundations of Health (Health & Welness) - General Books published for university and colleges references by popular authors and published by the reputed publisher.

CIE and SEE Evaluation (from 2022-23 batch)

CIE for Non integrated Courses: With LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

- Two tests + One Improvement test : (20+20+20 each of one hour duration)

  Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- CTA: Minimum two components such as assignments, quiz, seminar, written assignment, any technical activity related to course etc. each of 5 marks. Total CTA marks- 10
- CIE= 40(from tests)+10(from CTA) = 50 marks
- SEE: Exam will be conducted for 100 marks with 3 hours duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions.

CIE for Integrated Courses: With LTP 2-0-2 and 3-0-2 and 2-2-2

- Theory CIE component:

  Two tests + One Improvement test (20+20+20 each of one hour duration)
- Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- Practical CIE component (CTA): Laboratory component. 5 marks for conduction, regularity, involvement, journal etc. Lab Test -5 marks. A test as per the schedule announced will be conducted at the end for 50 marks and scaled down to 5 marks. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- CIE= 40(from tests) +10(from CTA i.e. lab component) = 50 marks
- SEE: Exam will be conducted for 100 marks with 3 hours duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions. The questions shall be asked to test practical understanding for maximum of 30 marks.

CIE for AEC/HSMS Courses: With LTP 1-0-0 for 1 Credit

- CIE for 1 credit AEC/HSMS Courses with LTP 1-0-0
- Two tests + One Improvement test
- 20+20+20 each of one hour duration
- QP pattern for IA: MCQ 15 questions
- Two higher scores from three tests are taken representing 40 marks
- CTA: Minimum two components such as assignments ,quiz, seminar, written assignment , any learning activity related to the course etc. each of 5 marks.
- CIE= 40(from tests)+10(from CTA)= 50 marks
- SEE: Exam will be conducted for 50 marks with 1 hour duration. There will be 50 MCQs. The question paper will contain 10 MCQ questions from each module.

II Semester (Physics Cycle)

Stream: **Computer Science & Engineering**
Branch: **Computer Science & Engineering**

22MATS214	Mathematics - II for CSE Stream	(2-2-2)

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Familiarize the importance of Integral calculus and Vector calculus.
- Learn vector spaces and linear transformations.
- Develop the knowledge of numerical methods and apply them to solve transcendental and differential equations.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.	-	-	1,2,12
CO-2	Understand the applications of vector calculus refer to solenoidal, and irrotational vectors, Orthogonal curvilinear coordinates.	-	-	1,2,12
CO-3	Demonstrate the idea of Linear dependence and independence of sets in the vector space, and linear transformation	-	-	1,2,12
CO-4	Apply the knowledge of numerical methods in analysing the discrete data and solving the physical and	-	-	1,2,12

	engineering problems.			
CO-5	Get familiarize with modern mathematical tools namely MATHEMATICA / MATLAB / PYTHON / SCILAB	-	-	1,2,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.4	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of fundamentals of calculus.

Course Contents:

Unit I (Integral Calculus)

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Center of gravity, Duplication formula.

Applications: Antenna and wave propagation, Calculation of optimum value in various geometries. Analysis of probabilistic models. **8 Hrs**

Unit II (Vector Calculus)

Introduction to Vector Calculus in Computer Science & Engineering: Scalar and vector fields. Gradient, directional derivative, curl and divergence – physical interpretation, solenoidal and irrotational vector fields. Problems.

Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. Problems.

Self-Study: Volume integral.

Applications: Conservation of laws, Electrostatics, Analysis of streamlines. **8 Hrs**

Unit III (Vector Spaces and Linear Transformations)

Vector spaces: Definition and examples, subspace, linear span, Linearly independent and dependent sets, Basis and dimension. Problems.

Linear transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation. Change of coordinates, Rank and nullity of a linear operator, rank-nullity theorem. Inner product spaces and orthogonality. Problems.

Self-study: Angles and Projections. Rotation, reflection, contraction and expansion.

Applications: Image processing, AI & ML, Graphs and networks, computer graphics. **8 Hrs**

Unit IV (Numerical Methods – 1)

Numerical methods: Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). Problems. Finite differences, Interpolation using Newton's forward and backward difference formulae, Newtons divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

Numerical integration: Trapezoidal, Simpson's (1/3)rd and (3/8)th rules (without proof). Problems.

S**elf-Study:** Bisection method, Lagrange's inverse Interpolation.

Applications: Estimating the approximate roots, extremum values, Area, volume, and surface area. Errors in finite precision. **8 Hrs**

Unit V (Numerical Methods – 2)

Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree – Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems.

Self-Study: Adam-Bashforth method.

Applications: Estimating the approximate solutions of ODE. **8 Hrs**

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1. Program to compute area, surface area, volume and centre of gravity
2. Evaluation of improper integrals
3. Finding gradient, divergent, curl and their geometrical interpretation
4. Computation of basis and dimension for a vector space and Graphical representation of linear transformation
5. Computing the inner product and orthogonality
6. Solution of algebraic and transcendental equations by Ramanujan's, Regula-

Falsi and Newton-Raphson method

7 Interpolation/Extrapolation using Newton's forward and backward difference formula

8 Computation of area under the curve using Trapezoidal, Simpson's (1/3)rd and (3/8)th rule

9 Solution of ODE of first order and first degree by Taylor's series and Modified Euler's method

10 Solution of ODE of first order and first degree by Runge-Kutta 4th order and Milne's predictor-corrector method

Suggested software's: Mathematica / MatLab / Python / Scilab

Reference Books:

1 **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.

2 **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

3 **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed. 2017

4 **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.

5 **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.

6 **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw –Hill Book Co., Newyork, 6th Ed., 2017.

7 **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education(India) Pvt. Ltd 2015.

8 **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.

9 **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

10 **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett

Publishers Inc., 6th Ed., 2017.
11 **William Stallings:** "Cryptography and Network Security" Pearson Prentice Hall, 6th Ed.,2013.
12 **David M Burton:** "Elementary Number Theory" Mc Graw Hill, 7th Ed.,2010.

22PHYS224	**Physics for CSE Stream**	**(2-2-2)**

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To study the essentials of photonics for engineering applications.
- To study the principles of quantum mechanics and its applications in quantum computing.
- To study the electrical properties of materials.
- To study the essentials of physics for computational aspects like design and data analysis.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the principles of LASERS and Optical fibers and their relevant applications.	1	2,12	-
CO-2	**Discuss** the basic principles of Quantum Mechanics and their application in Quantum Computing.	1,2	12	-
CO-3	**Summarize** the essential properties of superconductors and applications in Quantum Computing.	1,2	12	-

CO-4	**Illustrate** the application of physics in design and data analysis.	1	2,12	3,5
CO-5	**Practice** working in groups to conduct experiments in physics and **perform** precise and honest measurements.	1,8,9	2,5,12	3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.4	1.0	-	1.5	-	-	3.0	3.0	-	-	2.0	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

LASER: Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients, Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Semiconductor Diode Laser, Applications: Bar code scanner, Laser Printer, Laser Cooling. Numerical problems.

Optical Fiber: Principle and structure, Acceptance angle and Numerical Aperture (NA) and derivation of Expression for NA, Classification of Optical Fibers, Attenuation and Fiber Losses, Applications: Fiber Optic networking, Fiber Optic Communication. Numerical Problems.

Prerequisite: Properties of light

Self-learning: Total Internal Reflection & Propagation Mechanism (Optical Fibers) **8 Hrs**

Unit-II

Quantum Mechanics: de Broglie Hypothesis and Matter Waves, de Broglie wavelength and derivation of expression by analogy, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle and its application (Nonexistence of electron inside the nucleus-Non Relativistic), Principle of Complementarity, Wave Function, Time independent Schrodinger wave equation, Physical Significance of a wave function and Born Interpretation, Expectation value, Eigen functions and Eigen Values, Particle inside one-dimensional infinite potential well, Waveforms and Probabilities. Numerical problems.

Prerequisite: Wave-Particle dualism

Self-learning: de Broglie Hypothesis **8 Hrs**

Unit-III

Quantum Computing:

Wave Function in Ket Notation: Matrix form of wave function, Identity Operator, Determination of I|0> and I|1>, Pauli Matrices and its operations on 0 and 1 states, Mention of Conjugate and Transpose, Unitary Matrix U, Examples: Row and Column Matrices and their multiplication (Inner Product), Probability, Orthogonality

Principles of Quantum Information & Quantum Computing: Introduction to Quantum Computing, Moore's law & its end. Single particle quantum interference, Classical & quantum information comparison. Differences between classical & quantum computing, quantum superposition and the concept of qubit.

Properties of a qubit: Mathematical representation. Summation of probabilities, Representation of qubit by Bloch sphere

Quantum Gates:

Single Qubit Gates: Quantum Not Gate, Pauli -Z Gate Hadamard Gate, Pauli Matrices, Phase Gate (or S Gate), T Gate

Multiple Qubit Gates: Controlled gate, CNOT Gate, (Discussion for 4 different input states). Representation of, Swap gate, Controlled-Z gate, Toffoli gate,Accounting for the extra-ordinary capability of quantum computing, Model Realizations.

Prerequisites: Matrices.

Self-learning: Moore's law **8 Hrs**

Unit-IV

Electrical Properties of Materials and Applications:

Electrical conductivity in metals, Resistivity and Mobility, Concept of Phonon, Matthiessen's rule. Introduction to Super Conductors, Temperature dependence of resistivity, Meissner's Effect, Silsbee Effect, Types of Superconductors, Temperature dependence of critical field, BCS theory (Qualitative), Quantum Tunneling, High Temperature superconductivity, Josephson Junction, DC and AC SQUIDs (Qualitative), Applications in Quantum Computing (Mention). Numerical problems.

Pre-requisites: Basics of Electrical conductivity

Self-learning: Resistivity and Mobility **8 Hrs**

Unit-V

Applications of Physics in computing:

Physics of Animation: Taxonomy of physics-based animation methods, Frames, Frames per Second, Size and Scale, weight and strength, Motion and Timing in

Animations, Constant Force and Acceleration, The Odd rule, Motion Graphs, Numerical Calculations based on Odd Rule, Examples of Character Animation: Jumping, Walking. Numerical problems.

Statistical Physics for Computing: Descriptive statistics and inferential statistics, Poisson distribution and Normal Distributions (Bell Curves), Monte Carlo Method. Numerical problems.

Pre-requisites: Motion in one dimension

Self-learning: Frames, Frames per Second **8 Hrs**

Laboratory Component:

Any Ten Experiments have to be completed from the following list of experiments:

1. Wavelength of LASER using Grating
2. Numerical Aperture using optical fiber
3. Four Probe Method
4. Transistor Characteristics
5. Charging and Discharging of a Capacitor
6. Photo-Diode Characteristics
7. Series & Parallel LCR
8. Magnetic Field at any point along the axis of a circular coil
9. Plank's Constant using LEDs
10. Fermi Energy
11. Black Box
12. Energy gap of a given semiconductor
13. GNU Step Interactive Simulations
14. Study of motion using spread Sheets
15. Application of Statistic using Spread Sheets
16. PHET Interactive Simulations (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)

Reference Books:

1 Solid State Physics, S O Pillai, New Age International Private Limited, 8th

Edition, 2018.
2 Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
3 Concepts of Modern Physics, ArthurBeiser, McGraw-Hill, 6th Edition, 2009.
4 Lasers and Non-Linear Optics, B B Loud, New age international, 2011 edition.
5 A textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
6 Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.
7 Quantum Computing, Vishal Sahani, McGraw Hill Education, 2007 Edition.
8 Engineering Physics, S P Basavaraj, 2005 Edition
9 Physics for Animators, Michele Bousquet with Alejandro Garcia, CRC Press, Taylor & Francis, 2016.
10 Quantum Computation and Logic: How Quantum Computers Have Inspired Logical Investigations,Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli,TrendsinLogic, Volume 48, Springer.
11 Statistical Physics: Berkely Physics Course, Volume 5, F. Reif, McGraw Hill.
12 Introduction to Superconductivity, Michael Tinkham, McGraww Hill, INC, II Edition

22CED23 Computer Aided Engineering Drawing (2-0-2) 3

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To understand the basic principles and conventions of engineering drawing
- To use drawing as a communication mode
- To generate pictorial views using CAD software
- To understand the development of surfaces
- To visualize engineering components

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Draw and communicate the objects with definite shape and dimensions	1,5,10	2,12	6,8,9
CO-2	Recognize and Draw the shape and size of objects through different views	1,5,10	2,12	6,8,9
CO-3	Develop the lateral surfaces of the object	1,5,10	2,12	6,8,9
CO-4	Create a Drawing views using CAD software	1,2,5,10	-	6,7,9,12
CO-5	Identify the interdisciplinary engineering components or systems through its graphical representation.	1,5,10	2,12	9

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.6	-	-	3.0	1.0	1.0	1.0	1.0	3.0	-	1.7	-	-	-	-

Prerequisites: None

Course Contents:

Unit-I

Introduction: Significance of Engineering drawing, BIS Conventions of Engineering Drawing, Free hand sketching of engineering drawing, Scales. Introduction to Computer Aided Drafting software, Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves.

Orthographic Projections of Points, Lines and Planes: Introduction to Orthographic projections: Orthographic projections of points in 1st and 3rd quadrants. Orthographic projections of lines (Placed in First quadrant only). Orthographic projections of planes viz triangle, square, rectangle, pentagon, hexagon, and circular laminae (Placed in First quadrant only using change of position method). Application on projections of Lines & Planes. **8 Hrs**

Unit-II

Orthographic Projection of Solids: Orthographic projection of right regular solids (Solids Resting on HP only): Prisms & Pyramids (triangle, square, rectangle, pentagon, hexagon), Cylinders, Cones, Cubes &Tetrahedron. Projections of Frustum of cone and pyramids. **8 Hrs**

Unit-III

Isometric Projections: Isometric scale, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones and spheres. Isometric projection of combination of two simple solids. Conversion of simple isometric drawings into orthographic views. Problems on applications of Isometric projections of simple objects / engineering components. Introduction to drawing views using 3D environment. **8 Hrs**

Unit-IV

Development of Lateral Surfaces of Solids: Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Development of lateral surfaces of their frustums and truncations. Problems on applications of development of lateral surfaces like funnels and trays. Problems on applications of development of lateral surfaces of transition pieces connecting circular duct and rectangular duct. **8 Hrs**

Unit-V

Multidisciplinary Applications & Practice:

Free hand Sketching: True free hand, Guided Free hand, Roads, Buildings, Utensils, Hand tools & Furniture's etc

Drawing Simple Mechanisms: Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart & Four-wheeler carts to dimensions etc

Electric Wiring and lighting diagrams: Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software

Basic Building Drawing: Architectural floor plan, basic foundation drawing, steel

structures- Frames, bridges, trusses using Auto CAD or suitable software

Electronics Engineering Drawings: Simple Electronics Circuit Drawings, practice on layers concept.

Graphs & Charts: Column chart, Pie chart, Line charts, Gantt charts, etc. using Microsoft Excel or any suitable software. **8 Hrs**

Reference Books:

1. S.N. Lal, & T Madhusudhan:, Engineering Visulisation, 1st Edition, Cengage,Publication Parthasarathy N. S., Vela Murali, Engineering Drawing, Oxford University Press, 2015.
2. Bhattacharya S. K., Electrical Engineering Drawing, New Age International publishers, second edition 1998, reprint 2005.
3. Chris Schroder, Printed Circuit Board Design using AutoCAD, Newnes, 1997.
4. K S Sai Ram Design of steel structures, , Third Edition by Pearson
5. Nainan p kurian Design of foundation systems, Narosa publications
6. A S Pabla, Electrical power distribution, 6th edition, Tata Mcgraw hill
7. Bhatt, N.D., Engineering Drawing: Plane and Solid Geometry, 53rd edition, Charotar Publishing House Pvt. Limited, 2019.
8. K. R. Gopalakrishna, & Sudhir Gopalakrishna: Textbook Of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017

22ESC243 Introduction to Electronics Engineering (3-0-0) 3

Contact Hours: 40

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering.
- To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.
- Professionalism & Learning Environment: To inculcate in first-year engineering students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork,

ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Develop** the basic knowledge on construction and operation of rectifiers and amplifiers.	-	3	1
CO-2	**Apply** the acquired knowledge to construct small scale circuits consisting of oscillators and operational amplifiers.	-	1	-
CO-3	**Develop** the competence knowledge to construct basic digital circuit by making use of basic gates and its function.	-	1	3
CO-4	**Apply** the acquired knowledge to construct small scale embedded circuits.	-	1	12
CO-5	**Study** the conceptual blocks of basic communication system and **acquire** the knowledge of analog and digital communication schemes.	-	1	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.8	-	1.5	-	-	-	-	-	-	-	-	1.0	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Power Supplies: Block diagram, Half-wave rectifier, Full-wave rectifiers and filters,

Voltage regulators, Output resistance and voltage regulation, Voltage multipliers.
Amplifiers: CE amplifier with and without feedback, Multi-stage amplifier; BJT as a switch: Cutoff and saturation modes. **8 Hrs**

Unit-II

Oscillators: Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, Ladder network oscillator, Wein bridge oscillator, Multivibrators, Single-stage astable oscillator, Crystal controlled oscillators (Only Concepts, working, and waveforms. No mathematical derivations)
Operational amplifiers: Ideal op-amp; characteristics of ideal and practical op-amp; Practical opamp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, subtractor, integrator, differentiator. **8 Hrs**

Unit-III

Boolean Algebra and Logic Circuits: Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates
Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder **8 Hrs**

Unit-IV

Embedded Systems: Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Elements of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC
Sensors and Interfacing: Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. **8 Hrs**

Unit-V

Analog Communication Schemes: Modern communication system scheme, Information source, and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Multiplexing, Types of communication systems. Types of modulation (only concepts) – AM , FM, Concept of Radio wave propagation (Ground, space, sky)

Digital Modulation Schemes: Advantages of digital communication over analog communication, ASK, FSK, PSK, Radio signal transmission Multiple access techniques. **8 Hrs**

Reference Books:

1. Mike Tooley, 'Electronic Circuits, Fundamentals & Applications',4th Edition, Elsevier, 2015.
2. Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008
3. D P Kothari, I J Nagrath, 'Basic Electronics', 2nd edition, McGraw Hill Education (India),Private Limited, 2018.

22PLC25E3	Advanced C Programming	(2-0-2)

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Explore user-defined data structures like structures and pointers in implementing solutions to problems.
- Selection of appropriate data structures for solving a given problem.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the usage and the need for writing programs using structures, unions and pointers.	-	1,2,3	-
CO-2	**Solve** real time problems using concepts of dynamic memory allocation and storage classes.	-	1,2,3	-
CO-3	**Construct** Programming solutions using user defined functions and files for storage.	-	1,2,3	-
CO-4	**Demonstrate** sorting and searching algorithms.	-	1,2,3	-
CO-5	**Select** appropriate programming constructs and data structures to build solutions to variety of problems.	-	1,2,3	12,14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	2.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-	-

Pre-requisites: Knowledge of fundamental Principles of Programming.

Contents:

Unit-I

Pointers: Introduction, Understanding Pointers, Accessing the address of a variable, Declaration and Initialization of Pointers, Accessing a variable through its pointer, Chain of pointers, Pointer expressions, Pointer Increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers as Function arguments, Functions returning pointers. **8 Hrs**

Unit-II

Structures and Unions: Introduction, Defining a Structure, Declaring structure variables, Accessing structure members, structure initialization, copying and comparing structure variables, Operations on Individual Members, Arrays of structures, Arrays within structures, Structures within structures, Structures and Functions, Self-referential structures, Unions. **8 Hrs**

Unit-III

Storage Classes: Storage class specifiers, Local variable storage class: auto, register, and static. Global variable storage class: default global variable, extern, and static.

Dynamic Memory allocation: Motivation for dynamic memory requirement, Allocating a block of memory – malloc, allocating multiple blocks of memory – calloc, Releasing the used memory – free, Altering the size of a block – realloc. **8 Hrs**

Unit-IV

File Handling: Introduction, Defining an opening a file, Closing a file, Input and Output Operations on Files, Error Handling during IO operations, Random Access to Files, Command line arguments. **8 Hrs**

Unit-V

Sorting: Introduction, Bubble Sort, Selection Sort, Insertion Sort.

Searching: Introduction, Linear Search, Binary Search. **8 Hrs**

Reference Books:

1. E Balagurusamy, "Programming in ANSI C", 6th Edition, Tata McGraw Hill, 2012.
2. Yashavant Kanetkar, "Understanding Pointers in C and C++", 5th Edition, BPB Publications, 2019.
3. Reema Thareja, "Computer fundamentals and Programming in C", Oxford University, Second Edition, 2017.
4. B A Forouzan and R F Gilberg, "Computer Program: A structured programming approach using C", 3rd Edition, Thomson Learning, 2005
5. Brain W. Kernighan and Rob Pike, "The Practice of Programming", Pearson Education Inc. 2008.

22ENG26	Communicative English	(1-0-0) 1

Contact Hours: 15

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To know about Fundamentals of Communicative English and Communication Skills in general.
- To train to identify the nuances of phonetics, intonation and enhance pronunciation skills for better Communication skills.
- To impart Basic English grammar and essentials of important language skills.
- To enhance with English vocabulary and language proficiency for better communication skills.
- To learn about Techniques of Information Transfer through presentation.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	**Explain** and **apply** the Fundamentals of Communication Skills in their communication skills.	-	10	-
CO-2	**Identify** the nuances of phonetics, intonation and **enhance** pronunciation skills.	-	10	-
CO-3	**Impart** basic English grammar and essentials of language skills as per present requirement.	10	-	-
CO-4	**Explain** and **use** all types of English vocabulary and language proficiency.	-	10	-
CO-5	**Adopt** the Techniques of Information Transfer through presentation.	10	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	-	-	-	-	-	2.4	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Introduction to Communicative English : Communicative English, Fundamentals of Communicative English, Process of Communication, Barriers to Effective Communicative English, Different styles and levels in Communicative English. Interpersonal and Intrapersonal Communication Skills. **3 Hrs**

Unit-II

Introduction to Phonetics: Phonetic Transcription, English Pronunciation, Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non silent Letters, Syllables and Structure. Word Accent, Stress Shift and Intonation, Spelling Rules and Words often Misspelt. Common Errors in Pronunciation. **3 Hrs**

Unit-III

Basic English Communicative Grammar and Vocabulary - I: Grammar - Basic

English Grammar and Parts of Speech, Articles and Preposition. Question Tags, One Word Substitutes, Strong and Weak forms of words, Introduction to Vocabulary, All Types of Vocabulary – Exercises on it. **3 Hrs**

Unit-IV

Basic English Communicative Grammar and Vocabulary - II: Words formation - Prefixes and Suffixes, Contractions and Abbreviations. Word Pairs (Minimal Pairs) – Exercises, Tense and Types of tenses, The Sequence of Tenses (Rules in use of Tenses) and Exercises on it. **3 Hrs**

Unit-V

Communication Skills for Employment: Information Transfer:Oral Presentation and its Practice. Difference between Extempore/Public Speaking, Communication Guidelines. Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue Influence. Reading and Listening Comprehensions – Exercises. **3 Hrs**

Reference Books:

1. Communication Skills by Sanjay Kumar & PushpLata, Oxford University Press India Pvt Ltd - 2019
2. A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2- 7), Published by Infinite Learning Solutions, Bengaluru - 2022.
3. Technical Communication by Gajendra Singh Chauhan and Et al, (ISBN-978-93- 5350-050-4), Cengage learning India Pvt Limited [Latest Revised Edition] - 2019.
4. English for Engineers by N.P.Sudharshana and C.Savitha, Cambridge University Press – 2018.
5. English Language Communication Skills – Lab Manual cum Workbook, Cengage learning India Pvt Limited [Latest Revised Edition] – (ISBN-978-93-86668-45-5), 2019.
6. A Course in Technical English – D Praveen Sam, KN Shoba, Cambridge University Press – 2020.

7 Practical English Usage by Michael Swan, Oxford University Press – 2016.

22KSK27/22KBK27	Sanskrutik Kannada / Balake Kannada	(1-0-0) 1

Contact Hours: 15

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ - ಕನ್ನಡ ಬಲ್ಲ ಮತ್ತು ಕನ್ನಡ ಮಾತೃಭಾಷೆಯ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

Course Title:	**ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ**		
Course Code:	22KSK17 / 27	CIE Marks	50
Course Type (Theory/Practical /Integrated	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Course objectives : ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

The course (22KSK17/27) will enable the students,

1. ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಪರಿಚಯಿಸಿವುದು.
3. ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
4. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
5. ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ -1 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು **(03 hours of pedagogy)**

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಘಟಕ - 2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ **(03 hours of pedagogy)**

1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.
2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸರು
   ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ

ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ **(03 hours of pedagogy)**

1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು
2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

ಘಟಕ - 4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ **(03 hours of pedagogy)**

1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ. ಎನ್. ಮೂರ್ತಿರಾವ್
2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಘಟಕ - 5 ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ **(03 hours of pedagogy)**

1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ
2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ

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University Prescribed Textbook :

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ,

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ವಿಶೇಷ ಸೂಚನೆ : 1. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮಕ್ಕೆ ಸೀಮಿತವಾಗಿ ಅಂತಿಮ ಪರೀಕ್ಷೆಯ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ ಇರುತ್ತದೆ.

2. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮವನ್ನು ಹೊರತುಪಡಿಸಿದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಉಳಿದ ಪದ್ಯ & ಗದ್ಯ ಭಾಗ ಹಾಗೂ ಇತರ ಲೇಖನಗಳನ್ನು ಹೆಚ್ಚುವರಿ ಪೂರಕ ಓದಿಗಾಗಿ ಬಳಸಿಕೊಳ್ಳಬಹುದು. ಅಂತಿಮ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಈ ಪಾಠಗಳಿಂದ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುವುದಿಲ್ಲ.

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3. ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.

4. ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ & ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್ ಸೈಟ್ ನೋಡುವುದು.

At the end of the course the student will be able to:

CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಕುರಿತು ಅರಿವು ಮೂಡಿರುತ್ತದೆ.
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಕಲಿತು ಹೆಚ್ಚಿನ ಓದಿಗೆ ಮತ್ತು ಜ್ಞಾನಕ್ಕೆ ಸ್ಫೂರ್ತಿ ಮೂಡುತ್ತದೆ.
CO3	ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಹೆಚ್ಚಾಗುತ್ತದೆ.
CO4	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ತಿಳಿದುಕೊಂಡು ನಾಡಿನ ಇನ್ನಿತರ ವ್ಯಕ್ತಿಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳಲು ಕೌತುಕತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ.
CO5	ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

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ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

Course Title:	ಬಳಕೆ ಕನ್ನಡ		
Course Code:	22KBK17 / 27	CIE Marks	50
Course Type (Theory/Practical /Integrated	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	1:0:0:0	Exam Hours	01 Theory
Total Hours of Pedagogy	15 hours	Credits	01

Course objectives : ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

The course (22K**B**K17/27) will enable the students,

1. To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
2. To enable learners to Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To train the learners for correct and polite conservation.
5. To know about Karnataka state and its language, literature and General information about this state.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೊಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.
4. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕ್ಕೆಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
5. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module - 1

(03 hours of pedagogy)

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities, Key to Transcription
3. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words

Module - 2

(03 hours of pedagogy)

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು –ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) –**Predictive Forms, Locative Case**

Module - 3

(03 hours of pedagogy)

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - **Dative Cases, and Numerals**
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು **-Ordinal numerals and Plural markers**
3. ನ್ಯೂನ/ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು & ವರ್ಣ ಗುಣವಾಚಕಗಳು –**Defective/Negative Verbs & Colour Adjectives**

Module- 4

(03 hours of pedagogy)

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು
   Permission, Commands, encouraging and Urging words (Imperative words and sentences)
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು
   Accusative Cases and Potential Forms used in General Communication
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs
4. ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ, ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words

Module - 5

(03 hours of pedagogy)

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು -Different types of Tense, Time and Verbs
2. ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. **Kannada Vocabulary List :ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು -Kannada Words in Conversation**

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ಬಳಕೆ ಕನ್ನಡ

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ,

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ಸೂಚನೆ :

ವಿಶೇಷ ಸೂಚನೆ : 1. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮಕ್ಕೆ ಸೀಮಿತವಾಗಿ ಅಂತಿಮ ಪರೀಕ್ಷೆಯ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ ಇರುತ್ತದೆ.

2. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮವನ್ನು ಹೊರತುಪಡಿಸಿದ ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಉಳಿದ ಭಾಗಳನ್ನು ಹೆಚ್ಚುವರಿ ಪೂರಕ ಓದಿಗಾಗಿ ಬಳಸಿಕೊಳ್ಳಬಹುದು. ಅಂತಿಮ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಈ ಪಾಠಗಳಿಂದ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುವುದಿಲ್ಲ.

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3. ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.

4. ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ & ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್ ಸೈಟ್ ನೋಡುವುದು.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- ✓ Contents related activities (Activity-based discussions)
- ✓ For active participation of students instruct the students to prepare Flowcharts and Handouts
- ✓ Organising Group wise discussions Connecting to placement activities
- ✓ Quizzes and Discussions.
- ✓ Seminars and assignments.

Course Outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.	**6**		**10**
CO-2	To enable learners to Listen and understand the Kannada language properly.	**6**		**10**
CO-3	To speak, read and write Kannada language as per requirement.	**6**		**10**
CO-4	To train the learners for correct and polite conservation.	**6**		**10**
CO-5	To know about Karnataka state and its language, literature and General information about this state.	**6**		**10**

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	-	3.0	-	-	-	1.0	-	-

University Prescribed Textbook :

ಬಳಕೆ ಕನ್ನಡ

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ,

ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ಸೂಚನೆ :

ವಿಶೇಷ ಸೂಚನೆ : 1. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮಕ್ಕೆ ಸೀಮಿತವಾಗಿ ಅಂತಿಮ ಪರೀಕ್ಷೆಯ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ ಇರುತ್ತದೆ.

2. ಮೇಲಿನ ಪಠ್ಯಕ್ರಮವನ್ನು ಹೊರತುಪಡಿಸಿದ ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿನ ಉಳಿದ ಭಾಗಳನ್ನು ಹೆಚ್ಚುವರಿ ಪೂರಕ ಓದಿಗಾಗಿ ಬಳಸಿಕೊಳ್ಳಬಹುದು. ಅಂತಿಮ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಈ ಪಾಠಗಳಿಂದ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲಾಗುವುದಿಲ್ಲ.

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3. ಹೆಚ್ಚಿನ ಮಾಹಿತಿ ಮತ್ತು ವಿವರಣೆಗಳಿಗೆ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ (9900832331) ಇವರನ್ನು ಸಂಪರ್ಕಿಸಿ.

4. ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ, ಕೋರ್ಸ್ ಆಯ್ಕೆ ಮಾಹಿತಿ, ಅಧ್ಯಯನ ಸಾಮಗ್ರಿ & ಬಹು ಆಯ್ಕೆ ಮಾದರಿಯ ಪ್ರಶ್ನೆಗಳ ಕೈಪಿಡಿಗಾಗಿ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್ ಸೈಟ್ ನೋಡುವುದು.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- ✓ Contents related activities (Activity-based discussions)
- ✓ For active participation of students instruct the students to prepare Flowcharts and Handouts
- ✓ Organising Group wise discussions Connecting to placement activities
- ✓ Quizzes and Discussions.
- ✓ Seminars and assignments.

22IDT281 Innovation and Design Thinking (1-0-0)

Contact Hours: 15

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To explain the concept of design thinking for product and service development.
- To explain the fundamental concept of innovation and design thinking.
- To discuss the methods of implementing design thinking in the real world.

Course Outcomes (COs):

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Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Appreciate** various design process procedure.	-	-	3
CO-2	**Generate** and **develop** design ideas through different technique	-	-	3
CO-3	**Identify** the significance of reverse Engineering to Understand products.	-	-	6
CO-4	**Draw** technical drawing for design ideas.	-	-	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	-	1.0	-	-	1.0	-	-	-	-	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Process Of Design: Understanding Design thinking Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping **3 Hrs**

Unit-II

Tools for Design Thinking: Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design **3 Hrs**

Unit-III

Design Thinking in IT Design: Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping **3 Hrs**

Unit-IV

Design Thinking For strategic innovations: Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization –

Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design. **3 Hrs**

Unit-V

Design thinking workshop: Empathize, Design, Ideate, Prototype and Test **3 Hrs**

Reference Books:

1. John.R.Karsnitz, Stephen O"Brien and John P. Hutchinson, “Engineering Design”, Cengage learning (International edition) Second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.
5. Yousef Haik and Tamer M.Shahin, “Engineering Design Process”, Cengage Learning, Second Edition, 2011.
6. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).

CIE and SEE Evaluation (from 2022-23 batch)

CIE for Non integrated Courses: With LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

- Two tests + One Improvement test : (20+20+20 each of one hour duration)

  Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- CTA: Minimum two components such as assignments, quiz, seminar, written assignment, any technical activity related to course etc. each of 5 marks. Total CTA marks- 10
- CIE= 40(from tests)+10(from CTA) = 50 marks
- SEE: Exam will be conducted for 100 marks with 3 hours duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions.

CIE for Integrated Courses: With LTP 2-0-2 and 3-0-2 and 2-2-2

- Theory CIE component:

  Two tests + One Improvement test (20+20+20 each of one hour duration)
- Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- Practical CIE component (CTA): Laboratory component. 5 marks for conduction, regularity, involvement, journal etc. Lab Test -5 marks. A test as per the schedule announced will be conducted at the end for 50 marks and scaled down to 5 marks. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- CIE= 40(from tests) +10(from CTA i.e. lab component) = 50 marks

- SEE: Exam will be conducted for 100 marks with 3 hours duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions. The questions shall be asked to test practical understanding for maximum of 30 marks.

CIE for AEC/HSMS Courses: With LTP 1-0-0 for 1 Credit

- CIE for 1 credit AEC/HSMS Courses with LTP 1-0-0
- Two tests + One Improvement test
- 20+20+20 each of one hour duration
- QP pattern for IA: MCQ 15 questions
- Two higher scores from three tests are taken representing 40 marks
- CTA: Minimum two components such as assignments ,quiz, seminar, written assignment , any learning activity related to the course etc. each of 5 marks.
- CIE= 40(from tests)+10(from CTA)= 50 marks
- SEE: Exam will be conducted for 50 marks with 1 hour duration. There will be 50 MCQs. The question paper will contain 10 MCQ questions from each module.

Academic Program - UG

III & IV Semester B.E.

Computer Science and Engineering

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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Scheme of Teaching and Examination

III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
21UCSM300	BS	Engg.Mathematics-III	**3-0-0**	3	50	100	3	-	-
21UCSC300	PC	Digital Electronics	**3-0-0**	3	50	100	3	-	-
21UCSC301	PC	Data Structures and Applications	**3-0-0**	3	50	100	3	-	-
21UCSC302	PC	Computer Organization and Architecture	**3-0-0**	3	50	100	3	-	-
21UCSC303	PC	Operating Systems	**3-0-0**	3	50	100	3	-	-
21UAEE324	AE	Unix Administration and Programming	**2-0-0**	2	50	50	2	-	-
21UHUC300	HU	Universal Human Values - I	**2-0-0**	2	50	50	2	-	-
21UCSL305	PC	Digital Electronics Laboratory	**0-0-3**	1.5	50	-	-	50	3
21UCSL306	PC	Data Structures and Applications Laboratory	**0-0-3**	1.5	50	-	-	50	3
21UHUC301	HU	Kannada	**2-0-0**	1	50	50	2	-	-
21UMBA301	BS	Mathematics	**3-0-0**	Audit	50	-	-	-	-
Total			**24-0-6**	**23**	**550**	**650**	**-**	**100**	**-**

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IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
21UCSM400	BS	Engineering Mathematics-IV	**3-0-0**	3	50	100	3	-	-
21UCSC400	PC	Programming Computer Peripherals and Interfacing	**3-0-0**	3	50	100	3	-	-
21UCSC401	PC	Object Oriented Programming	**3-0-0**	3	50	100	3	-	-
21UCSC402	PC	Analysis and Design of Algorithms	**3-0-0**	3	50	100	3	-	-
21UCSC403	PC	Software Engineering	**3-0-0**	3	50	100	3	-	-
21UHUA400	HU	The Constitution of India and Professional Ethics.	**2-0-0**	Audit	50	-	-	-	-
21UHUC402	HU	Universal Human Values - II	**2-0-0**	2	50	50	2	-	-
21UCSL405	PC	Object Oriented Programming Lab	**0-0-3**	1.5	50	-	-	50	3
21UCSL406	PC	Programming Computer Peripherals and Interfacing Lab	**0- 0-3**	1.5	50	-	-	50	3
21UCSL407	PC	Introductory Project	**0–0-2**	1	50	-	-	-	-
21UMBA401	BS	Mathematics	**3-0-0**	Audit	50	-	-	-	-
Total			**22-0-8**	**21**	**550**	**550**		**100**	

III Semester

21UCSM300	Engineering Mathematics – III	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- The basic terminologies of mathematical and logical reasoning, functions, and relations associated with its properties and corresponding practical examples.
- Various counting principle methods to solve complex problems in combinatorics.
- Demonstration with examples, the basic terminologies of graphs and its types.
- Identify the applications of mathematical structures in other fields of computer science such as data structures and algorithms, databases, networks, operating systems etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Verify** the correctness of an argument using various techniques and strategies.	1	2	4,15
CO-2	**Solve** problems using counting techniques and combinatorics.	1	2	4,15
CO-3	**Solve** the problems on different types of functions, relations, and Generating functions.	1	2	4,13
CO-4	**Solve** the problems pertaining to graphs and related discrete structures.	1	2	4,13
CO-5	**Explain** the concepts and properties of algebraic structures such as groups and coding theory.	1	2	4,15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-

Pre-requisites: Knowledge of Elementary Mathematics

Contents:

Unit-I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference, The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems **9 Hrs**

Unit-II

Fundamental Counting: The Rules of Sum and Product, Permutations and Combinations, The Binomial coefficients, The Pigeonhole Principle.

Relations: Cartesian Products and Relations, Properties of Relations, Equivalence Relations and Partitions **9 Hrs**

Unit-III

Functions: Definition, Plain and One-to-One, Onto Functions, Function Composition, Inverse Functions, Directed Graphs, Hasse Diagrams. **7 Hrs**

Unit-IV

Generating Functions: Definitions and examples, Exponential Generating Functions.

Recurrence Relations: Recursive definitions. First Order Linear Recurrence Relations, Second order linear homogeneous recurrence relation with constant coefficients. **7 Hrs**

Unit-V

Graphs: Elements of graph theory, Graphs and its properties, Directed graphs, Sub-graph, Complements, Planar graphs, Euler Graph, Hamiltonian Graphs, Graph Colouring, Representation of graphs, Trees. Application to engineering. **7 Hrs**

Reference Books:

1) Ralph P Grimaldi & B.V.Ramana “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education, 2006.
2) Kenneth H Rosen, “Discrete Mathematics and its Applications”, 7th Edition, McGraw Hill, 2012.
3) Kolman B & Busby R C, “Discrete and Mathematical Structures for Computer Science”, 5th Edition, Prentice Hall of India 2004.
4) Thomas Kosay, “Discrete Mathematics with Applications”, Elsevier, 2005, Reprint 2008.

21UCSC300	Digital Electronics	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To introduce the fundamental principles of digital electronics commonly used in Computer Science and Engineering.
- To facilitate them to gain experience with the design of logic devices.
- To provide the student with an understanding of basic digital electronics abstractions on which analysis and design of electronic circuits/systems are based and the capability to model and analyze complex circuits.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Solve** the given Boolean expression to obtain simplified optimal solutions.	2	4	-
CO-2	**Conceptualize** and **solve** the given real time application by employing suitable reduction techniques.	13	3	15
CO-3	**Analyze** the operation of Flip-flops and Shift registers.	3	15	13
CO-4	**Design** sequential circuits for the	3	13	-

	given problem statement.			
CO-5	**Design** a finite state machine by **modeling** different states of a system in a given problem scenario.	13	3	15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	3.0	2.5	2.0	-	-	-	-	-	-	-	-	2.3	-	1.3	-

Pre-requisites: Knowledge of Basic Electronics.

Contents:

Unit-I

Introduction: Revision of Digital Signals and Waveforms, Digital Logic, logic gates, 7400 TTL Series, Boolean laws, Simplification of Boolean expressions – Minterm and Maxterm representations.

Design of Combinational Logic Circuits: Sum-of-Products simplification, Truth Table to Karnaugh Map, Pairs, Quads, and Octets, K-map Simplifications, Don't-care Conditions, Product-of-sums simplification, Simplification by Quine-McClusky Method, 0's & 1's Hazards. **7 Hrs**

Unit-II

Data-Processing Circuits: Multiplexers, De-multiplexers, Decoders, Encoders, Parity Generators and Checkers, Magnitude Comparators. **8 Hrs**

Unit-III

Clocks, Flip-Flops: Clock Waveforms, Clocked D Flip-Flop, Edge-triggered D Flip-Flop, Edge-triggered JK Flip-Flop, Flip-Flop Timing, JK Master-slave Flip-Flop, Switch Contact Bounce Circuits, Various Representation of Flip-Flops.

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. **8 Hrs**

Unit-IV

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Pre-settable Counters, Counter

Design as a Synthesis problem. **8 Hrs**

Unit-V

Non-linear Applications of Op-amp- Comparator, 555 Timers: working of Astable and Monostable mode

D/A Conversion and A/D Conversion: D/A Converters: Binary Ladder (R:2R),Binary-weighted, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Accuracy and Resolution **8 Hrs**

Reference Books:

1) Donald P Leach, Albert Paul Malvino & Goutam Saha, "Digital Principles and Applications", 7th Edition, Tata McGraw Hill, 2010.
2) R D Sudhaker Samuel, "Illustrative Approach to Logic Design", Sanguine-Pearson, 2010.
3) Charles H. Roth Jr., "Fundamentals of Logic Design", 5th Edition, Cengage Learning, 2004.
4) M Morris Mano, "Digital Logic and Computer Design", 10th Edition, Pearson Education, 2008.

21UCSC301	**Data Structures and Applications**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Working of various basic data structures and their implementation.
- Implementation issues of data structure in programming language.
- Selection of the appropriate data structure for solving a given problem.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	**Write** programs to solve problems using Pointers and Structures/Unions.	-	14	1,3,15,16
CO-2	**Write** programs to solve problems using files.	-	14	1,3,15,16
CO-3	**Write** programs to solve simple problems using stack and **explain** its working principles.	-	14	1,3,15,16
CO-4	**Write** programs to solve problems using queue and **explain** its working principles.	-	14	1,3,15,16
CO-5	**Write** programs to solve problems using Linked Lists and **explain** its working principles.	-	14	1,3,15,16
CO-6	**Write** programs to solve problems using trees and **explain** its working principles.	-	14	1,3,15,16

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	2.0	1.0	1.0

Pre-requisites: Problem Solving skills and knowledge of Programming in C language.

Contents:

Unit-I

Structures, unions and Pointers: Motivation for using structures. Pointer, access data from memory through pointer, pointer to structures. Motivation for dynamic memory requirement. Realizing arrays using pointer and dynamic memory allocation. Importance of memory management during allocation and de-allocation of memory.

8 Hrs

Unit-II

Stack: Realization of stack and its operations using static and dynamic structures. Application of stack in converting an expression from infix to postfix and evaluating a

postfix expression. Heterogeneous stack using Unions. Applications of Stacks. **8 Hrs**

Unit-III

Queues: Realization of queues (FIFO, Double-ended queue, Priority queue) and its operations using static and dynamic data structures, Applications of Queues. **8 Hrs**

Unit-IV

Lists: Constructing dynamic data structures using self-referential structure (using the same realized linked Lists), operations on lists. Doubly Linked list. Application of Lists in sorting. **8 Hrs**

Unit-V

Trees: Types of trees and their properties, Realization of trees using static and dynamic data structures. Operations on Binary trees and their application in searching (BST and AVL Tree), Binary heap as priority queues, Applications of Trees. **7 Hrs**

Reference Books:

1) Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, "Data Structures using C and C++", Pearson Education, 2006
2) E. Balagurusamy, "Programming in ANSI C", 7th Edition, Tata McGraw-Hill, 2016
3) Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Cengage Learning, 2003.

21UCSC302 Computer Organization and Architecture (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Basics of sub systems of a computer, their organization, structure and operation.
- Basic concept of programs as sequences of machine instructions.
- Operational aspects of I/O devices and standard I/O interfaces.
- Memory hierarchy and concept of virtual memory.
- Arithmetic and logical operations with integer and floating-point operands.

- Organization of a simple processor, pipelined processor and other computing systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the basic working principles of various sub-systems of a computer system.	-	-	1,2,8
CO-2	**Explain** the working principles of different sub systems, such as processor, Input/output, and memory.	-	3,8	1,2,4,6
CO-3	**Design** the required memory bank using basic memory units.	-	3	-
CO-4	**Explain** hardwired control and micro programmed control, pipelining, embedded and other computing systems.	3,4	1	2
CO-5	**Design** simple arithmetic and logical units for a given operational features.	4,8	1,2,3	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.5	1.3	2.3	2.3	-	1.0	-	2.0	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Digital Electronics and Programming language.

Contents:

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Unit-I

Basic Structure and Machine Instructions: Basic Operational Concepts, Bus Structures, Performance - Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions. **8 Hrs**

Unit-II

Input / Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCIBus, SCSI Bus, USB. **8 Hrs**

Unit-III

Memory System: Basic Concepts, Semiconductor RAM and ROM Memories, Speed, Size and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **8 Hrs**

Unit-IV

Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **8 Hrs**

Unit-V

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller. **7 Hrs**

Reference Books:

1) Carl Hamacher, Zvonko Vranesic & SafwatZaky, “Computer Organization”, 5th Edition, Tata Mc Graw Hill, 2011.
2) William Stallings, “Computer Organization & Architecture”, 9th Edition, Prentice Hall of India, 2012.

3) Vincent P. Heuring & Harry F. Jordan, “Computer Systems Design and Architecture”, 2nd Edition, Pearson education, 2004.

21UCSC303	Operating Systems	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): The contents of this course deal with the structure and working principles of generic operating systems at introductory level, focusing on process management, memory management, file system and device management. It also focuses on architecture and programming aspects of Linux based OS at fundamental level.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the working principles of processes and threads and solve problems related to process scheduling.	-	13,14,1,3	-
CO-2	**Solve** Critical Section problem required for process synchronization.	-	1,2,3,14	13
CO-3	**Explain** and **solve** the issues pertaining to deadlock.	-	1,2,3,14	13
CO-4	**Compare** and **contrast** different main memory management strategies.	-	1,2,3,13	15
CO-5	**Explain** the working principles of file system and its management.	-	1,2,13	14
CO-6	**Explain** the structure and working principles of secondary storage management.	-	1,2,13	14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Mapping Level	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	1.6	1.6	1.0	-

Pre-requisites: Knowledge of Computer Organization, Digital Electronics and Computer Programming at introductory level.

Contents:

Unit-I

Introduction to Operating Systems: 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; Special-purpose systems; Computing environments.

Process Management: Process concept; Process scheduling; Operations on processes; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling. **8 Hrs**

Unit-II

Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors. **8 Hrs**

Unit-III

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **8 Hrs**

Unit-IV

Memory Management: 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. **8 Hrs**

Unit-V

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

Secondary Storage Structures & Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems **7 Hrs**

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 9th Edition, Wiley India, 2018.
2. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
3. Tariq Mahmood, Imran Saeed and Tasleem Nustafa: Operating Systems and Networks, 5th Edition, IT Series, 2017

21UAEE324	UNIX Administration and Programming	(2-0-0) 2

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To provide the student with an exposure on UNIX platform so that various domain specific project activities can be performed with ease and comfort.
- To provide the student with an exposure on the structure and working principles of UNIX operating system at introductory level, focusing on OS services, commands, and scripting language for administration of UNIX operating system.

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to POs(1-12) / PSOs (13-16)

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the structure, working principles and basic commands of UNIX operating system.	-	-	13
CO-2	**Use** different UNIX commands and system calls to perform system administration and user specified tasks.	-	14, 15	-
CO-3	**Write** shell scripts to perform different system administrative tasks.	-	5, 13, 14, 15	-
CO-4	**Write** awk scrips to perform different system administrative tasks.	-	5, 13, 14, 15	-
CO-5	**Write** perl scrips to perform different system administrative tasks.	-	5, 13, 14, 15	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	2.0	-	-	-	-	-	-	-	1.7	2.0	2.0	-

Pre-requisites: Knowledge of basic UNIX commands.

Contents:

Unit-I

Unix System Architecture, commands and System calls: Unix System structure, Commands for performing various activities related to process, files, directories, devices, password protection, vi editors, and other administrative task. System calls related to process, files and directories. **5 Hrs**

Unit-II

Filters in Unix: Paginating Files, head: Displaying the Beginning of a File, tail: Displaying the End of a File, cut: Splitting a File Vertically, paste: Pasting Files, sort Ordering a File, uniq Locate Repeated and Non repeated Lines, tr Translating Characters, An Example: Displaying a Word count List. grep Searching for a Pattern,

Basic Regular Expressions (BRE) – An Introduction, Extended Regular Expressions (ERE) and egrep. **6 Hrs**

Unit-III

Shell Programming: Environment Variables, Aliases (bash), Command History (bash). Shell Scripts, read and readonly commands, Using Command Line Arguments, exit and Exit Status of Command, The Logical Operators && and || Conditional Execution, The if Conditional, Using test and [ ] to Evaluate Expressions, The case Conditional, expr: Computation and String Handling, $0: Calling a Script by Different names, while: Looping, for: Looping with a List, set and shift: Manipulating the Positional Parameters. **6 Hrs**

Unit-IV

Awk Scripting Language: awk program line and script structure, awk's operational mechanism, Records and fields, special variables $0, $1, $2, etc., patterns, The BEGIN and END, Variables, built in variables, built in functions, length, split, getline, print, printf, sprintf, index, system, substr, etc., control structures, operators in awk, associative arrays, writing simple awk scripts, Running awk scripts from the shell. **5 Hrs**

Unit-V

Perl - The Master Manipulator: Preliminaries, The chop function, Variables and Operators, String handling functions, Specifying filenames in a command line, $_, $. and .., Lists and arrays, argv[]: command line arguments, foreach, split, join, grep, associative arrays. **4 Hrs**

Reference Books:

1) Sumitabha Das UNIX Concepts and Applications, 3rd Edition, Tata McGraw Hill, 2003
2) Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
3) Behrouz A. Forouzan and Richard F.Gilberg UNIX and Shell Programming A Text book, Thomson, edition 2003.

21UHUC300	Universal Human Values - I	(2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs): This course provides an opportunity for the students to enhance their life skills like right understanding leading to the harmonious living in relationship with the self and family enhancing holistic development of the students.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Recite** and **follow** interpersonal relations with peers and the others	6	-	-
CO-2	**Comprehend** happiness, prosperity and **distinguish** between body and self	-	6, 9	-
CO-3	**Comprehend** harmony and **practice** Sanyam and Svasthya	-	9	-
CO-4	**Demonstrate** the values of human-human interaction and universal values such as *Nyaya*, *Visvasa*, and *Sammana*	7	-	-
CO-5	Clearly **visualize** the co-relation between lack of Human Values and the prevailing problems and **use** tangible steps and a roadmap for moving in the cherished direction.	8	9	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	-	2.5	3.0	3.0	2.0	-	-	-	-	-	-	-

Pre-requisites: None

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Contents:

Unit-I

Introduction to Value Education: Understanding the need, basic guidelines, content and process for Value Education, Self-exploration – its content and process; 'Natural Acceptance' and Experiential Validation – as the mechanism for self-exploration , Continuous Happiness and Prosperity – A look at basic human aspirations, Right understanding, Relationship and Physical Facilities – The basic requirements for fulfillment of aspirations of every human being. **6 Hrs**

Unit-II

Understanding Happiness and Prosperity: Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario and Method to fulfill the above human aspirations: Understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body' and the needs of Self ('I') and 'Body' - Sukh and Suvidhã, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). **5 Hrs**

Unit-III

Harmony in the Human Being: Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of 'I' with the Body: Sanyam and Svãsthya; correct appraisal of physical needs, meaning of prosperity in detail, Programs to ensure Sanyam and Svãsthya. **5 Hrs**

Unit-IV

Harmony in the Family: Understanding harmony in the Family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyãya and program for its fulfillment to ensure Ubhaya –tripti; Trust (Visvãsa) and Respect (Sammãna) as the foundational values of relationship. **5 Hrs**

Unit-V

Understanding Intention and Competence: Understanding the meaning of Visvãsa; Difference between intention and competence, Understanding the meaning of Sammãna, Difference between respect and differentiation; the other salient values in relationship. **5 Hrs**

Reference Books:

1. R.R.Gaur, R Asthana, and G.P Bagaria, "A Foundation Course in HUMAN VALUES and professional Ethics", 2nd Revised Edition. EXCEL BOOKS, New Delhi. 2019
2. Videos on UHV by AICTE

21UCSL305	Digital Electronics Laboratory	(0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- To gain an intuitive understanding of the role of the electronic components and learn how to employ them to model elementary electronic circuits.
- To take measurements of circuit behavior and compare the performance with predicted circuit models and explain discrepancies.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design** and **implement** independently combinational circuits for real time scenarios.	1,13	2,3	12
CO-2	**Design** and **implement** independently sequential circuits for real time scenarios.	1,13	2,3	12
CO-3	**Design** and **implement** any application circuit to simulate real time problems.	1,2	15	16

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Mapping Level	3.0	2.3	2.0	-	-	-	-	-	-	-	-	1.0	3.0	-	2.0	1.0

Pre-requisites: Basic Electronics.

List of Experiments

Experiment No. 1 **Logic Gates**

Aim To study and verify the truth table of various logic gates.

Learning Objective
- Identify various ICs for different logic operations.
- Understand ICs nomenclature and their specifications.

Experiment No. 2 **Realization of Boolean Functions**

Aim To simplify the given Boolean expression and to realize it using Basic gates and Universal gates.

Learning Objective
- To understand need for simplifying Boolean expressions.
- To simplify the given Boolean expression and to build the same using logic gates.
- Given a truth table, to derive the Boolean expressions and build the logic circuit to realize it.

Experiment No. 3 **Adders and Subtractors**

Aim To realize Half Adder and Full Adder, Half Subtractor and Full Subtractor using basic gates and NAND gates.

Learning Objective
- To realize the adder and subtractor circuits using basic gates and universal gates.
- To realize full adder using two half adders
- To realize a full subtractor using two half subtractors
- To realize arithmetic operations

Experiment No. 4 **Multiplexers / MEV Technique**

Aim To simplify given Boolean expression using Map Entered Variable(MEV) technique and realize the simplified

expression using 8:1 Multiplexers

Learning Objective

- Understand importance of MEV technique.
- Understand multiplexer usage to implement given Boolean expression
- To verify the various functions of IC 74153 and 74151

Experiment No. 5 **Decoders**

Aim To implement given Boolean function using decoders.

Learning Objective

- To learn about working principle of decoders and their usage
- Understand decoder usage to implement given Boolean expression
- To verify the various functions of IC 74138(Decoder)

Experiment No. 6 **Code Converters**

Aim To design and realize the code converters (Binary to Gray code and BCD to Excess – 3 code) using basic gates

Learning Objective

- Understand need for code converters
- To learn to realize various code converters

Experiment No. 7 **Comparators**

Aim To realize Two Bit Comparator using basic gates

Learning Objective

- To learn about various applications of comparator
- To realize logical operations

Experiment No. 8 **Flip-Flops**

Aim To realize the flip-flop conversions (JK to D, JK to T, D to JK, D to T).

Learning Objective

- To learn about various types of Flip-Flops
- Conversions of one type of Flip flop to another

Experiment No. 9 **Applications Flip-Flops**

Aim	To design and implement mod-n synchronous counter
Learning Objective	• To learn about applications of flip-flops. • To learn design procedure for counters.

Experiment No. 10	**Shift Registers / Ring and Johnson counters**
Aim	To realize and study Ring Counter and Johnson counter
Learning Objective	• To learn about Ring Counter and its applications • To learn about Johnson Counter and its application
Experiment No. 11	**Asynchronous counter**
Aim	Design and implement a mod-n (n<=9) asynchronous counter using Decade counter IC 7490.
Learning Objective	• To learn about asynchronous counters • To understand usage of IC 7490

Reference Books:

1. Donald P Leach, Albert Paul Malvino and Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2010.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Cengage Learning, 2004.
4. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson Education, 2008.

21UCSL306 Data Structures and Applications Laboratory (0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Realization of fundamental data structures like stacks, queues, linked lists and trees.
- Compare and contrast the benefits of dynamic and static data structure implementations.
- Selection of the appropriate data structure for solving a given problem.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Write** programs to solve problems using Pointers and Structures/Unions.	-	14	1,3, 15, 16
CO-2	**Write** programs to solve problems using files.	-	14	1,3, 15, 16
CO-3	**Write** programs to solve problems using stack.	-	14	1,3, 15, 16
CO-4	**Write** programs to solve problems using queue.	-	14	1,3, 15, 16
CO-5	**Write** programs to solve problems using Linked Lists.	-	14	1,3, 15, 16
CO-6	**Write** programs to solve problems using trees.	-	14	1,3, 15, 16

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	2.0	1.0	1.0

Suggested list of term works:

The list of experiments is based on the following concepts:

1. **1.** Pointers and Structures / Unions.
2. **2.** Files
3. **3.** Stack
4. **4.** Queue
5. **5.** Linked Lists
6. **6.** Trees

Reference Books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein: Data Structures using C and C ++, Pearson Education / PHI, 2006,
2. E. Balagurusamy: Programming in ANSI C, 7th Edition, Tata McGraw-Hill, 2016.

3. Behrouz A. Forouzan and Richard F. Gilberg: Computer Science: A Structured Programming Approach Using C, 2nd Edition, Ceng

21UHUC301	Kannada	(2-0-0) 1

Contact Hours: 26

21UMBA301	Mathematics	(3-0-0) Audit

Contact Hours: 39

Course Learning Objectives (CLOs): This audit course will enable the students to master the basic tools of differential & integral calculus, differential equations and partial differential equations. Further, it will make the students to become skilled to formulate, solve and analyze science and engineering problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	**Apply** the knowledge of calculus to solve problems related to polar curves, curvature andits applications in determining the bentness of a curve.	-	-	1,2
CO-2	**Learn** to solve multiple integration and use Beta and Gamma function to solve definite integrals	-	1,2	-
CO-3	**Solve** first order linear differential equations analytically using standard methods.	-	1,2	-
CO-4	**Solve** higher order differential equations with constant co-efficients and variable co-efficients.	-	1,2	-
CO-5	**Learn** partial differentiation to calculate rates of change of multivariate functions. **Solve** problems related to composite functions and Jacobians.**Solve** problems on partial differential equations by method of separation of variables.	-	-	1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Differentiation and Integration of functions

Contents:

Unit-I

n^{th} order differentiation of standard functions: Leibnitz theorem (Statement only & illustrative examples),Taylor's series for single variable (Statement only & illustrative examples), Maclaurin's series for single variable (Statement only & illustrative examples).

Polar curves: angle between the radius vector and tangent (Formula & illustrative examples), angle between two curves (Formula & illustrative examples).
Definition of Curvature and radius of curvature: Radius of curvature for Cartesian and polar curves (Formulas & illustrative examples). **10 Hrs**

Unit-II

Integral Calculus: Reduction formula for $\int_0^{\pi/2} sin^n\, x\, dx$, $\int_0^{\pi/2} cos^n\, x\, dx$ and $\int_0^{\pi/2} sin^n\, x\, cos^m x\, dx$ (Formula & illustrative examples). Definition of Beta and Gamma functions (illustrative examples). Relation between Beta and Gamma functions (No Proof) (illustrative examples). Evaluation of Double integral (direct and region given), Change of variables. Evaluation of Triple integral (direct examples). **10 Hrs**

Unit-III

Ordinary Differential Equations of First Order: Libnitz's Linear differential equation, Bernoulli's differential equation, Exact differential equations, Orthogonal trajectories. **5 Hrs**

Unit-IV

Differential Equations of Higher Order:

Solution of Second order Linear ordinary differential equation with constant coefficients. Method of variation of parameters. Legendre's homogeneous equations **8 Hrs**

Unit-V

Partial Differentiation: Definition of Partial derivative (illustrative examples), Total differentiation (illustrative examples), Differentiation of Composite functions (illustrative examples).Jacobians and its properties (NoProof) (illustrative examples).

Partial Differential Equations (PDE's): Formation of PDE's by elimination of arbitrary constants/functions. Solution of PDE by variable separable method. **6 Hrs**

Reference Books:

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. **H. K. Dass & Rajnish Verma:** Higher Engineering Mathematics, 3rd Edition, 2014.

Note:

Grades (i) PP (ii) NP

No semester End Examination

Audit (Bridge course).

The mandatory non – credit courses Mathematics for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.

These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

IV Semester

18UCSM400	Engineering Mathematics – IV	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To have an insight into Fourier series, Fourier transforms, Difference equations and Z-transforms.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Express** periodic function as a Fourier series and **obtain** the various harmonics of the Fourier series expansion for the given numerical data.	-	-	1
CO-2	**Transform** the given function using Fourier transforms depending on the nature of engineering applications. Solve difference equations using Z-transform.	-	-	1
CO-3	Make **Use** of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	-	1,2	-
CO-4	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	-	1,2	-
CO-5	Estimate the correlation, covariance using joint probability distributions. Also use student's t-distribution, Chi-square distribution as a test of goodness of it.	-	1,2	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-

Pre-requisites: Knowledge of

1. Differentiation of function.
2. Integration of function.
3. Basic Probability theory.
4. Statistical averages

Course Contents:

Unit I

Fourier Series: Periodic functions, Dirichlet's condition, Fourier series of periodic functions of period 2π and arbitrary period. Half-range Fourier series, Practical harmonic analysis, Examples from engineering field. **8 Hrs**

Unit II

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms, Simple problems.

Z-Transforms and Difference equations: Z-transform – definition, Standard Z – transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems, Inverse Z-transform, Simple Problems, Difference equations – Basic definition, Application of Z-transform to solve Difference equation. **8 Hrs**

Unit III

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression–problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form= $ax + b; y = ax^2 + bx + c; y = ax^b$. **8 Hrs**

Unit IV

Probability Distributions: Review of basic probability theory, Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson,

exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples. **8 Hrs**

Unit V

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **7 Hrs**

Reference Books:

1) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint) 2016.
2) B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
3) Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016.

21UCSC400	**Programming Computer Peripherals and Interfacing**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Understand the Basic architecture and Peripherals associated with Micro-processers & Micro-controllers.
- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

Course Outcomes (COs):

Description of the Course Outcome:	**Mapping to POs(1-12) / PSOs (13-16)**

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the Basic architecture and Peripherals associated with Micro-processers & Micro-controllers	-	1	-
CO-2	**Explain** the features of embedded systems, architecture of ARM7 and applications.	-	1	-
CO-3	**Illustrate** the ARM and THUMB instruction sets.	-	2,5	13
CO-4	**Write** an ASM / Embedded C program using the instruction set of ARM and THUMB to solve the engineering problems.	-	3	-
CO-5	**Design** and **Write** ARM (LPC2148) program for specific applications.	-	5	3,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	1.5	-	2.0	-	-	-	-	-	-	1.0	1.0	-	-	-

Pre-requisites: Number systems, Digital systems and Computer Organization

Course Contents:

Unit-I

Introduction to Processor & Controllers: Evolution of Microprocessor, Block diagram and Features of Microprocessor & Micro-controller, Comparison of Microprocessor and Microcontroller, The RISC & CISC design philosophy. **7 Hrs**

Unit-II

Peripheral Interfacing with Microprocessor: Static and Dynamic memories, Vector interrupt table, Interrupt service routine, Interfacing of microprocessor with Programmable Interrupt Controller 8259, DMA controller 8257, Programmable peripheral Interface-8255. **9 Hrs**

Unit-III

ARM Embedded Systems and ARM Processor Fundamentals: ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics **7 Hrs**

Unit-IV

ARM Instruction Set: Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status. IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.

Introduction to THUMB and ARM Programming: Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan. **8 Hrs**

Unit-V

Peripheral Interfacing: Salient features of LPC2148 ARM CPU, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units. GPIO, PLL & Timers: Features, Register description with example and Applications. Interfacing of Stepper motor, DC Motor, LED interface. **8 Hrs**

Reference Books:

1. Ramakant A Gayakwad, “Microprocessor and Interfacing ", 4th edition, 2009 Tata McGraw Hill
2. B.Ram, Microprocessors and Interfacing,
3. Atul P Godse and Mrs. Deepali A Godse, Microprocessors and Interfacing,
4. William Hohl, ARM Assembly Language, CRC Press.
5. Steve Furber, ARM System-on-chip Architecture, Pearson Education, 2012
6. LPC 2148 User Manual

21UCSC401	Object Oriented Programming	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Object Oriented (OO) concepts/philosophy and its benefits and drawbacks in system development.
- Basic features of Java programming language to implement Object Oriented (OO) Key concepts like ADT/Encapsulation, reusability (Inheritance/Composite Objects), polymorphism etc., and other core basic features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Prepare** an abstract data type for the given business scenario and **write** simple programs to represent ADT and **use** in the given application scenario**.**	13	1	-
CO-2	**Write** programs to solve given problem using different reusability features like inheritance and composite objects.	2, 14	1, 16	3
CO-3	**Write** a program to solve given problem using utility classes.	2, 14	1	3
CO-4	**Write** a program to solve given problem using abstract classes and differentiate with interfaces.	2, 14, 16	1	3
CO-5	**Write** a program to solve given problem using packages.	2, 14, 16	1	3
CO-6	**Write** a program to solve given problem using exception handling in construction of robust systems.	2, 14	1	3
CO-7	**Use** multithreading concept to solve conflicts due to interleaved execution of threads and write simple programs.	2, 14	1	3
CO-8	**Use** streams concept in developing system that needs facility for storage and retrieval of data.	2, 14	1	3
CO-9	**Design and Develop** GUI based system using applet, frames, events and other support available in AWT / Swings components.	2, 8, 14	1	3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	3.0	1.0	-	-	-	-	3.0	-	-	-	-	3.0	3.0	-	2.3

Pre-requisites: Knowledge of Programming language (any)

Contents:

Unit-I

Introduction to Object Oriented Paradigm (OOP): Object Oriented Philosophy, Key Concepts of OOP, Encapsulation, Polymorphism, Inheritance. **7 Hrs**

Unit-II

Basic Features of Java - 1: Introduction to JAVA, Data Types, Variables and Arrays, String Handling in Java, Control Structures. **8 Hrs**

Unit-III

Basic Features of Java - 2: Classes, Objects, Methods, Constructors, Overloading methods, Methods and Classes, Inheritance, Packages and Interfaces. **9 Hrs**

Unit-IV

Core Features of Java - 1: Exception Handling, Multi-Threaded Programming, Streams. **8 Hrs**

Unit-V

Core Features of Java - 2: AWT and Swings, Applets, Events **7 Hrs**

Reference Books:

1) Herbert Schildt, “Java-The Complete Reference”, 9th Edition, Tata McGraw Hill, 2014.
2) Grady Booch, “Object-Oriented Analysis and Design with Applications”, 3rd Edition, Pearson Education, 2007.
3) Raj Buyya et al “Object Oriented Programming with Java”, McGraw Hill Publications, 2009
4) Paul Tripti, “Object Oriented Programming using Java”, 1st Edition, Cengage Learning India, 2018.

21UCSC402 Analysis and Design of Algorithms (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Analyze the performance of algorithms.
- Demonstrate familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the importance of algorithmic/mathematical approach in solving different types of problems.	-	1	-
CO-2	**Analyze** time and space complexity for a given algorithm.	2	-	1
CO-3	**Apply** and **analyze** brute force technique and compare it with other techniques.	2	5	3,13
CO-4	**Apply** and **analyze** divide and conquer technique and compare it with other techniques.	2	5	3,13
CO-5	**Apply** and **analyze** greedy technique and compare it with other techniques.	2	5	3,13
CO-6	**Apply** and **analyze** dynamic programming technique and compare it with other techniques.	2	5	3,13
CO-7	**Apply** and **analyze** backtracking and branch & bound technique and compare it with other techniques.	2	5	3,13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping	1.5	3.0	1.0	-	2.0	-	-	-	-	-	-	-	1.0	-	-	-

Level																

Pre-requisites: Knowledge of Discrete Mathematics and Data Structures

Contents:

Unit-I

Introduction: Algorithm, Fundamentals of problem solving, Problem types, Principles of Algorithm Design. Analysis framework, Asymptotic notations, Mathematical analysis of Non recursive algorithms, Recurrence relations; Mathematical analysis of recursive analysis.

Brute force strategy: Selection Sort, Bubble sort, String matching **7 Hrs**

Unit-II

Divide and Conquer: Introduction and General method, Binary search, Merge sort, Quick sort, Matrix multiplication using Stressen's Matrix multiplication.

Basic Traversal and search techniques: Depth First search, Breadth First Search, Topological Sorting. **8 Hrs**

Unit-III

Dynamic Programming: Introduction and General method, Computing a binomial coefficient, Warshall's algorithm, Floyd's algorithm, Knapsack problem. **8 Hrs**

Unit-IV

Greedy Strategy: Introduction and General Method, Knapsack problem, Job sequencing with dead-lines, min cost spanning tree (Prim's & Kruskal's), Single Source Shortest Path. Huffman Tree. **8 Hrs**

Unit-V

Back tracking and Branch and Bound: Introduction General Method for both strategies Back Tracking: Sum of Sub sets, Knapsack problem, Traveling Sales person (TSP).

Limitations of Algorithm Power: Lower bound arguments, decision trees, P, NP and NP Complete Problems**.** **8 Hrs**

Reference Books:

1. Anany Levitin, "Introduction to the Design and analysis of algorithms", 3rd Edition, Pearson Education, 2011
2. Horowitz, Sahani et.al "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia Publication, 2004.
3. Marks Allen Weiss, "Data Structure and Algorithm Analysis", 3rd Edition, Pearson Education, 2009

4. Thomas H.Cormen, Charles E.Leiserson & Ronald L. Rivest, "Introduction to Algorithms", 2nd Edition, Prentice Hall of India, 2003.

21UCSC403	Software Engineering	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This is a 3 credit, 39 contact hours course at undergraduate level focusing on knowing the process of software system development and enables students to develop software system using engineering techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the properties of various critical systems and the quality parameters.	-	-	16
CO-2	**Describe** the different key practices of process models.	-	3,13	
CO-3	**Identify** various system requirements and **prepare** system specification reports to solve real life problems in various domains and **develop** domain expertise.	1,2,13	-	-
CO-4	**Conceptualize** the system through **design** and **modeling** the system architecture, components and processes with quality and standards.	1,2,3,13	5	10,12
CO-5	**Develop** software system using engineering techniques, industry relevant tools and programming features/techniques.	1,2,3,13,14	5,15	10,11,12,16
CO-6	**Verify** and **validate** the given system using standard tools and techniques.	-	5,15	10
CO-7	**Manage** project in terms of risk, configuration/versions, Cost and Resources.	-	9,11	10

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	3.0	2.7	-	2.0	-	-	-	2.0	1.0	1.5	1.0	2.8	3.0	2.0	1.0

Pre-requisites: Knowledge of

- Basics of computer systems and its uses
- Programming language (any)

Contents:

Unit-I

Overview: Introduction: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.
Critical Systems, Software Processes: Critical Systems: A simple safety critical system; System dependability; Availability and reliability. Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering. **7 Hrs**

Unit-II

Requirement Engineering: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document. Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management. **7 Hrs**

Unit-III

System models: System Models: Context models; Behavioral models; Data models; Object models; Structured methods.
Software Design and Development: Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles. Object-Oriented design. UI Design Issues.
Rapid Software Development: Agile methods; Extreme programming; Rapid application development. Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution. **9 Hrs**

Unit-IV

Verification and Validation: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. Software testing: System testing; Component testing; Test case design; Test automation.

Testing Techniques: Equivalence Partitioning, Boundary Value Analysis,, Cause Effect Graphing, Test Generation from Predicates, Statement testing, Branch Testing, Condition Testing, Path Testing, Procedural Call Testing, Data Flow Testing. **9 Hrs**

Unit-V

Software Quality & Project Management: Various Software quality parameters and associated standards and procedures, Project Management activities; Project planning; Project scheduling; Risk management. Configuration Management, Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model. Software Cost Estimation: Productivity; Estimation techniques, Project duration and staffing. **7 Hrs**

Reference Books:

1. Ian Somerville, "Software Engineering", 10/E, Person Education, 2016.
2. Roger Pressman, "Software Engineering, Practitioners approach", 7/E, McGraw-Hill, 2010.
3. Bharat Bhushan Agarwal & Sumit Prakash Tayal, "Software Engineering", 2nd Edition, Firewal Media Publications, 2007.
4. A.A.Puntambekar, "Software Engineering & Quality Assurance", 1st Edition, Technical Publications Pune, 2010

21UHUA400 Constitution of India and Professional Ethics (2-0-0) Audit

Contact Hours: 26

Course Learning Objectives (CLOs): The students being citizens of India are to learn about the basic constituents of the constitution of India. Further, they are expected to know about professional ethics and code of practice and also to understand about the society & Engineering and human rights.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Recite** the Preamble, Salient features of the Constitution, fundamental Rights & limitations.	-	6,7	8
CO-2	**Explain** the directive Principles and the functions of Union executives	-	6,7	8
CO-3	**Explain** the functions of the state	-	6,7	8

	executives.			
CO-4	**Exhibit** the knowledge of Special Provisions and Human Rights.	-	6,7	8
CO-5	**Practice** professional ethics and safe guard the societal comfort.	-	6,7	8

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	-	2.0	2.0	1.0	-	-	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Introduction to the Constitution of India: The Making of the Constitution and Salient features of the Constitution.

Preamble to the Indian Constitution: Fundamental Rights & its limitations. **5 Hrs**

Unit-II

Directive Principles: State Policy & Relevance of Directive Principles State Policy Fundamental Duties.

Union Executives: President, Prime Minister, Parliament and Supreme Court of India. **5 Hrs.**

Unit-III

State Executives: Governor, Chief Minister, State Legislature and High Court of State. Electoral Process in India, Amendment Procedures. **5 Hrs**

Unit-IV

Special Provision for SC & ST, Special Provision for Women, Children & Backward Classes and Emergency Provisions. Powers and functions of Municipalities, Panchyats and Co -Operative Societies.

Human Rights: Meaning and Definitions, Legislation Specific Themes in Human Rights-Working of National Human Rights Commission in India **6 Hrs**

Unit-V

Scope & **Aims**: Engineering Ethics, Responsibility of Engineers, Impediments to

Responsibility.

Risks, Safety and liability: Engineers, Honesty, Integrity & Reliability in Engineering.

5 Hrs.

Reference Books:

1. Durga Das Basu: "Introduction to the Constitution on India", (Students Edition), Prentice –Hall EEE, 19th / 20th Edn., 2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins "Engineering Ethics" Thompson Asia, 2003.
3. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
4. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice Hall of India Pvt. Ltd. New Delhi, 2004
5. Brij Kishore Sharma,"Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.
6. Latest Publications of Indian Institute of Human Rights, New Delhi.

21UHUC402 Universal Human Values (2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs): This course provides an opportunity for the students to enhance their life skills like right understanding leading to the harmonious living in relationship with the self and family enhancing holistic development of the students.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Recite** and **follow** interpersonal relations with peers and the others	6	-	-
CO-2	**Demonstrate** the concept of harmony in nature and need of self-regulation.	-	6, 9	-
CO-3	**Recite** and **follow** natural acceptance and differentiate between intention and competence.	-	9	-

CO-4	**Differentiate** between the charachersticis and activities of different orders existing in nature and demonstrtate the role of human beings in mutual fulfilment with all the orders of Nature.	7	-	-
CO-5	**Visualize** and involve in the strategic preparation for Universal Human Order.	8	9	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	-	2.5	3.0	3.0	2.0	-	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Harmony in the Society: Understanding the harmony in the society (society being an extension of family): Samãdhãna, Samriddhi, Abhaya, Sah-astitva as comprehensive Human Goals. **Visualizing a universal harmonious order in society** – Undivided Society (AkhandSamãj), Universal Order (SãrvabhaumaVyavasthã) - from family to world family. **5 Hrs**

Unit-II

Harmony in the Nature (Existence): Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature – recyclability and self-regulation in nature, Understanding existence as co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. **6 Hrs**

Unit-III

Implications of the Holistic Understanding: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Universal Human Order. **5 Hrs**

Unit-IV

A Look at Professional Ethics: Competence in Professional Ethics:
(a) Ability to utilize the professional competence for augmenting universal human order
(b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models **5 Hrs**

Unit-V

Strategy for transition towards Universal Human Order:

- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
    a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    b. At the level of society: as mutually enriching institutions and organizations. **5 Hrs**

Reference Books:

1. R.R.Gaur, R Asthana, and G.P Bagaria, "A Foundation Course in HUMAN VALUES and professional Ethics", 2nd Revised Edition. EXCEL BOOKS, New Delhi. 2019
2. Videos on UHV by AICTE

21UCSL404	Object Oriented Programming Laboratory	(0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Object Oriented (OO) concepts/philosophy and its benefits and drawbacks in system development.
- Basic features of Java programming language to implement Object Oriented (OO) Key concepts like ADT/Encapsulation, reusability (Inheritance/Composite Objects), polymorphism etc., and other core basic features.

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to POs(1-12) / PSOs (13-16)

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Prepare** an abstract data type for the given business scenario and **write** simple programs to represent ADT and **use** in the given application scenario**.**	13	1	-
CO-2	**Write** programs to solve given problem using different reusability features like inheritance and composite objects.	2, 14	1, 16	3
CO-3	**Write** a program to solve given problem using utility classes.	2, 14	1	3
CO-4	**Write** a program to solve given problem using abstract classes and differentiate with interfaces.	2, 14, 16	1	3
CO-5	**Write** a program to solve given problem using packages.	2, 14, 16	1	3
CO-6	**Write** a program to solve given problem using exception handling in construction of robust systems.	2, 14	1	3
CO-7	**Use** multithreading concept to solve conflicts due to interleaved execution of threads and write simple programs.	2, 14	1	3
CO-8	**Use** streams concept in developing system that needs facility for storage and retrieval of data.	2, 14	1	3
CO-9	**Design and Develop** GUI based system using applet, frames, events and other support available in AWT / Swings components.	2, 8, 14	1	3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	3.0	1.0	-	-	-	-	3.0	-	-	-	-	3.0	3.0	-	2.3

Pre-requisites: Knowledge of: Registration/Completion of the course Object Oriented Programming.

Suggested Platforms:

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Notepad (Non IDE), IDE (JCreator, Net Beans, Eclipse etc) in Windows OS and Linux OS

All programs should:

1. Be written to realize the Object Oriented Philosophy and core Java features.
2. Be written with Java Naming & Coding conventions and well documented.
3. Handle exceptions.
4. Be tested for all possible scenarios.

Course Contents:

Minimum one exercise to cover each course outcome specified above. Minimum 8 experiments to be completed by each student independently covering all course outcomes defined for this course. Course teacher has to publish list of experiments along with individual outcome for every experiments, on the first day of the semester. Examiner may set any problem based on the published term work during tests.

Reference Books:

1) Herbert Schildt, "Java: The Complete Reference: 7th Edition, Tata McGraw Hill, 2007.

2) Kathy Sierra & Bert Bates, "Head First Java", 2nd Edition, O'Reilly, 2009

3) Patrick Niemeyer & Daniel Leuck, "Learning Java", 4th Edition, O'Reilly, 2013

4) Laura Lemay & Charles L. Perkins, "Teach Yourself Java in 21 Days", 7th Edition, Sams Publishing, 2016

21UCSL405	Programming Computer Peripherals and Interfacing Laboratory	(0-0-3)	1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.

- Design & develop Assembly Language Program /& C program for a given real time application.
- Understand the use of interrupts & other advanced concepts related to ARM7
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Execute** assembly level codes for a given specific problem using ARM processor.	-	2, 4	3,15
CO-2	**Execute** embedded C programs for a given specific problem using ARM processor.	-	4,14	15,16
CO-3	**Implement** programs for interfacing with real world devices such as LCD's Keyboards, DAC, ADC, Relays Motors and Serial Interface - RTC, USB, UART, I2C.	13	4,5,16	3,12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	2.0	1.0	2.0	2.0	-	-	-	-	-	-	1.0	3.0	2.0	1.0	1.5

Course Contents:

PART A: Conduct the following experiments to learn ALP using ARM:

- Arithmetic and logical operations
- Interrupts related operations
- Timer related applications.

PART B: Conduct interfacing experiments to learn embedded C for ARM:

- LCD- interfacing
- Stepper Motor Interfacing

- Real time sensors Interfacing
- 7-segment LED interface
- Serial Interface (USB, UART, I2C)
- Timer /Counters
- Interrupt Controller

Reference Books:

1. William Hohl, ARM Assembly Language, CRC Press.
2. Steve Furber, ARM System-on-chip Architecture by, Pearson Education, 2012
3. James K. Peckol, Embedded Systems: A Contemporary Design Tool, 2008
4. Jonathan W. Valvano, Brookes / Cole, Embedded Microcomputer Systems, Real Time Interfacing, 1999
5. LPC 2148 User Manual.

21UCSL406	Introductory Project	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs): This course enables the student to identify the community expectations in terms of possible engineering solutions and prepare project proposal.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the societal problems	-	-	2,6,7,9,12,13
CO-2	**Analyze** real environment and **Formulate** the problem statement.	-	-	9,12,13
CO-3	**Conduct** exhaustive literature survey	-	-	9,12,13

CO-4	**Propose** sustainable engineering solutions	-	-	5,7,12,13
CO-5	**Prepare** the report and communicate effectively through presentation.	-	-	9,10,12,13
CO-6	**Manage** the project in terms of various resources in a particular discipline or in a multi-disciplinary domain.	-	-	11

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	1.0	-	-	1.0	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	-	-	-

Guidelines for conduction:

1. Team consists of 4-5 students.
2. Students have to choose a guide among the faculty members who are teaching their semester.
3. In consultation with guide, the team should carry out their project work.
4. Final evaluation is based on seminar and report submission.
5. This requires designated committee to monitor the process of conduction

21UMBA401	**Mathematics**	**(3-0-0)**

Contact Hours: 39

Course Learning Objectives (CLOs): This audit course will enable students to use Laplace transform to solve differential equations. Also, it enables students to analyze and solve system of linear equation. Further, it makes students to understand the concept of vector differentiation and vector integration.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial	**Moderate**	**Slight**

		Level (3)	Level (2)	Level (1)
CO-1	**Transform** the given function using Laplace transforms and study their properties.	-	-	1,2
CO-2	**Apply** Laplace transform tosolvedifferential equations.	-	-	1,2
CO-3	**Compute** the solution of system of equations. **Evaluate** Eigen values and Eigen vectors for a matrix.	-	1,2	
CO-4	**Study** vector calculus and **compute** gradient, divergence, curl of a single valued function**.**	-		1,2
CO-5	**Study** vector integration and **evaluate** Linear Integrals,Surface Integrals and Volume Integrals	-		1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Differentiation and Integration of functions, Elementary row transformation of matrix, Vector Algebra.

Course Contents:

Unit-I

Laplace Transforms:

Definition and Properties. Laplace transform of elementary functions. Laplace transform of $e^{at}f(t)$ Laplace transform of $t^n f(t)$, Laplace transform of $\frac{f(t)}{t}$,Laplace transforms of Periodic functions and unit-step function–problems **8 Hrs**

Unit-II

Inverse Laplace Transforms: Problems with standard, Convolution theorem (without proof) to find the inverse Laplace transform and problems.Solution of linear differentialequations using Laplace transform. **8 Hrs**

Unit-III

Elementary Linear Algebra: Rank ofa matrix - Row Echelon form. Test for consistency for system of linear equations. Solution of system of linear equations – Gauss-elimination method(consistency), Gauss-Seidel iterative method. Eigen values and Eigen vectors- Rayleigh's power method. **8 Hrs**

Unit-IV

Vector Differentiation: Scalar point function and vector point functions. Gradient, Directional Derivative; Curl and Divergence - physical interpretation. Solenoidal and irrotational vectors. Illustrative problems. **8 Hrs**

Unit-V

Vector Integration: Line integrals, Surface integrals and Volume integrals.Green's theorem, Gauss divergence theorem and Stoke's theorem (only statements).

7 Hrs

Reference Books:

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. **H. K. Dass & Rajnish Verma:** Higher Engineering Mathematics, 3rd Edition, 2014.

Note: 1. Grades (i) PP (ii) NP
2. No semester End Examination
3. Audit (Bridge course).

1. The mandatory non – credit courses Mathematics for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said

course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.

2. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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Academic Program - UG

III & IV Semester B.E.

Computer Science and Engineering

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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Scheme of Teaching and Examination

III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UMAC300	BS	Engg.Mathematics-III	**3-0-0**	3	50	100	3	-	-
18UCSC300	PC	Digital Electronics	**4-0-0**	4	50	100	3	-	-
18UCSC301	PC	Discrete Structures in Computer Science	**3-2-0**	4	50	100	3	-	-
18UCSC302	PC	Data Structures and Applications	**4-0-0**	4	50	100	3	-	-
18UCSC303	PC	Computer Organization and Architecture	**3-0-0**	3	50	100	3	--	--
18UCSC304	PC	Introduction to Unix Operating Systems	**2-0-2**	3	50	100	3	--	--
18UCSL305	PC	Digital Electronics Laboratory	**0-0-3**	1.5	50	--	--	50	3
18UCSL306	PC	Data Structures and Applications Laboratory	**0-0-3**	1.5	50	--	--	50	3
Total			**19-2-8**	**24**	**400**	**600**	**-**	**100**	**-**

Note: BS- Basic Science, PC- Program Core, HU- Humanity Science, CIE- Continuous Internal Examination, SEE- Semester End Examination
L- Lecture, T-Tutorials, P-Practicals. *SEE for theory is conducted for 100 marks and is reduced to 50 marks

IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UMAC400	BS	Engineering Mathematics-IV	**3-0-0**	3	50	100	3	-	-
18UCSC400	PC	ARM Processor	**3-0-0**	3	50	100	3	-	-
18UCSC401	PC	Finite Automata and Formal Languages	**3-0-0**	3	50	100	3	-	-
18UCSC402	PC	Object Oriented Programming	**4-0-0**	4	50	100	3	-	-
18UCSC403	PC	Analysis and Design of Algorithms	**3-0-2**	4	50	100	3	-	-
18UCSC404	PC	Operating Systems	**4-0-0**	4	50	100	3	-	-
18UCSL405	PC	Object Oriented Programming Lab	**0-0-3**	1.5	50	--	-	50	3
18UCSL406	PC	ARM Processor Lab	**0- 0-3**	1.5	50	--	-	50	3
18UCSL407	PC	Introductory Project	**0–0-2**	1	50	--	--	--	--
Total			**20-0-10**	**25**	**450**	**600**		**100**	

Note: BS- Basic Science, PC- Program Core, HU- Humanity Science, CIE- Continuous Internal Examination, SEE- Semester End Examination L- Lecture, T-Tutorials, P-Practicals. *SEE for theory is conducted for 100 marks and is reduced to 50 marks

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III Semester

18UMAC3003	Engineering Mathematics – III	(3-0-0)

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To have an insight into Laplace transforms, Fourier series, Fourier Transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus.
- To solve ODE's arising in engineering applications, using numerical methods.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Transform** the given function using Laplace / Fourier transforms depending on the nature of engineering applications.	-	-	1
CO-2	**Express** periodic function as a Fourier series and **obtain** the various harmonics of the Fourier series expansion for the given numerical data.			1,2
CO-3	**Solve** difference equations using Z-transform.			1
CO-4	**Solve** first and second order differential equations arising in engineering problems using single step and multistep numerical methods.		1,2	
CO-5	**Determine** the extremals of functional using calculus of variations and **solve** problems			1,2

	arising in engineering.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.2	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Differentiation and Integration of Functions.

Contents:

Unit-I

Laplace Transforms: Definition and Properties, Laplace transforms of elementary functions, Laplace transforms of Periodic functions and unit-step function - Problems
Inverse Laplace Transforms: Inverse Laplace Transform – Problems, Convolution Theorem (without proof) to find the inverse laplace transform and problems, Solution of linear differential equations using Laplace Transform **8Hrs**

Unit-II

Fourier Series: Periodic functions, Dirichlet's condition, Fourier series of periodic functions of period 2π and arbitrary period. Half-range Fourier series, Practical harmonic analysis, Examples from engineering field. **8 Hrs**

Unit-III

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms, Simple problems.
Z-Transforms and Difference equations: Z-transform – definition, Standard Z – transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems, Inverse Z-transform, Simple Problems, Difference equations – Basic definition, Application of Z-transform to solve Difference equation. **8 Hrs**

Unit-IV

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree - Taylor's series method, Modified Euler's method, Runge – Kutta method of fourth order, Milne's predictor and corrector method (Noderivations of formulae), Problems. **7 Hrs**

Unit-V

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and Corrector method (No derivations of formulae).
Calculus of Variations: Variation of function and functional, Variational problems, Euler's equation (without proof), Geodesics (plane), Hanging chain problems. **8 Hrs**

Reference Books:

1) B.S.Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2) E.Kreyszig, "Advanced Engineering Mathematics", 10th Edition (Reprint), John Wiley & Sons, 2016.
3) Srimanta Pal et al, "Engineering Mathematics", 3rd Edition, Oxford University Press, 2016.
4) C.Ray Wylie & Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co, 1995.
5) S.S.Sastry, "Introductory Methods of Numerical Analysis", 4th Edition, Prentice Hall of India, 2010.
6) B.V.Ramana, "Higher Engineering Mathematics", 11th Edition, Tata McGraw-Hill, 2010.
7) N.P.Bali & Manish Goyal, "A Text Book of Engineering Mathematics", 7th Edition, Laxmi Publishers, 2014.
8) Veeraranjan T, "Engineering Mathematics for First Year", Tata McGraw-Hill, 2008.
9) Thomas G.B. & Finney R.L., "Calculus and Analytical Geometry", 9th Edition, Pearson, 2012.

18UCSC3004	Digital Electronics	(4-0-0)

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To introduce the fundamental principles of digital electronics commonly used in Computer Science and Engineering.
- To facilitate them to gain experience with the design of logic devices.
- To provide the student with an understanding of basic digital electronics abstractions on which analysis and design of electronic circuits/systems are based and the capability to model and analyze complex circuits.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Solve** the given boolean expression to obtain simplified optimal solutions.	2	4	-
CO-2	**Conceptualize** and **solve** the given real time application by employing suitable reduction techniques.	13	3	15
CO-3	**Design** combinational subsystems to perform different logical and arithmetic operations.	3	15	13
CO-4	**Design** sequential circuits for the given problem statement.	3	13	-
CO-5	**Design** a finite state machine by **modeling** different states of a system in a given problem scenario.	13	3	15
CO-6	**Use** MSI chips to **build system** for the given real time application.	5	4	14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	3.0	2.5	2.0	3.0	-	-	-	-	-	-	-	2.3	1.0	1.3	-

Pre-requisites: Knowledge of Basic Electronics.

Contents:

Unit-I

Introduction: Revision of logic gates. Definitions for Digital Signals, Digital Waveforms, Digital Logic, 7400 TTL Series Working of Op-amp, Non-linear applications – Comparator, Schmitt Trigger.

Combinational Logic Circuits: 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, Hazards. **9 Hrs**

Unit-II

Data-Processing Circuits: Multiplexers, De-multiplexers, 1-to-16 Decoder, Encoders,

Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays.

Clocks, Flip-Flops: Clock Waveforms, TTL Clock, Clocked D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Analysis of Sequential Circuits. **11 Hrs**

Unit-III

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.

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Pre-settable Counters, Counter Design as a Synthesis problem. **11 Hrs**

Unit-IV

Design of Synchronous Sequential Circuits: Synchronous Sequential Circuit: Model Selection, State Transition Diagram, State Synthesis Table, Design Equations and Circuit Diagram, Algorithmic State Machine, State Reduction Technique. **10 Hrs**

Unit-V

Design of Asynchronous Sequential Circuits: Analysis of Asynchronous Sequential Circuit, Problems with Asynchronous Sequential Circuits, Design of Asynchronous Sequential Circuit.

D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution. **11 Hrs**

Reference Books:

5) Donald P Leach, Albert Paul Malvino & Goutam Saha, “Digital Principles and Applications”, 7th Edition, Tata McGraw Hill, 2010.
6) R D Sudhaker Samuel, “Illustrative Approach to Logic Design”, Sanguine-Pearson, 2010.
7) Charles H. Roth Jr., “Fundamentals of Logic Design”, 5th Edition, Cengage Learning, 2004.
8) M Morris Mano, “Digital Logic and Computer Design”, 10th Edition, Pearson Education, 2008.

18UCSC3014	Discrete Structures in Computer Science	(3-2-0)

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- The basic terminologies of mathematical and logical reasoning, functions, and relations associated with its properties and corresponding practical examples.
- Various counting principle methods to solve complex problems in combinatorics.
- Demonstration with examples, the basic terminologies of graphs and its types.
- Identify the applications of mathematical structures in other fields of computer science such as data structures and algorithms, databases, networks, operating systems etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Verify** the correctness of an argument using various techniques and strategies.	1	2	4,15
CO-2	**Solve** problems using counting techniques and combinatorics.	1	2	4,15
CO-3	**Solve** the problems on different types of functions, relations, and Generating functions.	1	2	4,13
CO-4	**Solve** the problems pertaining to graphs and related discrete structures.	1	2	4,13
CO-5	**Explain** the concepts and properties of algebraic structures such as groups and coding theory.	1	2	4,15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-

Pre-requisites: None

Contents:

Unit-I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference, The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems **9L +3T Hrs**

Unit-II

Fundamental Counting: The Rules of Sum and Product, Permutations and Combinations, The Binomial coefficients, The Pigeon-hole Principle.
Relations: Cartesian Products and Relations, Properties of Relations, Equivalence Relations and Partitions **8L+3T Hrs**

Unit-III

Functions: Definition, Plain and One-to-One, Onto Functions, Function Composition, Inverse Functions, Directed Graphs, Hasse Diagrams. **7L+3T Hrs**

Unit-IV

Generating Functions: Definitions and examples, Exponential Gnerating Functions.
Recurrence Relations: Recursive definitions. First Order Linear Recurrence Relations, Second order linear homogenious recurrence retelation with constant coefficients. **7L+3T Hrs**

Unit-V

Graphs: Elements of graph theory, Graphs and its properties, Directed graphs, Subgrapgh, Complements, Planar graphs, Euler Graph, Hamiltonian Graphs, Graph Coloring, Representation of graphs, Trees.
Groups: Definitions, Examples, and Elementary Properties, Homomorphisms, Isomorphisms **7L+2T Hrs**

Reference Books:

5) Ralph P Grimaldi & B.V.Ramana “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education, 2006.
6) Kenneth H Rosen, “Discrete Mathematics and its Applications”, 7th Edition, McGraw Hill, 2012.

7) Kolman B & Busby R C, “Discrete and Mathematical Structures for Computer Science”, 5th Edition, Prentice Hall of India 2004.
8) Thomas Kosay, “Discrete Mathematics with Applications”, Elsevier, 2005, Reprint 2008.

18UCSC302 Data Structures and Applications (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Working of various basic data structures and their implementation.
- Implementation issues of data structure in programming language.
- Selection of the appropriate data structure for solving a given problem.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Write** programs to solve problems using Pointers and Structures/Unions.	-	14	1,3,15,16
CO-2	**Write** programs to solve problems using files.	-	14	1,3,15,16
CO-3	**Write** programs to solve simple problems using stack and **explain** its working principles.	-	14	1,3,15,16
CO-4	**Write** programs to solve problems using queue and **explain** its working principles.	-	14	1,3,15,16
CO-5	**Write** programs to solve problems using Linked Lists and **explain** its working principles.	-	14	1,3,15,16
CO-6	**Write** programs to solve problems using trees and **explain** its working principles.	-	14	1,3,15,16
CO-7	**Write** programs to solve problems using Hashing and **explain** its	-	14	1,3,15,16

	working principles.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	2.0	1.0	1.0

Pre-requisites: Problem Solving skills and knowledge of Programming in C language.

Contents:

Unit-I

Structures, unions and Pointers: Motivation for using structures. Pointer, access data from memory through pointer, pointer to structures. Motivation for dynamic memory requirement. Realizing arrays using pointer and dynamic memory allocation. Importance of memory management during allocation and de-allocation of memory. **10 Hrs**

Unit-II

Stack: Realization of stack and its operations using static and dynamic structures. Application of stack in converting an expression from infix to postfix and evaluating a postfix expression. Heterogeneous stack using Unions. Applications of Stacks. **10 Hrs**

Unit-III

Queues: Realization of queues (FIFO, Double-ended queue, Priority queue) and its operations using static and dynamic data structures, Applications of Queues. **10 Hrs**

Unit-IV

Lists: Constructing dynamic data structures using self-referential structure (using the same realized linked Lists), operations on lists. Doubly Linked list. Application of Lists in sorting. **12 Hrs**

Unit-V

Trees: Types of trees and their properties, Realization of trees using static and dynamic data structures. Operations on Binary trees and their application in searching (BST and AVL Tree), Binary heap as priority queues, Applications of Trees.

Hash Table: Realizing effective hash table with proper data stricture and hash function, its application. **10 Hrs**

Reference Books:

4) Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, “Data Structures using C and C++”, Pearson Education, 2006
5) E. Balagurusamy, “Programming in ANSI C”, 7th Edition, Tata McGraw-Hill, 2016
6) Behrouz A. Forouzan & Richard F. Gilberg, “Computer Science: A Structured Programming Approach Using C”, 2nd Edition, Cengage Learning, 2003.

18UCSC303 Computer Organization and Architecture (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Basics of sub systems of a computer, their organization, structure and operation.
- Basic concept of programs as sequences of machine instructions.
- Operational aspects of I/O devices and standard I/O interfaces.
- Memory hierarchy and concept of virtual memory.
- Arithmetic and logical operations with integer and floating-point operands.
- Organization of a simple processor, pipelined processor and other computing systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the basic working principles of various sub-systems of a computer system.	-	-	1,2,8
CO-2	**Explain** the working principles of different sub systems, such as processor, Input/output, and memory.	-	3,8	1,2,4,6
CO-3	**Design** the required memory bank using basic memory units.	-	3	-

CO-4	**Explain** hardwired control and micro programmed control, pipelining, embedded and other computing systems.	3,4	1	2
CO-5	**Design** simple arithmetic and logical units for a given operational features.	4,8	1,2,3	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.5	1.3	2.3	2.3	-	1.0	-	2.0	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Digital Electronics and Programming language.

Contents:

Unit-I

Basic Structure and Machine Instructions: Basic Operational Concepts, Bus Structures, Performance - Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions. **8 Hrs**

Unit-II

Input / Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCIBus, SCSI Bus, USB. **8 Hrs**

Unit-III

Memory System: Basic Concepts, Semiconductor RAM and ROM Memories, Speed, Size and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **8 Hrs**

Unit-IV

Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **8 Hrs**

Unit-V

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller. **7 Hrs**

Reference Books:

4) Carl Hamacher, Zvonko Vranesic & SafwatZaky, "Computer Organization", 5th Edition, Tata Mc Graw Hill, 2011.
5) William Stallings, "Computer Organization & Architecture", 9th Edition, Prentice Hall of India, 2012.
6) Vincent P. Heuring & Harry F. Jordan, "Computer Systems Design and Architecture", 2nd Edition, Pearson education, 2004.

18UCSC304 Introduction to UNIX Operating Systems (2-0-2) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To provide the student with an exposure on UNIX platform so that various other domain specific project activities can be performed with ease and comfort.
- To provide the student with an exposure on the structure and working principles of UNIX operating systems at introductory level, focusing on OS services, commands and scripting language for administration of UNIX operating system.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the structure and working	-	-	13

	principles of UNIX operating system.			
CO-2	**Use** different UNIX commands and System Calls to perform system administration and user specified tasks.	-	14,15	-
CO-3	**Write** shell scripts to perform different system administrative task.	-	5,13,14,15	-
CO-4	**Write** awk scripts to perform different system administrative task.	-	5,13,14,15	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	2.0	-	-	-	-	-	-	-	1.7	2.0	2.0	-

Pre-requisites: None

Contents:

Unit-I

Introduction to Operating Systems: Computer System organization/ architecture; Operating System structure; Operating System operations; Introduction to Process management; Memory management; Storage management; Protection and security; Distributed system; Computing environments. Operating System Services; System calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; System boot **4L Hrs**

Unit-II

Unix System Architecture, commands and System calls: Unix System structure, Commands for performing various activities related to process, files, directories, devices, password protection, vi editors, and other administrative task. Daemon process. System calls related to process, files and directories. **5L + 3 P Hrs**

Unit-III

Filters in Unix: Paginating Files, head: Displaying the Beginning of a File, tail: Displaying the End of a File, cut: Splitting a File Vertically, paste: Pasting Files, sort Ordering a File, uniq Locate Repeated and Non repeated Lines, tr Translating Characters, An Example: Displaying a Word count List. grep Searching for a Pattern, Basic Regular Expressions (BRE) – An Introduction, Extended Regular Expressions (ERE) and egrep. **6L + 3P Hrs**

Unit-IV

Shell Programming: Environment Variables, Aliases (bash), Command History (bash). Shell Scripts, read and readonly commands, Using Command Line Arguments, exit and Exit Status of Command, The Logical Operators && and || Conditional Execution, The if Conditional, Using test and [ ] to Evaluate Expressions, The case Conditional, expr: Computation and String Handling, $0: Calling a Script by Different names, while: Looping, for: Looping with a List, set and shift: Manipulating the Positional Parameters. **6L +3P Hrs**

Unit-V

Awk Scripting Language: awk program line and script structure, awk's operational mechanism, Records and fields, special variables $0, $1, $2, etc., patterns, The BEGIN and END, Variables, built in variables, built in functions, length, split, getline, print, printf, sprintf, index, system, substr, etc., control structures, operators in awk, associative arrays, writing simple awk scripts, Running awk scripts from the shell.

6L + 3P Hrs

Note: Course teachers' assessment (CTA) consists of study of various commands, mastery over vi editors, structure of UNIX operating system, in depth writing shell and awk scripts for simple administrative task. The report is to be submitted by individual students. Students are expected to spend approximately 26 hours on practice based learning and its evaluation.

Reference Books:

1) Sumitabha Das UNIX Concepts and Applications, Third edition, Tata McGraw Hill, 2003
2) Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
3) Behrouz A. Forouzan and Richard F.Gilberg UNIX and Shell Programming A Text book, Thomson, edition 2003.

18UCSL305	**Digital Electronics Laboratory**	**(0-0-3) 1.5**

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Combinational circuit design and simplification techniques used for realizing them.
- Sequential circuit design and working of a basic storage element.
- Simple circuits using passive elements (resistors, capacitors, inductors).

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design and implement** combinational circuit for the problem scenarios.	1,13	2,3	12
CO-2	**Design and implement** sequential circuit for problem scenarios.	1,13	2,3	12
CO-3	**Design and implement** an application circuit to simulate given problem.	1,2	15	16

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	3.0	2.3	2.0	-	-	-	-	-	-	-	-	1.0	3.0	-	2.0	1.0

Pre-requisites: Basic Electronics.

List of Experiments:

1 Study and verification of the truth table of various logic gates.

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2 Realization of Boolean Functions:

i) Simplify the given Boolean expression and to realize it using Basic gates and Universal gates.
ii) Realize the adder and subtract or circuits using basic gates and universal gates.
iii) Simplify given Boolean expression using Map Entered Variable (MEV) technique and realize the simplified expression using 8:1 Multiplexers.
iv) To implement given Boolean function using decoders.

3 Flip-Flops (Sequential Circuits):

i) To realize flip-flop conversions.
ii) Applications Flip-Flops:
a) To design and implement mod-n synchronous counter.
b) Design and implement a mod-n asynchronous counter.
c) To realize and study Shift Registers / Ring counter and Johnson counter.

Reference Books:

5. Donald P Leach, Albert Paul Malvino and Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2010.
6. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
7. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Cengage Learning, 2004.
8. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson Education, 2008.

18UCSL306 Data Structues and Applications Laboratory (0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Realization of fundamental data structures like stacks, queues, linked lists and trees.

- Compare and contrast the benefits of dynamic and static data structure implementations.
- Selection of the appropriate data structure for solving a given problem.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Write** programs to solve problems using Pointers and Structures/Unions.	-	14	1,3, 15, 16
CO-2	**Write** programs to solve problems using files.	-	14	1,3, 15, 16
CO-3	**Write** programs to solve problems using stack.	-	14	1,3, 15, 16
CO-4	**Write** programs to solve problems using queue.	-	14	1,3, 15, 16
CO-5	**Write** programs to solve problems using Linked Lists.	-	14	1,3, 15, 16
CO-6	**Write** programs to solve problems using trees.	-	14	1,3, 15, 16
CO-7	**Write** programs to solve problems using Hashing.	-	14	1,3, 15, 16

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	2.0	1.0	1.0

Suggested list of term works:

The list of experiments is based on the following concepts:

7. Pointers and Structures / Unions.
8. Files
9. Stack

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10. Queue
11. Linked Lists
12. Trees
13. Hashing

Reference Books:

4. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein: Data Structures using C and C ++, Pearson Education / PHI, 2006,
5. E. Balagurusamy: Programming in ANSI C, 7th Edition, Tata McGraw-Hill, 2016.
6. Behrouz A. Forouzan and Richard F. Gilberg: Computer Science: A Structured Programming Approach Using C, 2nd Edition, Ceng

IV Semester

18UMAC400	Engineering Mathematics – IV	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To provide an insight into applications of conformal mapping, integration of complex functions and application of probability distributions in Engineering.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Construct** and **use** the concepts of analytic function to solve the problems arising in Engineering field.	-	-	1
CO-2	**Utilize** conformal transformation and complex integral to transform irregular domain onto a relatively simple domain.	-	1	-
CO-3	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	-	1	-
CO-4	**Make use** of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	-	1,2	-
CO-5	**Estimate** the correlation, covariance using joint probability distributions. Also use student's t-	-	1,2	-

	distribution, Chi-square distribution as a test of goodness of fit.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.8	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

- Differentiation of Functions
- Integration of Functions.
- Basics of Probability
- Statistical Averages

Contents:

Unit-I

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic functions: Milne-Thomson method-Problems. **7 Hrs**

Unit-II

Conformal transformations: Introduction. Discussion of transformations: $w = e^z; w = z^2$, $w = z + \frac{1}{z}, z \neq o)$. Bilinear transformations- Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's Integral theorem. **8 Hrs**

Unit-III

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples. **8 Hrs**

Unit-IV

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression–problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the

form$= ax + b; y = ax^2 + bx + c; y = ax^b$. **8 Hrs**

Unit-V

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **8 Hrs**

Reference Books:

4) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint) 2016.
5) B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
6) Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016.
7) C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
8) S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010.
9) B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
10) N. P. Bali and Manish Goyal : A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2014.

18UCSC400 3	**ARM Processor**	**(3-0-0)**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Understand the use of interrupts & other advanced concepts related to ARM7

- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the features of embedded systems, architecture of ARM7 and applications.	-	1	-
CO-2	**Write** a program using the instruction set of ARM and THUMB state to solve the engineering problems.	-	2,5	13
CO-3	**Explain** the exception, interrupts and interrupt handling schemes and **write** program to solve simple problems.	-	3	-
CO-4	**Explain** the architectural features of LPC2148 microcontrollers.	-	1,2	13,15
CO-5	**Write** a program to interface hardware to LPC2148 microcontrollers.	-	5	3,12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.0	2.0	1.5	-	2.0	-	-	-	-	-	-	1.0	1.0	-	1.0	-

Pre-requisites: None

Contents:

Unit-I

ARM Embedded Systems and ARM Processor Fundamentals: Evolution of Microcontroller and Microprocessor, The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system

software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics. **9 Hrs**

Unit-II

ARM Instruction Set: Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status. **7 Hrs**

Unit-III

Introduction to THUMB and ARM Programming: Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan. **8 Hrs**

Unit-IV

Exception and Interrupt handling schemes: Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ exceptions with example- code for enabling and disabling IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design. **7 Hrs**

Unit-V

LPC2148 ARM CPU: Salient features, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units.

Peripherals - GPIO, PLL & Timers: Features, Register description with example and Applications. **8 Hrs**

Reference Books:

1) Andrew N. Sloss, ARM System Developer's guide, ELSEVIER Publications, 2016
2) William Hohl, ARM Assembly Language, CRC Press.
3) Steve Furber, ARM System-on-chip Architecture by, Pearson Education, 2012
4) James K. Peckol, Embedded Systems: A Contemporary Design Tool, 2008
5) Jonathan W. Valvano, Brookes / Cole, Embedded Microcomputer Systems, Real Time Interfacing, 1999

6) LPC 2148 USER MANUAL.

18UCSC401 Finite Automata and Formal Languages (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Study abstract computing machines, Language representation techniques, regular expressions, grammar constructions and associated theories and tools to realize formal language.
- Employ finite state machines to solve problems in computing.
- Comprehend the hierarchy of problems arising in the computer sciences.
- Understand the Turing theory and its significance.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Construct** a finite automaton for a given pattern and **explain** its working principles.	-	1,2,3,13	-
CO-2	**Write** regular expressions for given patterns and **explain** different techniques and principles used.	-	1,2,3,13	-
CO-3	**Verify** the properties of given languages using standard procedures and **explain** the language properties.	-	1,15	2, 4
CO-4	**Design** grammar for a given language specification and **explain** the design principles.	-	1,2,3,13	-
CO-5	**Write** lexical analyzer and parser for simple programming constructs using standard compiler writing tools.	-	1,2,3,5	-

CO-6	**Design and verify** pushdown automata for a given language specification and **explain** its underlying working principles.	-	1,2,3,15	-
CO-7	**Design and verify** Turing Machine for a given language specification and **explain** its underlying working principles.	-	1,2,3,15	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.0	1.9	2.0	1.0	2.0	-	-	-	-	-	-	-	2.0	-	2.0	-

Pre-requisites: Knowledge of Programming language (any)

Contents:

Unit-I

Introduction to Finite Automata: Structural Representation. The central concepts of Automata theory – Alphabet, Strings & Languages. Finite Automata: Introduction, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Equivalence of NFA and DFA, Applications of Finite automata, FA with Epsilon (ϵ) transitions. **8 Hrs**

Unit-II

Regular Expressions and languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions. Properties of Regular Languages (RL): Proving Languages not to be Regular. Closure properties of Regular Languages, Decision properties of Regular Languages, Equivalence and Minimization of Automata. **7 Hrs**

Unit-III

Context-Free Grammars (CFG) and Languages (CFL): Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Compiler Writing Tools: Structure of compiler writing tools like LEX and YACC. Simple programs on LEX and YACC. **9 Hrs**

Unit-IV

Pushdown Automata (PDA): Definition of Pushdown Automata, The languages of a PDA, Equivalence of PDA's and CFG'S, Deterministic Pushdown Automata. Properties

of Context Free Languages: Normal forms for Context Free Grammar, Pumping lemma for Context Free Languages, Closure properties of Context Free languages. **8 Hrs**

Unit-V

Turing Machines (TM): Introduction, Design of Turing Machine, Extensions to Basic Turing Machine. **7 Hrs**

Reference Books:

1) John E. Hopcroft, Rajeev Motwani & Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3rd Edition, 2013.
2) Elaine A.Rich, "Automata, Computability, and Complexity", Pearson Publication, 2007.
3) Alfred V Aho, Monica S. Lam, Ravi Sethi & Jeffrey D. Ullman "Compilers Principles, Techniques and Tools", Pearson Education, 2nd Edition, 2008.
4) John R. Levine and Tony Mason & Doug Brown, "UNIX programming tools", 2nd Edition, 1992.
5) Peter Linz, "An Introduction to Formal Languages and Automata", Narosa Publishing House, 5th Edition, 2011.
6) John Martin, "Introduction to languages and theory of computation", Tata McGraw-Hill, 4th Edition, 2010.

18UCSC402	**Object Oriented Programming**	**(4-0-0) 4**

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Object Oriented (OO) concepts/philosophy and its benefits and drawbacks in system development.
- Basic features of Java programming language to implement Object Oriented (OO) Key concepts like ADT/Encapsulation, reusability (Inheritance/Composite Objects), polymorphism etc., and other core basic features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial	**Moderate**	**Slight**

able to:		Level (3)	Level (2)	Level (1)
CO-1	**Prepare** an abstract data type for the given business scenario and **write** simple programs to represent ADT and **use** in the given application scenario**.**	13	1	-
CO-2	**Write** programs to solve given problem using different reusability features like inheritance and composite objects.	2, 14	1, 16	3
CO-3	**Write** a program to solve given problem using utility classes.	2, 14	1	3
CO-4	**Write** a program to solve given problem using abstract classes and differentiate with interfaces.	2, 14, 16	1	3
CO-5	**Write** a program to solve given problem using packages.	2, 14, 16	1	3
CO-6	**Write** a program to solve given problem using exception handling in construction of robust systems.	2, 14	1	3
CO-7	**Use** multithreading concept to solve conflicts due to interleaved execution of threads and write simple programs.	2, 14	1	3
CO-8	**Use** streams concept in developing system that needs facility for storage and retrieval of data.	2, 14	1	3
CO-9	**Design and Develop** GUI based system using applet, frames, events and other support available in AWT / Swings components.	2, 8, 14	1	3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	3.0	1.0	-	-	-	-	3.0	-	-	-	-	3.0	3.0	-	2.3

Pre-requisites: Knowledge of Programming language (any)

Contents:

Unit-I

Introduction to Object Oriented Paradigm (OOP): Object Oriented Philosophy, Key

Concepts of OOP, Encapsulation, Polymorphism, Inheritance. **9 Hrs**

Unit-II

Basic Features of Java - 1: Introduction to JAVA, Data Types, Variables and Arrays, String Handling in Java, Control Structures. **9 Hrs**

Unit-III

Basic Features of Java - 2: Classes, Objects, Methods, Constructors, Overloading methods, Methods and Classes, Inheritance, Packages and Interfaces. **12 Hrs**

Unit-IV

Core Features of Java - 1: Exception Handling, Multi-Threaded Programming, Streams. **10 Hrs**

Unit-V

Core Features of Java - 2: AWT and Swings, Applets, Events **12 Hrs**

Reference Books:

5) Herbert Schildt, "Java-The Complete Reference", 9th Edition, Tata McGraw Hill, 2014.
6) Grady Booch, "Object-Oriented Analysis and Design with Applications", 3rd Edition, Pearson Education, 2007.

18UCSC403 Analysis and Design of Algorithms (3-0-2) 4

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Analyze the performance of algorithms.
- Demonstrate familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to POs(1-12) / PSOs (13-16)

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the importance of algorithmic/mathematical approach in solving different types of problems.	-	1	-
CO-2	**Analyze** time and space complexity for a given algorithm.	2	-	1
CO-3	**Apply** and **analyze** brute force technique and compare it with other techniques.	2	5	3,13
CO-4	**Apply** and **analyze** divide and conquer technique and compare it with other techniques.	2	5	3,13
CO-5	**Apply** and **analyze** greedy technique and compare it with other techniques.	2	5	3,13
CO-6	**Apply** and **analyze** dynamic programming technique and compare it with other techniques.	2	5	3,13
CO-7	**Apply** and **analyze** backtracking and branch & bound technique and compare it with other techniques.	2	5	3,13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.5	3.0	1.0	-	2.0	-	-	-	-	-	-	-	1.0	-	-	-

Pre-requisites: Knowledge of Discrete Mathematics and Data Structures

Contents:

Unit-I

Introduction: Algorithm, Fundamentals of problem solving, Problem types, Principles of Algorithm Design. Analysis framework, Asymptotic notations, Mathematical analysis of Non recursive algorithms, Recurrence relations; Mathematical analysis of recursive analysis.

Brute force strategy: Selection Sort, Bubble sort, string matching **6L + 2P Hrs**

Unit-II

Divide and Conquer: Introduction and General method, Binary search, Merge sort, Quick sort, Matrix multiplication using Stressen's Matrix multiplication.

Basic Traversal and search techniques: Depth First search, Breadth First Search, connected components, labeling of components, Path. **6L + 2P Hrs**

Unit-III

Dynamic Programming: Introduction and General method, Computing a binomial coefficient, Warshall's algorithm, Floyd's algorithm, knapsack problem. **6L + 2P Hrs**

Unit-IV

Greedy Strategy: Introduction and General Method, Knapsack problem, Job sequencing with dead-lines, min cost spanning tree (Prim's & Kruskal's), single source shortest path. Huffman Tree. **6L + 2P Hrs**

Unit-V

Back tracking and Branch and Bound: Introduction General Method for both strategies Back Tracking: Sum of Sub sets, Knapsack problem, Traveling Sales person (TSP).

Limitations of Algorithm Power: Lower bound arguments, decision trees, P, NP and NP Complete Problems**.** **5L + 2P Hrs**

Reference Books:

5. Anany Levitin, "Introduction to the Design and analysis of algorithms", 3rd Edition, Pearson Education, 2011
6. Horowitz, Sahani et.al "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia Publication, 2004.
7. Marks Allen Weiss, "Data Structure and Algorithm Analysis", 3rd Edition, Pearson Education, 2009
8. Thomas H.Cormen, Charles E.Leiserson & Ronald L. Rivest, "Introduction to Algorithms", 2nd Edition, Prentice Hall of India, 2003.

18UCSC404	**Operating Systems**	**(4-0-0) 4**

Contact Hours: 52

Course Learning Objectives (CLOs): The contents of this course deal with the structure and working principles of generic operating systems at introductory

level, focusing on process management, memory management, file system and device management. It also focuses on architecture and programming aspects of Linux based OS at fundamental level.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the fundamental concepts of operating system and **Write** programs to demonstrate working principles of process/threads, related issues using system calls and standard libraries.	-	13,14	1,15
CO-2	**Compare** different scheduling algorithms.	-	2	3,13
CO-3	**Compare** and contrast various memory allocation strategies.	-	2	3,13
CO-4	**Explain** the structure and working principles of a file organization and **Write** programs to demonstrate the various file operations using system calls.	-	13,14	1,15
CO-5	**Explain** the structure and working principles of secondary storage and issues related to protection/access strategies.	-	13	1
CO-6	**Explain** the architecture and working principles of industry standard OS.	-	13	1

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	2.0	1.0	-	-	-	-	-	-	-	-	-	1.7	2.0	1.0	-

Pre-requisites: Knowledge of Computer Organization, Digital Electronics and Computer Programming at introductory level.

Contents:

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Unit-I

Process Management: Process concept; Process scheduling; Operations on processes; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling. **10 Hrs**

Unit-II

Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

Case Study: UNIX process synchronization **10 Hrs**

Unit-III

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Case Study: UNIX process/thread management and programming related to process creation, conflict management and IPCs using system calls and p-thread libraries.

10 Hrs

Unit-IV

Memory Management: 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.

Case Study:UNIX memory management. **10 Hrs**

Unit-V

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

Case Study: UNIX file structure and programming on various file operations like creation, listing attributes, directory listing and lock operations.

Secondary Storage Structures & Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems **12 Hrs**

Reference Books:

4. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.

5. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.

18UCSL405	**Object Oriented Programming Laboratory**	**(0-0-3) 1.5**

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Object Oriented (OO) concepts/philosophy and its benefits and drawbacks in system development.
- Basic features of Java programming language to implement Object Oriented (OO) Key concepts like ADT/Encapsulation, reusability (Inheritance/Composite Objects), polymorphism etc., and other core basic features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Prepare** an abstract data type for the given business scenario and **write** simple programs to represent ADT and **use** in the given application scenario**.**	13	1	-
CO-2	**Write** programs to solve given problem using different reusability features like inheritance and composite objects.	2, 14	1, 16	3
CO-3	**Write** a program to solve given problem using utility classes.	2, 14	1	3
CO-4	**Write** a program to solve given problem using abstract classes and differentiate with interfaces.	2, 14, 16	1	3
CO-5	**Write** a program to solve given problem using packages.	2, 14, 16	1	3
CO-6	**Write** a program to solve given problem using exception handling in construction of robust systems.	2, 14	1	3
CO-7	**Use** multithreading concept to solve	2, 14	1	3

	conflicts due to interleaved execution of threads and write simple programs.			
CO-8	**Use** streams concept in developing system that needs facility for storage and retrieval of data.	2, 14	1	3
CO-9	**Design and Develop** GUI based system using applet, frames, events and other support available in AWT / Swings components.	2, 8, 14	1	3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	3.0	1.0	-	-	-	-	3.0	-	-	-	-	3.0	3.0	-	2.3

Pre-requisites: Knowledge of: Registration/Completion of the course Object Oriented Programming.

Suggested Platforms:
Notepad (Non IDE), IDE (JCreator, Net Beans, Eclipse etc) in Windows OS and Linux OS

All programs should:

5. Be written to realize the Object Oriented Philosophy and core Java features.
6. Be written with Java Naming & Coding conventions and well documented.
7. Handle exceptions.
8. Be tested for all possible scenarios.

Course Contents:

Minimum one exercise to cover each course outcome specified above. Minimum 8 experiments to be completed by each student independently covering all course outcomes defined for this course. Course teacher has to publish list of experiments along with individual outcome for every experiments, on the first day of the semester. Examiner may set any problem based on the published term work during tests.

Reference Books:

5) Herbert Schildt, "Java: The Complete Reference: 7th Edition, Tata McGraw Hill, 2007.
6) Kathy Sierra & Bert Bates, "Head First Java", 2nd Edition, O'Reilly, 2009
7) Patrick Niemeyer & Daniel Leuck, "Learning Java", 4th Edition, O'Reilly, 2013
8) Laura Lemay & Charles L. Perkins, "Teach Yourself Java in 21 Days", 7th Edition, Sams Publishing, 2016

18UCSL406	**ARM Processor Laboratory**	**(0-0-3) 1.5**

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on the following learning perspectives:

- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Understand the use of interrupts & other advanced concepts related to ARM7
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Execute** assembly level codes for a given specific problem using ARM processor.	-	2, 4	3,15
CO-2	**Execute** embedded C programs for a given specific problem using ARM processor.	-	4,14	15,16
CO-3	**Implement** programs for interfacing with real world devices such as LCD's Keyboards, DAC, ADC, Relays Motors	13	4,5,16	3,12

	etc.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	2.0	1.0	2.0	2.0	-	-	-	-	-	-	1.0	3.0	2.0	1.0	1.5

Course Contents:

PART A: Conduct the following experiments to learn ALP using ARM:

- Arithmetic and logical operations
- Interrupts related operations
- Timer related applications.

PART B: Conduct interfacing experiments to learn embedded C for ARM:

- LCD- interfacing
- Stepper Motor Interfacing
- Real time sensors Interfacing
- 7-segment LED interface

Reference Books:

6. Andrew N. Sloss, ARM System Developer's guide, ELSEVIER Publications, 2016
7. William Hohl, ARM Assembly Language, CRC Press.
8. Steve Furber, ARM System-on-chip Architecture by, Pearson Education, 2012
9. James K. Peckol, Embedded Systems: A Contemporary Design Tool, 2008
10. Jonathan W. Valvano, Brookes / Cole, Embedded Microcomputer Systems, Real Time Interfacing, 1999
11. LPC 2148 USER MANUAL.

18UCSL407	Introductory Project	(0-0-2)
1		

Contact Hours:

24

Course Learning Objectives (CLOs): This course enables the student to identify the community expectations in terms of possible engineering solutions and prepare project proposal.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Identify** the societal problems	-	-	2,6,7,9,12,13
CO-2	**Analyze** real environment and **Formulate** the problem statement.	-	-	9,12,13
CO-3	**Conduct** exhaustive literature survey	-	-	9,12,13
CO-4	**Propose** sustainable engineering solutions	-	-	5,7,12,13
CO-5	**Prepare** the report and communicate effectively through presentation.	-	-	9,10,12,13
CO-6	**Manage** the project in terms of various resources in a particular discipline or in a multi-disciplinary domain.	-	-	11

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	1.0	-	-	1.0	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	-	-	-

Guidelines for conduction:

6. Team consists of 4-5 students.
7. Students have to choose a guide among the faculty members who are teaching their semester.
8. In consultation with guide, the team should carry out their project work.
9. Final evaluation is based on seminar and report submission.
10. This requires designated committee to monitor the process of conduction

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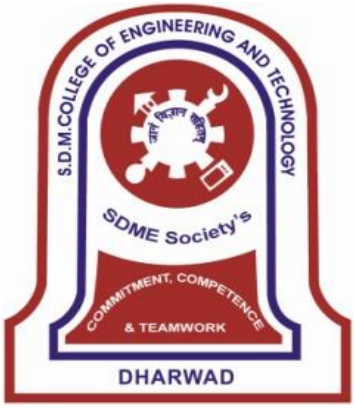
Academic Program - UG

V & VI Semester B.E.

Computer Science and Engineering



SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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Scheme of Teaching and Examination

V Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UHUC500	HU	Management, Entrepreneurship and IPR	**4-0-0**	4	50	100	3	-	-
18UCSC500	PC	Data Communication	**4-0-0**	4	50	100	3	-	-
18UCSC501	PC	Database Management Systems	**4-0-0**	4	50	100	3	-	-
18UCSC502	PC	Compiler Design and System Software	**3-0-0**	3	50	100	3	-	-
18UCSC503	PC	Software Engineering	**3-0-0**	3	50	100	3	--	--
18UCSL504	PC	Database Management Systems Lab	**0-0-3**	1.5	50	--	--	50	3
18UCSL505	PC	Compiler Design and System Software Lab	**0- 0 -3**	1.5	50	--	--	50	3
18UCSL506	PC	Minor Project-1	**0-0 – 2**	1	50	--	--	--	--
18UHUL507	HU	Soft skills/Aptitude	**0-0 – 2**	1	50	--	--	--	--
Elective Courses (One elective is to be chosen by the students)									
18UCSE508	PE	Advanced Object Oriented Programming	**3-0-0**	3	50	100	3	-	-
18UCSE509	PE	System Simulation and Modeling	**3-0-0**	3	50	100	3	-	-
18UCSE510	PE	Advanced Graph Theory	**3-0-0**	3	50	100	3	-	-
Total			**21-0-10**	**26**	**500**	**600**		**100**	

Note: BS- Basic Science, PC- Program Core, HU- Humanity Science, CIE- Continuous Internal Examination, SEE- Semester End Examination

L- Lecture, T-Tutorials, P-Practicals. *SEE for theory is conducted for 100 marks and is reduced to 50 marks

VI Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UCSC600	PC	Computer Networks	**4-0-0**	4	50	100	3	-	-
18UCSC601	PC	Object Oriented System Modeling and Design	**4-0-0**	4	50	100	3	-	-
18UCSL602	PC	Computer Networks Lab	**0-0-3**	1.5	50	-	-	50	3
18UCSL603	PC	Industry Oriented Programming Practices Lab	**0-0-3**	1.5	50	-	-	50	3
18UCSL604	PC	Minor Project-2	**0-0-4**	2	50	-	-	50	3
18UHUL605	HU	Soft skills/Aptitude	**0-0-2**	1	50	-	-	-	-
Elective Courses (Two Core Electives and One Open Elective are to be chosen by the students)									
18UCSE606	PE	Unix Systems Programming	**3-0-0**	3	50	100	3	-	-
18UCSE607	PE	Digital Image Processing	**3-0-0**	3	50	100	3	-	-
18UCSE608	PE	Principles of Programming	**3-0-0**	3	50	100	3	-	-
18UCSE609	PE	Data Mining	**3-0-0**	3	50	100	3	-	-
18UCSE610	PE	Advanced Data Structures and Algorithms	**3-0-0**	3	50	100	3	-	-
18UCSE611	PE	Pattern Recognition	**3-0-0**	3	50	100	3	-	-
18UCSO612	OE	Embedded Systems	**3-0-0**	3	50	100	3	-	-
Total			**17 - 0 -12**	**23**	**450**	**500**		**150**	

Note: BS- Basic Science, PC- Program Core, HU- Humanity Science, CIE- Continuous Internal Examination, SEE- Semester End Examination L- Lecture, T-Tutorials, P-Practicals. *SEE for theory is conducted for 100 marks and is reduced to 50 marks

18UHUC5004	Management, Enterprenuership, and IPR	(4-0-0)

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- The evolution of IT managementand related aspects.
- The scope of entrepreneurship in digital firms.
- The issues and procedures related to intellectual property rights.

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Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Study** the principles of management in a given organization.	-	2	-
CO-2	**Describe** and **analyze** the role of staffing and the need for motivation in management	-	2	-
CO-3	**Explain** the role of entrepreneur in establishing an organization.	-	2,6	-
CO-4	**Describe** the importance and provisions of institutional support in establishing an enterprise.	-	2,6	-
CO-5	**Explain** the core principles, procedures and related laws and **apply** IPR for given new idea/invention.	-	5,8,10	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	2.0	-	-	2.0	2.0	-	2.0	-	2.0	-	-	-	-	-	-

Pre-requisites: Knowledge of humanities course.

Contents:

Unit-I

Engineering and Management: Historical Development of Engineering and Management, Management as synthesis.

Planning, Forecasting and Decision Making: Nature of Planning, foundation of planning, some planning concepts, forecasting, nature of decision making, management science, tools for decision **10Hrs**

Unit-II

Organizing and staffing: Nature of organizing, traditional organizational theory, technology and modern organization structures, staffing technical organization, authority and power; delegation, meeting and committees. Motivation: Motivation, leadership, motivating and leading technical professionals. Controlling: Process of control, financial and non-financial controls. **11 Hrs**

Unit-III

Foundations of Entrepreneurship: Meaning of entrepreneur, functions of entrepreneur, types of entrepreneur, concept of entrepreneurship, role of entrepreneurs in economic development& barriers of entrepreneurship. Small Scale Industry: Definition, characteristics of SSI, role of SSI in economic development, advantages of SSI, steps to start an SSI, impact of liberalization, privatization, and globalization on SSI, definition of ancillary and tiny industry. **11 Hrs**

Unit-IV

Government and Institutional Support: Nature of support from government, objectives and functions of SSI, SIDBI, DIC, single window agency, KIADB, KSSIDC, KSFC. Preparation of Project: Meaning of project identification, project report, contents and formulation, identification of business opportunities, feasibility studies, types and purpose. **10 Hrs**

Unit-V

Intellectual Property Rights: Meaning and forms of intellectual property rights, competing rationale for protection, international conventions and security. Copyright: Meaning of copyright, content of copy right, ownership and rights, period of copyright, assignment and relinquishment of copyright, license, infringement of copy right, fair use, offenses and penalties. Patents: Concept of patent, patentable inventions, procedure for obtaining patent, rights and obligations of patent holders, infringements and remedies, offenses and penalties. Industrial Designs: Definition of design, procedure for registration, rights conferred by registration, infringements, Trademark and related issues. **10 Hrs**

Reference Books:

10) Kenneth C. Laudon and Jane P. Laudon, "Management Information Systems - Managing the Digital Firm", 8th Edition, Pearson Publications, 2017.

11) Making Intellectual Property Work for Business - Handbook for Chambers of Commerce and Business Associations Setting Up Intellectual Property Services by ICC and WIPO, Paperback, 2012.

18UCSC5004	Data Communication	(4-0-0)

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Evolution of network and internet.
- Protocols, applications pertaining to network and internet communication.
- Layered architecture and services.
- Network performance measurement and emerging technologies.

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Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the evolution and core operating principles of computer network in terms of architecture, functions, switching techniques and protocols.	-	1	2
CO-2	**Explain** the fundamental concepts of analog and digital communication	-	1	2, 13

	techniques; analyze the communication channels for errors.			
CO-3	**Explain** the core working principles of switching techniques and their applications.	-	1	2,13
CO-4	**Explain** the working principles of peer to peer and logical link control protocols in building networked space.	1	2	3, 13
CO-5	**Compare** and **contrast** the different Medium access control protocols for effective channel utilization.	-	1,2	3,13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.2	1.4	1.0	-	-	-	-	-	-	-	-	-	1.0	-	-	-

Pre-requisites: NIL

Contents:

Unit-I

Communication Networks, Services, applications and layered architectures: Evolution of Network Architecture and Services: Telegraph Networks and Message Switching, Telephone Networks and Circuit Switching, and the Internet, Computer Networks and Packet Switching, examples of Protocols, Services, and Layering: HTTP, DNS, and SMTP, TCP and UDP Transport Layer Services; The OSI Reference Model: The seven layer OSI Reference Model, Unified View of Layers, Protocols, and Services

Overview of TCP/IP Architecture: TCP/IP Architecture, TCP/IP Protocol: How the layer work together, Protocol Overview; Application Layer Protocols and TCP/IP Utilities **10Hrs**

Unit-II

Digital Transmission Fundamentals: Digital Representation of Information: Block-Oriented Information, Stream Information; Why Digital Communications ?: Comparison of Analog and Digital Transmission, Basic properties of Digital Transmission Systems; Digital Representation of Analog Signals: Bandwidth of Analog Signals, Sampling of

an Analog Signal, Digital Transmission of Analog Signals; Characterization of Communication Channels: Frequency Domain Characterization, Time Domain Characterization; Fundamental Limits in Digital Transmission: The Nyquist Signaling Rate, The Shannon Channel Capacity; Line Coding ;Modems and Digital Modulation: Binary Phase Modulation, QAM and Signal Constellations, Twisted Pair, Coaxial Cable, Optical Fiber, Radio Transmission, Infrared Light; Error Detection and Correction: Error Detection, Two Dimensional Parity Checks, Internet Checksum, Polynomial Codes, Standardized Polynomial Codes, Error Detecting Capability of a Polynomial Code. **12 Hrs**

Unit-III

Circuit Switching Networks: Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Wavelength-Division Multiplexing; SONET: SONET Multiplexing, SONET Frame Structure; Transport Networks: SONET Networks, Optical Transport networks; Circuit Switches: Space Division Switches, Time Division Switches; The Telephone Network: Transmission Facilities, End to End Digital Services. **10 Hrs**

Unit-IV

Peer-to-Peer Protocols and Data Link Layer: Peer-to-Peer Protocols: Peer –to-Peer Protocols and Service Models; ARQ Protocols and Reliable Data Transfer Service: Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ; Other Peer-to-Peer Protocols; Data Link Controls: Framing; Point to Point Protocol; HDLC Data link Control; Link Sharing using Packet Multiplexers: Statistical Multiplexing, Speech Interpolation and the Multiplexing of Packetized Speech. **10 Hrs**

Unit-V

Medium Access Control Protocols and Local Area Networks: The Medium Access Control Protocols: Multiple Access Communications; Random Access: ALOHA, Slotted ALOHA, CSMA, CSMA-CD; Scheduling Approaches to Medium Access Control: Reservation Systems, Polling, Token-Passing Rings; Channelization: FDMA, TDMA, CDMA. **10 Hrs**

Reference Books:

1) Alberto Leon Garcia & Indra Widjaja, “Communication Networks: Fundamental Concepts and Key architectures”, 2nd Edition, Tata McGraw-Hill, 2001
2) Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, Tata McGraw-Hill, 2017
3) William Stallings, “Data and Computer Communication”, 9th Edition, Pearson Publications, 2013

18UCSC501	Database Management Systems	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Data models and relational theories
- Database design, programming using SQL/PL-SQL, database architecture and transaction concepts.

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Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Compare** the traditional file system and Data Base approach	-	2,13	-
CO-2	**Identify** entities, attributes, their relationships and **prepare** ER model for the given application scenario.	2,3,13	-	15
CO-3	**Write** the queries using relational algebra for the given data manipulation requirement of an RDBMS.	2,3,13,14	-	15
CO-4	**Write** SQL queries using all the standard clauses, correlated queries, aggregate and date related functions for the given application scenario.	2,3,13,14	-	15
CO-5	**Write** triggers, stored procedures and functions for the given application scenario.	2,3,13,14	-	15
CO-6	**Design** database in appropriate normal form for a given application scenario.	2,3,13,14	-	15

CO-7	**Explain** the strategies to deal with the issues related to transaction management and to ensure ACID properties.		1,13	

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.8	3.0	-	-	-	-	-	-	-	-	-	2.7	3.0	1.0	-

Pre-requisites: Knowledge of

- Programming languages
- Set Theory
- File Systems
- Abstract application development process.

Contents:

Unit-I

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures;

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two. **10Hrs**

Unit-II

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Examples of Queries in Relational Algebra; Relational Database Design ER-to-Relational Mapping. **10 Hrs**

Unit-III

SQL: Data Definition and Data Types; DDL statements like creation and specification od table, DCL statements for Schema change, alter, delete etc; DML statements like Insert, Delete and Update statements in SQL etc and more complex statements for Basic queries Nested sub queries, Correlated sub queries. PL/SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL. **12 Hrs**

Unit-IV

Database Design – 1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Inference rule, Equivalence of sets, Minimal set cover. Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. **10 Hrs**

Unit-V

Database Design –2: Properties of Relational Decompositions; Dependency preservation, Lossless (non additive) join properties, Problem with null values and dangling tuples.

Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Check pointing.
10 Hrs

Reference Books:

1. Elmasri & Navathe, "Fundamentals of Database Systems", 6th Edition, Addison-Wesley, 2012.
2. Raghu Ramakrishnan & Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw-Hill, 2003.
3. Silberschatz, Korth and Sudharshan, "Data base System Concepts", 6th Edition, Mc-Graw Hill, 2010.
4. C.J. Date, A. Kannan & S. Swamynatham, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

18UCSC502	**Compiler Design and System Software**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This is a 3 credit course at undergraduate level enabling the students to understand structure of a compiler,representation

of patterns and syntax using lexical rules and grammars respectively, working of parsers, translation schemes, code optimization and code generation, working of assemblers, loaders, linkers and macro processor.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the basic structure and working principles of phases of compiler.	-	13	1
CO-2	**Write** a parser for the given input based on the appropriate parsing technique and **validate** the design	13,14	1,2,3	15
CO-3	**Generate** an optimized intermediate code.	-	1,2,3,13	15
CO-4	**Explain** the working principles of run time environments that include stack allocation, heap management and garbage collection technique used in compiler.	-	1,2,3,13	15
CO-5	**Generate** optimized code for the given intermediate code	-	1,2,3,13	15
CO-6	**Design** Assembler for the given language specification and **validate** the design.	-	1,2,3,13,14	15
CO-7	**Design** Macroprocessor for the given language specification and **validate** the design.	-	1,2,3,13,14	15
CO-8	**Explain** the working principles of Linkers & Loaders for the given language specification.	-	1,2,3,13,14	15

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping	1.9	2.0	2.0	-	-	-	-	-	-	-	-	-	2.1	2.3	1.0	-

Level																

Pre-requisites: Knowledge of

- Finite Automata and Formal languages
- Programming language (any)

Contents:

Unit-I

Introduction: Different Phases of Compilers, Comparison of Compilers and Interpreters. Top-down Parsing: RDP and Predictive parsing. **7 Hrs**

Unit-II

Bottom-up Parsing: Simple LR, LALR, CLR, parsers ambiguous grammars. **8 Hrs**

Unit-III

Intermediate Code Generation and Optimizations: Syntax-directed translation; Syntax-directed translation schemes, Variants of syntax trees; Three-address code; Types and declarations; Translation of expressions; Type checking; Control flow; Various techniques of machine independent optimization. **8 Hrs**

Unit-IV

Run-Time Environments: Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.
Code Generation: Issues in the design of Code Generator; The Target language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator **8 Hrs**

Unit-V

Ancillary Code Processing Techniques: Generic description of Assembler, Loader, Linker and Macro's. Assemblers: Basic Assembler Features & Functions and Design of assembler. Loaders and Linkers: Basic Loader Functions - Design of Loaders and Linkers Macro Processor: Design of Macro Processors. **8 Hrs**

Reference Books:

1) Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman,"Compilers-Principles, Techniques and Tools", 2/E, Addison-Wesley, 2007.
2) D.M.Dhamdhere, "System Programming and Operating Systems", 2nd revised edition, Tata McGraw - Hill, 2009 reprint.
3) Leland L Beck, "System Software : An Introduction to Systems Programming" 3rd Edition Pearson Education 2007
4) John J Donovan, "System Programming", Tata McGraw-Hill 2017

18UCSC503	**Software Engineering**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This is a 3 credit, 39 contact hours course at undergraduate level focusing on knowing the process of software system development and enables students to develop software system using engineering techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the properties of various critical systems and the quality parameters.	-	-	16
CO-2	**Describe** the different key practices of process models.	-	3,13	
CO-3	**Identify** various system requirements and **prepare** system specification reports to solve real life problems in various domains and **develop** domain expertise.	1,2,13	-	-
CO-4	**Conceptualize** the system through **design** and **modeling** the system architecture, components and processes with quality and	1,2,3,13	5	10,12

	standards.			
CO-5	**Develop** software system using engineering techniques, industry relevant tools and programming features/techniques.	1,2,3,13,14	5,15	10,11,12,16
CO-6	**Verify** and **validate** the given system using standard tools and techniques.	-	5,15	10
CO-7	**Manage** project in terms of risk, configuration/versions, Cost and Resources.	-	9,11	10

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	3.0	2.7	-	2.0	-	-	-	2.0	1.0	1.5	1.0	2.8	3.0	2.0	1.0

Pre-requisites: Knowledge of

- Basics of computer systems and its uses
- Programming language (any)

Contents:

Unit-I

Overview: Introduction: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.
Critical Systems, Software Processes: Critical Systems: A simple safety critical system; System dependability; Availability and reliability. Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering. **7 Hrs**

Unit-II

Requirement Engineering: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document. Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management. **7 Hrs**

Unit-III

System models: System Models: Context models; Behavioral models; Data models; Object models; Structured methods.

Software Design and Development: Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles. Object-Oriented design. UI Design Issues.
Rapid Software Development: Agile methods; Extreme programming; Rapid application development. Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution. **9 Hrs**

Unit-IV

Verification and Validation: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods. Software testing: System testing; Component testing; Test case design; Test automation. Testing Techniques: Equivalence Partitioning, Boundary Value Analysis,, Cause Effect Graphing, Test Generation from Predicates, Statement testing, Branch Testing, Condition Testing, Path Testing, Procedural Call Testing, Data Flow Testing. **9 Hrs**

Unit-V

Software Quality & Project Management: Various Software quality parameters and associated standards and procedures, Project Management activities; Project planning; Project scheduling; Risk management. Configuration Management, Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model. Software Cost Estimation: Productivity; Estimation techniques, Project duration and staffing. **7 Hrs**

Reference Books:

5. Ian Somerville, “Software Engineering”, 10/E, Person Education, 2016.
6. Roger Pressman, “Software Engineering, Practitioners approach”, 7/E, McGraw-Hill, 2010.
7. Bharat Bhushan Agarwal & Sumit Prakash Tayal, “Software Engineering”, 2nd Edition, Firewal Media Publications, 2007.
8. A.A.Puntambekar, “Software Engineering & Quality Assurance”, 1st Edition, Technical Publications Pune, 2010

18UCSL504 Database Management Systems Lab (0-0-3)1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on hands on experience on creation of data models, database design, programming using SQL/PL-SQL and development of an application using any high level language.

Course outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ PSOs (13-16)		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** entities, attributes, their relationships and **prepare** ER model for the given problem.	2, 3, 13	-	15
CO-2	**Design** database in appropriate normal form for the given problem.	2,3,13	-	15
CO-3	**Write** SQL queries using all the standard clauses, correlated queries, aggregate and date related functions for the given application scenario.	2,3,13,14	-	15
CO-4	**Write** the programs using advanced features of data base programming that includes PL/SQL, Cursors, Triggers, Stored procedures and Functions for given application scenario.	2,3,13,14	-	15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	3.0	3.0	-	-	-	-	-	-	-	-	-	3.0	3.0	1.0	-

Prerequisites: Registration for / Completion of: DBMS theory course

Contents:

Part A: Multiple standalone preparatory exercises to meet the course outcomes.

Part B: Project work (Standalone application or web enabled application) based on knowledge gained from theory course and part-A hands on experience.

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18UCSL505	Compiler Design and System Software Lab	(0-0-3)1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This laboratory course focuses on representation of patterns and syntax using lexical rules and grammars respectively, Implementation of parser & translation schemes, Implementation of assemblers, loaders, linkers & macro processor, Knowledge of system level APIs for implementation of IPC and system commands.

Course outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Prepare** the grammar for the given constructs and **Write** a program using compiler writing tools to implement lexical analyzer and parser.	13,14	1,2,3	15
CO-2	**Write** a program to **implement** a parser.	13,14	1,2,3	15
CO-3	**Write** a program to implement assembler functions.	13,14	1,2,3	15
CO-4	**Write** a program to **Implement** various UNIX commands using system calls.	13,14	1,2,3	15
CO-5	**Use** IPC concepts in implementing communication protocol.	13,14	1,2,3	15

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	3.0	3.0	1.0	-

Prerequisites: Knowledge of: Unix Operating System, Any programming language, and Finite automata and formal Languages

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Contents:

1. Programs on Lex and Yacc.
2. Implementation of parser.
3. Implementation of assembler.
4. Emulation of basic commands of UNIX using system calls.
5. Application development using Inter Process Communication.

18UCSL506	Minor Project - 1	(0-0-2)1

Contact Hours: 24

Course Learning Objectives (CLOs): This course enables the student to identify the community expectations in terms of possible engineering solutions and prepare project proposal.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the societal problems.	-	2,6,7,9,12,13	-
CO-2	**Analyze** real environment and **Formulate** the problem statement.	-	2,9,12,13	-
CO-3	**Conduct** exhaustive literature survey	-	2, 9,12,13	-
CO-4	**Propose** sustainable engineering solutions / prototypes.	-	3,5,7,12,13	-
CO-5	**Prepare** the report and communicate effectively through presentation.	-	8,9,10,12	-
CO-6	**Manage** the project in terms of various resources in a particular discipline or in a multi-disciplinary domain.	-	11	-

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	2.0	2.0	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	-	-	-

Guidelines for conduction:

1. Team consists of 4-5 students.
2. In consultation with guide, the team should carry out their project work.
3. Final evaluation is based on following evidence will be looked into and accordingly rubrics will be developed, such as problem statement, design, prototype/part of implementation, use of standard tools and techniques for testing and validation procedure.
4. This requires designated committee to monitor the process of conduction

18UHUL5071	**Soft Skills / Aptitude**	**(0-0-2)**

Contact Hours: 24

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSO(13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of communication in the profession.	-	10	-
CO-2	**Use** the English language with proficiency	-	10	12
CO-3	**Solve** Aptitude related problems	-	9	12
CO-4	**Demonstrate** the competency in the placement activities.	-	9	-

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-	-

Level																

Contents:

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

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ELECTIVES

18UCSE508 Advanced Object Oriented Programming (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on core and advanced Java language features that are part of JDK 8 and above.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Build** graphical user interface using JavaFX for a given problem.	13,14,15	-	1, 2,3, 5, 9,16
CO-2	**Develop** applications that involve parallel programming abilities using concurrent utility feature.	13,14,15	-	1, 2,3, 5, 9,16
CO-3	**Write** programs to solve a given problem using generics and collection Frameworks.	13,14,15	-	1, 2,3, 5, 9,16
CO-4	**Use** Java networking features to **write** applications that involve client / server interactions.	13,14,15	-	1, 2,3, 5, 9,16
CO-5	**Develop** an application that use appropriate driver classes to connect databases and **perform** database operations required as per problem specification.	13,14,15	-	1, 2,3, 5, 9,16
CO-6	**Develop** web-based applications using J2EE features like Servlets and JSP.	13,14,15	-	1, 2,3, 5, 9,16
CO-7	**Write** program using lambda expressions to solve given problem scenario.	13,14,15	-	1, 2,3, 5, 9,16
CO-8	**Write** program using stream APIs to solve given problem scenario.	13,14,15	-	1, 2,3, 5, 9,16

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	1.0	1.0	-	1.0	-	-	-	1.0	-	-	-	3.0	3.0	3.0	1.0

Pre-requisites: Knowledge of

- Basic features of Java
- Object oriented programming paradigm, its concepts and practices

Contents:

Unit-I

GUI programming with JavaFX: Introducing JavaFX GUI programming – JavaFX basic concepts, JavaFX application skeleton, the Application thread; Exploring JavaFX controls – ToggleButton, RadioButton, CheckBox, ListView, TextField, TreeView, disabling a control; Introducing JavaFX menus – menu basics, overview of MenuBar, Menu and MenuItem, create main menu, add mnemonics and accelerators to menu items, use RadioMenuItem and CheckMenuItem, create ContextMenu and Toolbar **7 Hrs**

Unit-II

Concurrent Utilities: concurrent API packages, using synchronization objects, phaser, using an executer, TimeUnit enumeration, concurrent collections, locks, atomic operations, parallel programming via Fork/Join framework.

Generics and Collections Framework: Generics - what are generics, a simple generics example, a generic class with two type parameters, general form of general class, bounded types, using wildcard arguments, creating a generic method; Collections Framework – collections overview, the collection interfaces, the collection classes, accessing a collection via an iterator, for-each alternative to iterators, spliterators, storing user-defined classes in collections. **9 Hrs**

Unit-III

Networking and RMI: networking basics, the networking classes and interfaces, InetAddress class, TCP/IP client sockets, HttpURLConnection class, TCP/IP server sockets, Datagrams; Remote Method Invocation (RMI) – A simple client/server application using RMI

J2EE Databases: the concept of JDBC, JDBC driver types, a brief overview of JDBC process, database connection, Statement objects, ResultSet class, ResultSetMetaData class **7 Hrs**

Unit-IV

Java Servlets: Introduction,benefits of Java servlets, a simple java servlet, anatomy of a Java servlet, deployment descriptor, reading data from a client, reading/writing HTTP

request/response headers; working with cookies, tracking sessions
Java ServerPages: Introduction,JSP tags, Request string, User sessions, cookies, session objects **9 Hrs**

Unit-V

Extended features of Java: Lambda Expressions – introducing lambda expressions, block lambda expressions, passing lambda expressions as arguments, lambda expressions and exceptions, lambda expressions and variable capture, method references; The Stream API – stream basics, reduction operations, using parallel streams, mapping, collecting, iterators and streams. **7 Hrs**

Reference Books:

1) Herbert Schildt, "Java: The Complete Reference", 10th edition, McGraw-Hill, 2017
2) Jim Keogh, "J2EE: The Complete Reference", McGraw-Hill, 2011
3) Gregory Brill, "CodeNotes for J2EE: EJB, JDBC, JSP, and Servlets", Random House Publishing Group, 2002.
4) John Hunt & Chris Loftus, "Guide to J2EE: Enterprise Java", Springer Publications, 2012.

18UCSE509 System Simulation and Modeling (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- To introduce students to basic simulation methods and tools for modelling and simulation of continuous, discrete and combined systems.
- The ability to analyze a system and to make use of the information to simulate various systems to improve the performance.
- Analytical methods (Markov Models and Queuing Networks) and simulation techniques (Monte Carlo Techniques and Event Driven Simulation) applied in performance modelling of communication systems and networks.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	**Conceptualize** the discrete system simulation with the aid of real time examples.	-	5,13	1,2,3,15
CO-2	**Write** a program to simulate a given scenario.	-	5,13,14	1,2,3,15
CO-3	**Apply** different statistical models available in simulation and their usage in specific applications.	-	5,13,14	1,2,3,15
CO-4	**Design** the queuing systems and **evaluate** the performance.	-	5,13	1,2,3,15
CO-5	**Identify** the distribution of data to adhere to fitness test and also analyze the corresponding simulation.	-	5,13	1,2,3,15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	1.0	1.0	-	2.0	-	-	-	-	-	-	-	2.0	2.0	1.0	-

Pre-requisites: Knowledge of Probability and Statistics

Contents:

Unit-I

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. Simulation examples: Simulation of queuing systems; Simulation of inventory systems; other examples of simulation. General Principles. **7 Hrs**

Unit-II

Concepts in Discrete-Event Simulation: The Event-Scheduling, Time-Advance Algorithm, World Views, Manual simulation Using Event scheduling; List processing. **7 Hrs**

Unit-III

Statistical Models In Simulation: Review of technology and concepts; Useful statistical models; discrete distributions; Continuous distributions; Poisson process; Empirical distributions. **8 Hrs**

Unit-IV

Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady state behavior of M/G/1 queue; Networks of queues. **8 Hrs**

Unit-V

Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; selecting input models without data; Multivariate and Time-Series input models.
Estimation of absolute performance: Types of simulations with respect to output analysis; stochastic nature of output data; Measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations. **9 Hrs**

Reference Books:

1) Banks, John S. Carson II, Barry L. Nelson- David M. Nicol, "Discrete-Event System Simulation", 5th Edition, Pearson Education, 2013.
2) J. A. Sokolowski, C.M. Banks, "Principles of Modeling and Simulation: A multidisciplinary Approach", John Wiley & Sons Publications, 2011.
3) Sheldon M. Ross, "Simulation", 4th Edition, Elsevier, 2006.
4) D.S.Hira, "System Simulation", 2nd Edition, S.Chand Publications, 2008.

18UCSE510 Advanced Graph Theory (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Isomorphism, Connected and Disconnected Graphs.
- Spanning trees and Cutsets.
- Planarity of Graphs.
- Chromatic Number and Polynomial.
- Directed Graphs.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Determine** whether the two graphs are isomorphic or not.	-	1,2	-

CO-2	**Prove** the properties of trees, cutsets and **determine** the spanning trees of a graph.	-	2,13	1
CO-3	**Determine** the planarity and dual of a graph.	-	2,13	1
CO-4	**Determine** the chromatic polynomial and chromatic number of a graph.	-	2,13	1
CO-5	**Explain** the principles of directed graphs and **represent** the digraphs in different forms.	-	2,13	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	2.0	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-

Pre-requisites: Knowledge of Discrete Mathematical Structures.

Contents:

Unit-I

Introduction to Graphs: Definition, Finite and Infinite Graphs, Incidence and Degree, Isolated vertex, Pendant Vertex, and Null graph.
Paths and Circuits: Isomorphism, Subgraphs, Walks, Paths, and Circuits, Connected and Disconnected Graphs, Operations on Graphs, Euler graphs, Hamiltonian Paths and Circuits **8 Hrs**

Unit-II

Trees and Fundamental Circuits: Trees, Fundamental properties of trees, Pendant vertices in a tree, Distance and Centres in a tree, Rooted and Binary trees, Spanning Trees, Finding all spanning trees in a graph, Spanning trees in a weighted graph, The matrix – tree theorem.
Cutsets: Introduction, Properties, All cutsets in a graph, Fundamental circuits and cutsets**,** The Chinese Postman problem. **8 Hrs**

Unit-III

Planar and Dual Graphs: Introduction to Planar graphs, Kuratowski's two graphs, Different representations of a Planar graph, Detection of Planarity, Geometric Dual.
8 Hrs

Unit-IV

Coloring: Chromatic number, Chromatic Partitioning, Chromatic Polynomial, Matchings, Coverings, The Four Color Problem, Brooks Theorem. **7 Hrs**

Unit-V

Directed Graphs: Definition, Types of Digraphs, Binary Relations, Directed Paths and Connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuits in Digraphs, Matrices A,B, and C of Digraphs, Adjacency matrix of Digraph, Random graphs. **8 Hrs**

Reference Books:

1. Narasingh Deo,"Graph Theory with Applications to Engineering and Computer Science", Dover Publications Inc 2016.
2. R.Balakrishnan & K.Ranganathan, "A Text Book of Graph Theory", 1st Edition, Springer Publications, 2000
3. Ralph P. Grimaldi "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education. 2006.
4. Kenneth H. Rosen "Discrete Mathematics and its Applications", 7th Edition, McGraw Hill, 2012.

VI Semester

18UCSC600 4	Computer Networks	(4-0-0)

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Various network services and switching networks.
- Protocol design, implementation and performance issues.
- Various network management issues and possible remedies.
- Virtual networks for security issues in Internet Protocol (IP).

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the communication services, protocols and algorithms of packet-switching networks.	-	1,2,13	-
CO-2	**Explain** the working of TCP/IP layered model of communication and **analyze** the traffic management.	4,5	1,2,13	14
CO-3	**Explain** the issues of internet routing protocols, VPN and overlay networks.	-	1,2,13	-
CO-4	**Explain** the working of ATM layered model of communication.	-	1,2,13	-
CO-5	**Explain** the need of network management services, associated security issues and **use** modern tools to **perform** network management.	4,5	1,2,13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	-	3.0	3.0	-	-	-	-	-	-	-	2.0	1.0	-	-

Pre-requisites: Knowledge of

- Data Communication
- Operating Systems

Contents:

Unit-I

Packet-Switching Networks: Network services and internal network operations, Packet network topology, Datagrams and virtual circuits, Routing in packet networks, Shortest-path routing, ATM networks. **10 Hrs**

Unit-II

Traffic management at the packet level: Traffic management at the flow level, Traffic management at the flow-aggregate level.
TCP / IP: TCP / IP architecture, The Internet protocol, User datagram protocol, Transmission control protocol. **12 Hrs**

Unit-III

Internet routing protocols, Multicast routing, DHCP, NAT and Mobile IP.
VPNs, Tunneling, Overlay Networks: Virtual Private Networks, Multiprotocol Label switching, Overlay networks. **10 Hrs**

Unit-IV

ATM Networks: Introduction to ATM networks, BISDN reference model, ATM layer, ATM adaptation layer, ATM signaling, PNNI routing, Classical IP over ATM**. 10 Hrs**

Unit-V

Network Management, Security: Network management overview, SNMP, Structure of Management information, MIB, Remote network monitoring, Overview of Security and cryptographic algorithms. **10 Hrs**

Reference Books:

1. Alberto Leon – Garcia & Indra Widjaja, "Communication networks – Fundamental Concepts and Key Architecture", 2nd Edition, Tata McGraw Hill, 2005.

2. Nader F.Mir, “Computer and Communication Networks”, 2nd Edition, Pearson Education, 2009
3. Behrouz A Forouzon, “Data Communications and Networking”, 10th Edition, Tata McGraw Hill, 2006
4. William Stallings, “Data and Computer Communication”, 8th Edition, Pearson Education, 2013.

18UCSC601 Object Oriented System Modelling and Design (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This is a 4 credit, 52 contact hours course at undergraduate level focusing on the process of object oriented system modeling, design, patterns and tools used in the industry to enable them to construct software system using various standards and techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** fundamental Object Oriented concepts in solving problems.	13,14	1,2,3,15	-
CO-2	**Analyze** problem scenario and **identify** classes/ Objects, their properties and associations.	13	1,2,3,5,15	-
CO-3	**Analyze** problem scenario and **model** the system using UML diagrams.	13	1,2,3,5,15	-
CO-4	**Evaluate** the quality of Object Oriented system in-terms of Cohesion, coupling, sufficiency, completeness and primitiveness.	-	16	15
CO-5	**Implement** Object Oriented model in any Object Oriented language.	13,14	1,2,3	15
CO-6	**Identify** and **apply** the appropriate patterns in solving problems.	-	13,16	1
CO-7	**Propose** the appropriate strategies	-	13,16	1

	to incorporate standard quality parameters in the design of a system.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.7	2.0	2.0	-	2.0	-	-	-	-	-	-	-	2.7	3.0	1.6	2.0

Pre-requisites: Knowledge of

- Object Oriented Programming Language (any)
- Software Engineering

Contents:

Unit-I

Review: Object Oriented Concepts and principles.

Introduction, modeling concepts, class modeling: Object Orientation, developments themes; Evidence for usefulness of developments; modeling history. Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

10 Hrs

Unit-II

Advanced class modeling, state modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips. State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

Advanced state modeling, interaction modeling: Advance state modeling: nested state diagrams; nested states; signal generalization; concurrency; a sample state model; relation of class and state models; practical tips. Interaction modeling: use case models; sequence models; activity models. Use case relationships; procedural sequence models; special constructs for activity models.

Evaluation: OO system quality in terms of Cohesion, coupling, sufficiency, completeness and primitiveness.

Implementation : OO design in appropriate language **12 Hrs**

Unit-III

Patterns–Part 1: Introduction; layers, pipes and filters, blackboard.Distributed systems: broker; interactive systems: mvc, presentation-abstraction-control. **10 Hrs**

Unit-IV

Patterns—Part2: Adaptable systems: microkernel; reflection. Structural decomposition**:** whole - part; organiz**a**tion of work: master - slave; access control: proxy. Others: Command Processor, View Handler, Forward Receiver, Client-Dispatcher-Server and publish Subscriber. **10 Hrs**

Unit-V

Quality: Functionality and architecture; architecture and quality attributes; system quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Styles. **10 Hrs**

Reference Books:

1) Michael Blaha & James Rumbaugh, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education, 2007.

2) Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad & Michael Stal, "Pattern-Oriented Software Architecture", A System of Patterns - Volume 1, John Wiley and Sons, 2006.

3) Len Bass, Paul Clements & Rick Kazman, "Software Architecture in Practice", 2nd Edition, Pearson Education, 2003.

4) Grady Booch et al, "Object-Oriented Analysis and Design with Applications", 3rd Edition, Pearson Education, 2007.

5) Ali Bahrami, "Object oriented systems development", McGrawHill, 1999.

6) Mary Shaw and David Garlan, "Software Architecture Perspectives on an Emerging Discipline", Prentice-Hall of India, 2007.

18UCSL602	**Computer Networks Lab**	**(0-0-3) 1.5**

Contact Hours: 36

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Configuration of networking devices.
- Troubleshooting IPv4 and IPv6 Addressing
- DHCP and DNS Servers

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to POs(1-12)/ PSOs (13-16)

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Configure** the Cisco networking devices like routers, switches, and hubs etc using commands.	13,14	1,2,3	5,15
CO-2	**Simulate** different topologies/network using Cisco Packet Tracer application.	13,14	1,2,3	5,15
CO-3	**Manage** IP addresses and troubleshooting	13,14	1,2,3	5,15
CO-4	**Manage** applications like Web, Email, DHCP, DNS and FTP.	13,14	1,2,3	5,15
CO-5	**Study** on Industry relevant tools to perform traffic management.	13,14	1,2,3	5,15
CO-6	**Write** C program using RFCs to implement standard protocol using TCP / IP.	13,14	1,2,3	5,15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	2.0	-	1.0	-	-	-	-	-	-	-	3.0	3.0	1.0	-

Pre-requisites: Knoweldge of Data Communication and Computer Networks (registration).

Contents:

Sl. No.	Term Work
T1	**Building a Simple Network:** Part 1: Set Up the Network Topology (Ethernet only) Part 2: Configure PC Hosts Part 3: Configure and Verify Basic Switch Settings **Learning Outcomes: [CO-1,2]**
T2	**Connecting a Wired and Wireless** Part 1: Connect to the Cloud Part 2: Connect Router0 Part 3: Connect Remaining Devices Part 4: Verify Connections Part 5: Examine the Physical Topology **Learning Outcomes: [CO-1,2]**

T3	**Troubleshooting IPv4 and IPv6 Addressing** Part 1: Troubleshoot First Issue Part 2: Troubleshoot Second Issue Part 3: Troubleshoot Third Issue **Learning Outcomes:[CO-2,3]**
T4	**Configuring IPv6 Addresses on Network Devices** Part 1: Set Up Topology and Configure Basic Router and Switch Settings Part 2: Configure IPv6 Addresses Manually Part 3: Verify End-to-End Connectivity **Learning Outcomes:[CO-2,3]**
T5	**Designing and Implementing a Subnetted IPv4 Addressing Scheme** Part 1: Design a Network Subnetting Scheme Part 2: Configure the Devices Part 3: Test and Troubleshoot the Network **Learning Outcomes:[CO-1,2,3]**
T6	**Web and Email** Part 1: Configure and Verify Web Services Part 2: Configure and Verify Email Services **Learning Outcomes:[CO-3,4]**
T7	**DHCP and DNS Servers** Part 1: Configure Static IPv4 Addressing Part 2: Configure and Verify DNS Records **Learning Outcomes:[CO-3,4]**
T8	**FTP Servers** Part 1: Configure FTP Services on Servers Part 2: Upload a File to the FTP Server Part 3: Download a File from the FTP Server **Learning Outcomes:[CO-3,4]**
T9	**Troubleshooting Connectivity Issues** The objective of this Packet Tracer activity is to troubleshoot and resolve connectivity issues, if possible. Otherwise, the issues should be clearly documented and so they can be escalated. **Learning Outcomes:[CO-1,2,3,4]**
T10	**Study** on Industry relevant tools to perform traffic management.

	Learning Outcomes:[CO-5]
T11	**Write** C program using RFCs to implement standard protocol using TCP / IP. **Learning Outcomes:[CO-6]**

18UCSL603 Industry Oriented Programming Practices Lab (0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- The study of the various programming practices through demonstration,
- The implementation in different programming paradigm/languages in terms of principles and benefits it offers in the system design and development.
- The coding guidelines encompassing all aspects of code development to enable them to be a professional software developer.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the various styles, standards of different programming paradigm and **Write** simple programs.	-	1,2,3,13,14,15	5
CO-2	**Write** simple programs to explain the code quality and assess the quality of the given code.	-	1,2,3,13,14,15	5
CO-3	**Illustrate** the need for parallelization of serial parograms and its impact on performance.	-	1,2,3,13,14,15	5
CO-4	**Write** simple scripts for given system administration.	-	1,2,3,13,14,15	5
CO-5	**Generate** the technical reports and effectively communicate through presentation slides and tools.	10	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	2.0	-	1.0	-	-	-	-	3.0	-	-	2.0	2.0	2.0	-

Pre-requisites: Knowledge of any computer programming and Software Engineering is essential. Introductory level exposure to different domains like OS, Network, DBMS, and Web Technology is desirable.

Contents:

Naming convention & consistency; comments; Consistent indentations; Spaces; Structure and its impact on readability and efficiency; Organization of: Programs, Function, File and folder. Guidelines for portability and performance; Separation of code and data; Documentation; Writing reusable codes; Programming Paradigm specific style and practices (Object orientation V/S procedural etc.).;Writing code with quality in terms of: Robustness, Maintainability, Testability, Adaptability, Availability, Usability, sufficiency, completeness, Primitiveness, Cohesiveness, and Coupling; Communications, Documentations, Proposals/ technical writing, Sharing of information in a group, Conduction of meeting/ review, versioning.

Note:

1. This course is to be conducted in the **laboratory** by demonstrating various programming/industry practices.
2. **Adjunct faculty** from industry may be used to give industry relevance to the course coverage.
3. Students are expected to **write programs / do the course work** using knowledge gained and prepare **reports** based on the course work assigned by a course teacher.
4. Students are expected to give presentation on a chosen topic approved by the course teacher. **Internal evaluation** is to be based on the **continuous evaluation** of each activity of the **course work, report** preparation and **presentation**.
5. Final evaluation (SEE) is to be based on oral exams based on implementation.

Reference Books:

1. Brain W. Kernighan & Rob Pike, “The Practice of Programming”, Pearson education, 2008.
2. Knowledge repository created by various industries available on the internet

18UCSL604 2	Minor Project - 2	(0-0-4)

Contact Hours: 48

Course Learning Objectives (CLOs): Though the specific objectives of this course depend on the Project chosen, below are the generic objectives of this course:

Understand the domain, Analyze through Modeling and Implementation through state of the art technology available. To know Software Engineering Principles: Modeling, Estimation, Design standards and architectural issues through use of Standards etc. Also, write modular programs and handle exceptions to provide reliable solutions, to test and verify the programs for different scenarios.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and **formulate** the problem.	11,12	1,2,8	6,7
CO-2	**Analyze** the problem scenario and **Design** the solutions to complex engineering problem using software engineering principles or appropriate research methodology.	11,12, 13	2,3,5,8,16	6,7
CO-3	**Identify** and **Implement** a feasible solution using appropriate technology, tools, procedures and techniques.	11,12,14	3,4,5,8,16	-
CO-4	**Verify** and **Validate** the proposed system for correctness and to demonstrate compliance with the design and hence the stated requirements/ research gap.	11,12,15	5,8,16	-
CO-5	**Prepare** the report and	10,11	8,9	-

	communicate effectively through presentation.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	2.0	2.0	2.0	1.0	1.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0

Prerequisites: Knowledge of

- Software Engineering concepts
- Any Programming Language

Guidelines for the Conduction of Project Work:

A project may belong to any of the following categories:

1. Learning Centric: Here the output of the project activity is enhancement of the student's knowledge. Here the student chooses a work with the intension to gain the knowledge.

2. Application: Traditional Software Engineering project, with appreciable complexity. Scenario of demonstration had to be made clear and Completeness is important.

3. Product Base: The final output is a novel one which may be the assembly of several existing subsystems. Completeness is important till the user manual.

4. Research Oriented: A research problem of student's interest. Achievement would be a publication in the IEEE/ACM international/national conferences.

General Instructions to Students:

- Students are expected to perform extensive literature survey, identify problem statements and prepare synopsis in consultation with project guide/supervisor. Students are expected to submit Synopsis- Initial (Registration Phase-1) approved by project guide, to the project coordinator as per the schedule notified. A copy is to be maintained with students and the guide. This registration/ Initial synopsis contains the description of the project concept created and acts as a base line for design and Implementation of the system.
- Notification/schedules and evaluation procedures will be sent to all students in the Google groups created in the department.

- Batch size is of maximum 4 students. Mixing of divisions is not permitted unless it is the sponsored/research project and request is initiated by project supervisor/guide.
- Students may approach the faculty members of CSE department for choosing them as project guide/supervisor.
- A teacher can guide/supervise maximum of 2 UG project groups. However in special case, a DUGC (Project Coordinating Team, **PCT**, working on the behalf of DUGC) may assign additional project groups to a given teacher.
- The department will financially support presentations of publication of paper only for reputed conference publications.
- DUGC/Project coordinating team (**PCT**) may be consulted for any other/ missing information.

Evaluation Procedures:

a) CIE Marks for the project is to be awarded by project guide/supervisor and SEE marks are to be awarded by examiners (appointed by DUGC) and PCT based on the overall guidelines and project classifications/rubrics by looking into Software Engineering aspects & usefulness w.r.t research/innovation/technology/industry trends through formal interactions and presentations. However, each team is expected to give a formal complete presentation of their work at the end of each phase (1 to 4) to project coordinating team (PCT).
b) PCT evaluates the work and suggest the corrections and observation. All project teams are expected to incorporate these changes in their work. These observations will be made available to Project guides and SEE examiners, which will help them to evaluate and award marks during assessment process.
c) Project guides should keep track of all interactions they do with project team members on weekly basis.
d) All Projects are evaluated and individual students are awarded a grade based on the grading criteria set.
e) Individuals' grade/marks is decided based on both CIE and SEE marks/grade.
f) A project is considered for possible award of S grade; if and only if its 'research outputs' / 'product innovation outputs' results in to a publication of a paper. In a special case, innovative or sponsored business applications with focus on recent technological trends/ Industry trends catering for societal needs may be considered. If contents of paper/research output are not at satisfactory level, then, the assessment results in to appropriate lower grades.

g) A project is considered for possible award of A grade; if and only if it demonstrate product development skills in core system or systems level applications using all aspects of software engineering product development phases like: requirements, design, implementation, testing including standards like: use of design/architectural patterns, coding standards, use of tools for design/testing, programming practices, documentation and reporting etc..,. In a special case, innovative or sponsored business applications with focus on recent technological trends / Industry trends catering for societal needs may be considered.

h) If project work contribution/ output is not at satisfactory level, then the assessment results @ appropriate lower grades. All grades/marks are awarded based on individual contributions evaluated from software engineering perspectives **specified in the rubrics**.

i) Expected important features:

- Report preparation using Latex.
- Online plagiarism check report is to be enclosed in the report.
- Use of IEEE standard. Ex: reference listing and use of PPTs for presentation etc…
- Use of software tools. Ex: for Design, version control, UI design, Testing etc…
- Conduction of workshop/ training on technology/domain to students and Preparation of training material/manual (.doc & .pdf).
- Publication of paper based on outcome of the project.
- Submission of proposal to KSCST (Govt. of Karnataka) or other agencies for funding.
- Any other features suggested by guides/coordinators from time to time.

j) Marks Weightage and Various parameters for project evaluation for both CIE and SEE level @ 6th Semester.

k)

Sl.No.	Parameter for Assessment	Marks (%)
1	Requirements Analysis (SRS): Abstract and Detailed.	20
2	Design Specification; Use of: UML diagrams, architecture diagram, ER diagram, Patterns etc… Proper cohesiveness and coupling of various	35

	components in the system design.	
4	Use of Tools and standards.	5
5	Implementation: Code documentation, style, robustness, maintainability, Testability, Usability (User Experience) etc…	10
6	Testing: for every scenario of all use cases identified.	10
7	Final Oral Presentation (viva-voce) (IEEE Standards for slides, oral presentation techniques etc…)	10
8	Project Reports- Final and Intermediate if any: preparation using LATEX and plagiarism check	10

Note:

1. Sufficient and completeness of each parameter is to be seen while awarding marks for individual students.
2. Marks for individual students in a given project team may vary based on individuals 'learning outcomes.

- All project teams are expected to participate in the project exhibition arranged at department level. Project teams are expected to share their project experience to all their juniors and motivate them to take-up challenging work as their project work. During project exhibition, Top 2 projects from the batch will be awarded with a certificate of appreciation at the end of academic year.

18UHUL6051	**Soft Skills / Aptitude**	**(0-0-2)**

Contact Hours: 24

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSO(13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the significance of communication in the profession.	-	10	-
CO-2	**Use** the English language with proficiency	-	10	12
CO-3	**Solve** Aptitude related problems	-	9	12
CO-4	**Demonstrate** the competency in the placement activities.	-	9	-

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-	-

Contents:

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

ELECTIVES

18UCSE606	UNIX Systems Programming	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course facilitates the students to get familiarity with system calls, UNIX kernel structure and use of standards like ANSI and POSIX in programming.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the ANSI and POSIX standards used in UNIX operating system and programming	-	1	13
CO-2	**Explain** the UNIX file types and **demonstrate** the use of UNIX file APIs in programming.	13,14	1,2,3	15
CO-3	**Identify** the process management activities of UNIX and **write** programs that make use of processes and their environment.	13,14	1,2,3	15
CO-4	**Describe** the use of signals in UNIX and **illustrate** the use of signals in programs.	13,14	1,2,3	15
CO-5	**Explain** the need of daemons in UNIX and **identify** the use of daemons in UNIX OS.	13,14	1,2,3	15
CO-6	**Explain** inter process communication mechanisms of UNIX and **write** programs to demonstrate IPCs for client-server interactions.	13,14	1,2,3	15
CO-7	**Describe** the ANSI and POSIX standards used in UNIX operating system and programming.	-	1	13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Mapping Level	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	2.4	3.0	1.0	-

Pre-requisites: Knowledge of

- UNIX operating system and its commands
- Operating Systems Fundamentals
- Basics of Networking

Contents:

Unit-I

ANSI and POSIX Standards: UNIX and ANSI Standards – ANSI C standard, POSIX standards, POSIX environment, POSIX feature test macros, limits checking at compile time and run time; UNIX and POSIX APIs – POSIX APIs, UNIX and POSIX development environment, API common characteristics

UNIX Files: file types, UNIX and POSIX file systems, UNIX and POSIX file attributes, inodes in UNIX system V, UNIX kernel support for files, directory files, hard and symbolic links. **7 Hrs**

Unit-II

UNIX File APIs: General file APIs, open, read, write, close, fcntl, lseek, link, unlink, stat, fstat, lstat, access, chmod, fchmod, chown, fchown, lchown, utime, file and record locking, directory file APIs, device file APIs, FIFO file APIs, symbolic link file APIs. **7 Hrs**

Unit-III

Environment of a UNIX Process: Introduction, main function, process termination, command line arguments, environment list, memory layout of a C program, alloca function, environment variables, setjmp and lonjmp functions, getrlimit and setrlimit functions

Process Control: Introduction, process identifiers, fork function, vfork function, exit functions, wait and waitpid functions, race conditions, exec functions, changing user IDs and group IDs, system function. **9 Hrs**

Unit-IV

Process Relationships: Introduction, terminal logins, network logins, process groups, sessions, controlling terminal, job control

Signals and Daemon Processes: Signals – UNIX kernel support for signals, signal, signal mask, sigaction, sigsetjmp and siglongjmp APIs, kill, alarm, interval timers; Daemon Processes – introduction, daemon characteristics, coding rules, error logging, client-server model. **9 Hrs**

Unit-V

Interprocess Communication: Introduction, pipes, message queues, UNIX APIs for message queues, client-server example for message queue, sockets, socket APIs, client-server example for socket. **7 Hrs**

Reference Books:

1) Terrence Chan, "UNIX System programming using C++",Prentice Hall India, 2015

2) W. Richard Stevens, "Advanced Programming in the UNIX environment", Pearson Education/ PHI, 2005

3) Kay A Robbins & Steven Robbins, "Unix Systems Programming: Communication, Concurrency, and Threads", Prentice Hall Publications, 2003.

18UCSE607 Digital Image Processing (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning objectives:

- To learn fundamental theories and techniques of digital image processing.
- To acquire the skill necessary to explore advanced topics of digital image processing.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the principles of Digital Image Processing.	-	1,2	3,5,13,14
CO-2	**Demonstrate** the image enhancement techniques that include primitives image sensing and acquisition techniques, image formation, image representation &	13,14	1,2,3	15

	relationship between the pixels.			
CO-3	**Explain** the basic principles of mathematical morphology & **write** program to **extract** the characteristic features of image using morphological operations.	13,14	1,2,3	15
CO-4	**Apply** segmentation techniques for a given application scenario.	13,14	1,2,3	15
CO-5	**Explain** and **implement** the core princples of image representation techniques.	13,14	1,2,3	15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	1.8	-	1.0	-	-	-	-	-	-	-	2.6	2.6	1.0	-

Pre-requisites: Knowledge of

- Basics of Statistics
- Linear Algebra

Contents:

Unit-I

Digital Image Fundamentals - Introduction, Applications, Fundamental Steps in Digital Image Processing, Elements of visual perception, Image sensing and acquisition, Image Sampling and Quantization, Basic relationships between pixels.

8 Hrs

Unit-II

Intensity Transformations and Spatial Filtering - Basic Intensity Transformation Functions, Histogram Processing; Fundamentals of Spatial Filtering., Smoothing and Sharpening Spatial filters. **8 Hrs**

Unit-III

Morphological Image Processing- Erosion and Dilation, Opening and Closing, Hit or Miss Transforms, Basic Morphological Algorithms, GrayScale Morphology. **8 Hrs**

Unit-IV

Image Segmentation- Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds. **8 Hrs**

Unit-V

Representation and Description- Image Representation, Boundary and Regional Descriptors **7 Hrs**

Reference Books:

1. Rafel C Gonzalez & Richard E Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Milan Sonka, Vaclav Hlavac & Roger Boyle, "Image Processing, Analysis and Machine Vision", 2nd Edition, Thomoson Learning, 2001.
3. Anil K Jain, "Fundamentals of Digital Image Processing", Prentice-Hall of India Pvt. Ltd., 1997.
4. B.Chanda & Dutta Majumder, "Digital Image Processing and Analysis", Prentice-Hall, India, 2002.

18UCSE608	**Principles of Programming**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning objectives:

- Explain the value of declaration models, especially with respect to programming-in-the-large.
- Identify and describe the properties of a variable such as its associated address, value, scope, persistence, and size.
- Demonstrate different forms of binding, visibility, scoping, and lifetime management.
- Justify the philosophy of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
- Evaluate the trade offs between the different paradigms, considering such issues as space efficiency, time efficiency (of both the computer and the programmer), safety, and power of expression.
- Design, code, test, and debug programs using the functional paradigm.
- Outline the strengths and weaknesses of the logic programming paradigm.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ PSOs (13-16)		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the notations to describe syntax and semantics of programming languages.	-	-	1
CO-2	**Explain** the principles of imperative programming languages such as binding, scope, control structures, subprograms and parameter passing methods and **write** simple programs to demonstrate these for a given application.	13,14	1,2,3	15
CO-3	**Use** principles of object oriented programming features in writing the programs for the given problem scenario.	13,14	1,2,3	15
CO-4	**Write** the formal syntax for a specification of functional programming languages.	13,14	1,2,3	15
CO-5	**Write** programs in the Prolog language for given problem scenario.	13,14	1,2,3	15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.8	2.0	2.0	-	-	-	-	-	-	-	-	-	3.0	3.0	1.0	-

Pre-requisites: Knowledge of

- Programming language
- Mathematics

Contents:

Unit-I

Introduction: Toward higher-level languages, Programming paradigms, Language implementation: Bridging the gap, Expression notations, and Abstract syntax trees.

Types: Data Representation: Elementary data types – Data objects, Variables and Constants, Data types, Declarations, Type checking and type conversion. Numeric data types, Enumerations, Booleans, Characters. Structured data types - Structured data objects and data types, Specification of data structure types, Implementation of

data structure types, Vectors and arrays, Records. **8 Hrs**

Unit-II

Imperative Programming: Basic Statements, structured sequence control, handling special cases in loops, programming with variants, proof rules for partial correctness. Procedure activations – Simple call-return subprograms, Parameter passing methods, Scope rules for names, Nested scopes in the source text, Activation records, Lexical scope: Procedures as in C. **8 Hrs**

Unit-III

Object-Oriented Programming: Object-oriented design, Encapsulation and information-hiding, Separation of behavior and implementation, Classes and subclasses, Inheritance (overriding, dynamic dispatch), Polymorphism (subtype polymorphism vs. inheritance). **7 Hrs**

Unit-IV

Functional Programming: Lamda Calculus, Elements of functional programming – A Little language of expressions, Types: values and operations, Approaches to expression evaluation, Lexical scope, Type checking. Functional programming in a typed language -Exploring a list, Function declaration by cases, Function as first-class values, ML: Implicit types, Data types, Exception handling in ML. Functional programming with lists - Scheme, a dialect of lisp, The structure of lists, List manipulation. **9 Hrs**

Unit-V

Logic Programming: Predicate Logic: FOL, Computing with relations, Introduction to prolog, Data structures in prolog, Programming techniques, Control in prolog. **7 Hrs**

Reference Books:

1. Ravi Sethi, Programming languages, concepts & constructs Addison Wesley 2/E, 2009
2. Terrence W.Pratt, Programming languages Design and Implementation Pearson Education, 4/E, 2009.
3. Robert W Sebesta, Concept of Programming language Pearson Education, 11/E, Pearson Education, 2019

18UCSE609	Data Mining	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning objectives:

- Compare and contrast different conceptions of data mining as evidenced in both research and application.
- Explain the role of finding associations in commercial market basket data.
- Characterize the kinds of patterns that can be discovered by association rule mining.
- Describe how to extend a relational system to find patterns using association rules.
- Evaluate methodological issues underlying the effective application of data mining.
- Identify and characterize sources of noise, redundancy, and outliers in presented data.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the given scenario and **perform** data pre-processing using appropriate methods.	13,14	1,2,3	15
CO-2	**Predict** group membership for data instances using Hunt's algorithm, Rule based and Nearest Neighbor classification techniques**.**	13,14	1,2,3	15
CO-3	**Analyse** the data using Apriori and Non-Apriori based algorithms in order to determine **patterns** from the large data sets.	13,14	1,2,3	15
CO-4	**Explain** and **apply** the partitional and heirarchical clustering techniques for a given data set.	13,14	1,2,3	15
CO-5	**Illustrate** the statistical, proximity based and clustering based techniques to detect the outliers in	13,14	1,2,3	15

	the data set.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.8	2.0	2.0	-	-	-	-	-	-	-	-	-	3.0	3.0	1.0	-

Pre-requisites: Knowledge of Statistics at Introductory level

Contents:

Unit-I

Introduction and Basic Concepts: What is Data Mining? Motivating Challenges, The Origins of Data Mining, Data Mining Tasks.
Data: Types of Data, Data Quality, Data pre-processing, Measures of Similarity and Dissimilarity. **8 Hrs**

Unit-II

Classification: Preliminaries, General approach to solving a classification problem, Decision tree induction, Model over fitting, Evaluation of the performance of a classifier, Rule based Classification, Nearest Neighbour classifiers. **8 Hrs**

Unit-III

Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, FP tree Growth algorithm, Evaluation of Association Patterns. **8 Hrs**

Unit-IV

Cluster Analysis: Overview, K-means algorithm, Agglomerative Hierarchical Clustering, DBSCAN, Prototype-based Clustering. **8 Hrs**

Unit-V

Anamoly Detection: Preliminaries, Statistical approaches – Parametric and Non Parametric models, Proximity based approaches – Distance and Density based techniques, Clustering based techniques. **7 Hrs**

Reference Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 3rd Edition, Pearson Education, 2014.
2. Jiawei Han &MichelineKamber, “Data Mining – Concepts and Techniques”, 3rd Edition, Morgan Kaufmann Publishers, 2011.

3. Arun K Pujari, “Data Mining Techniques”, 3rd Edition, Universities Press, 2013.
4. K. P. Soman, S. Diwakar & V. Ajay, “Insight into Data Mining”, Prentice Hall India, 2008.

18UCSE610 Advanced Data Structures and Algorithms (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Asymptotic and Amortized Analyses
- Linear sorting algorithms
- Advanced data structures such as Heaps, B-trees, Red-Black trees etc.
- String matching algorithms

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the performance of the given algorithm using asymptotic notations and amortized techniques.	-	1,2	-
CO-2	**Explain** the working and assumptions of linear sorting methods and **apply** them to solve a given problem.	-	2,13	1
CO-3	**Compare** the working of string matching algorithms and **use** them appropriately in developing applications.	-	2,13	1
CO-4	**Build** and **perform** the operations on heap structures.	-	2,13	1
CO-5	**Build** and **perform** the operations on search structures.	-	2,13	1
CO-6	**Use** the hash tables for the implementation of dictionary operations.	-	2,13	1
CO-7	**Choose** the appropriate data structure and **use** relevant algorithms to solve problems in	-	2,13	1,11

	different domains including project management.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.1	2.0	-	-	-	-	-	-	-	-	1.0	-	2.0	-	-	-

Pre-requisites: Knowledge of

- Programming language (any)
- Data Structures
- Algorithms

Contents:

Unit-I

Introduction to Complexity Analysis: Review of Asymptotic notations and their properties, Amortized analysis – Aggregate, Accounting and Potential methods.
Linear Sorts: Counting Sort, Bucket Sort, and Radix Sorting with Analysis for all algorithms. **8 Hrs**

Unit-II

String Matching: Naive algorithm; Rabin-Karp algorithm; String matching with Finite automata, KMP algorithm, Boyer-Moore algorithm. **8 Hrs**

Unit-III

Heap Structures: Binomial heaps, Fibonacci heaps.
Search Structures: 2-3 trees, 2-3-4 trees, B-trees, B^+ trees, Red-black trees. **8 Hrs**

Unit-IV

Hashing: Direct Address Tables, Hash Tables, Collision Resolution by Chaining – Analysis, Hash Functions – Properties, Division and Multiplication methods, Universal Hashing, Open Addressing – Linear and Quadratic Probing, Double hashing. **8 Hrs**

Unit-V

Applications: Huffman coding, Garbage collection and compaction, Min-Cut Max-Flow algorithm, Activity networks. **7 Hrs**

Reference Books:

1. Thomas H.Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein- "Introduction to Algorithms", 3rd Edition, Prentice Hall India, 2009.

2. E. Horowitz, S.Sahni and Dinesh Mehta- "Fundamentals of Data structures in C++", Galgotia, 2006.
3. Anany Levitin, "Introduction to the Design and analysis of algorithms", 3rd Edition, Pearson Education, 2011

18UCSE611 3	**Pattern Recognition**	**(3-0-0)**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning objectives:

- Fundamentals of pattern recognition system
- Feature extraction and pattern classification algorithms.
- Unsupervised classification or clustering techniques
- Applications of pattern classification algorithm for a pattern recognition problem

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the basic structure and inherent issues of the pattern recognition problems.	-	1, 13	2, 3, 4
CO-2	**Apply** feature types and classification techniques like Bayesian classifier and its derivatives in solving problems.	-	1, 13	2, 3, 4
CO-3	**Compute** the probability density using parametric, non-parametric and linear discriminant functions.	-	1, 13	2, 3, 4
CO-4	**Distinguish** supervised learning	-	1, 13	2, 3, 4

	methods from the unsupervised ones and **apply** learning methods to the classifier design.			
CO-5	**Use** non metric methods to classify the models that can be described by logical rules.	-	1, 13	2, 3, 4
CO-6	**Apply** a suitable clustering method to solve a given problem.	-	1, 13	2,3, 4

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	1.0	1.0	1.0	2.0	-	-	-	-	-	-	-	2.0	-	-	-

Pre-requisites: Knowledge of Statistics, Linear Algebra and Programming

Contents:

Unit-I

Introduction: What is pattern recognition? Pattern Recognition System; The Design Cycle; Learning and Adaptation. Clustering vs. Classification; Applications;
Features: Feature vectors - Feature spaces - Problem of feature identification Feature selection and feature extraction. **8 Hrs**

Unit-II

Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.
Maximum-Likelihood and Bayesian Parameter Estimation: Introduction; maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models. **8 Hrs**

Unit-III

Non-Parametric Techniques: Introduction; Density Estimation; Parzen windows; K Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.
Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures. **8 Hrs**

Unit-IV

Support Vector Machines and Kernel based method: Introduction, obtaining the optimal hyperplane SVM formulation with slack variables; nonlinear SVM classifiers Kernel Functions for nonlinear SVMs; Mercer and positive definite Kernels. Support Vector Regression and ε-insensitive Loss function, examples of SVM learning. **8 Hrs**

Unit-V

Non-Metric Methods: Introduction; Decision Trees; CART; Recognition with Strings; Grammatical Methods.

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiably; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering. **7 Hrs**

Reference Books:

1) Richard O. Duda, Peter E. Hart, & David G.Stork, "Pattern Classification", 2nd Edition, Wiley-Interscience, 2012.
2) Earl Gose, Richard Johnsonbaugh, & Steve Jost, "Pattern Recognition and Image Analysis", Pearson Education, 2007.
3) V Susheela Devi & M NarsimhaMurthy, "Pattern Recognition - An Introduction", Universities Press, 2011.

18UCSO612	Embedded Systems	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Discuss the major components that constitute an embedded system.
- Implement small programs to solve well-defined problems on an embedded platform.
- Develop familiarity with tools used to develop in an embedded environment.

Course Outcomes (COs):

Description of the Course Outcome:	Mapping to POs(1-12)/ PSOs (13-16)

At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the design considerations in selecting components for embedded systems, both hardware and software.	-	13,14,15,16	1,2,3,4,5
CO-2	**Design** a system using industry relevant automation tools for the given application scenario.	13,14,15,16	1,2,3,4,5	-
CO-3	**Explain** the fundamentals of RTOS and its usage in firmware development for Embedded Systems.	-	13,14,15,16	1,2,3,4,5
CO-4	**Implement** basic kernel services of VxWorks and MicroC/OS-II	13,14,15,16	1,2,3,4,5	-
CO-5	**Explain** the basic philosophy and features of RISC V Processor instruction set.	-	13,14,15,16	1,2,3,4,5

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.4	1.4	1.4	1.4	1.4	-	-	-	-	-	-	-	2.4	2.4	2.4	2.4

Pre-requisites: Knowledge of

- Computer Architecture
- Microcontroller

Contents:

Unit-I

Introduction: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.Characteristics and Quality Attributes of Embedded Systems.

Hardware Software Co-Design and Program Modelling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language, Hardware Software Trade-offs. **9 Hrs**

Unit-II

Embedded Hardware Design and Development :EDA Tools, How to Use EDA Tool, Schematic Design – Place wire, Bus , port, junction, creating part numbers, Design Rules check, Bill of materials, Net list creation , PCB Layout Design – Building blocks. **7 Hrs**

Unit-III

Real-Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS **7 Hrs**

Unit-IV

An introduction to Embedded System Design with VxWorks and MicroC OS II RTOS **8 Hrs**

Unit-V

RISC V: Philosophy of RISC V**.** Introduction to instruction set architecture manual, volume 1. [Chapter 1 and 2] **8 Hrs**

Reference Books:

1) Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2012

2) James K Peckol, "Embedded Systems – A contemporary Design Tool", John Weily, 2008

3) The RISC-V Instruction Set Manual, Volume I: User Level ISA, Document Version 2.2

Academic Program - UG

VII & VIII Semester B.E.

Computer Science and Engineering

ACADEMIC AUTONOMY

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

Ph: **0836-2447465** **Fax: 0836-2464638** **Web:** www.sdmcet.ac.in

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Scheme of Teaching and Examination

VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
					CIE	Theory (SEE)		Practical (SEE)	
			L-T-P (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)
18UCSC700	PC	Artificial Intelligence and Machine Learning	**4-0-0**	4	50	100	3	-	-
18UCSC701	PC	Advanced Computer Architecture	**4-0-0**	4	50	100	3	-	-
18UCSL702	PC	Artificial Intelligence and Machine Learning Lab	**0-0-2**	1	50	--	--	50	3
18UCSL703	PC	Major Project Phase-1	**0- 0 -4**	2	50	--	--	50	3
18UCSL704	PC	Internship	**4weeks**	2	50	--	--	50	3
Elective Courses (Two electives are to be chosen by the students)									
18UCSE705	PE	Computer Graphics	**3-0-0**	3	50	100	3	-	-
18UCSE706	PE	Software Testing	**3-0-0**	3	50	100	3	-	-
18UCSE707	PE	Web Technology	**3-0-0**	3	50	100	3	-	-
18UCSE708	PE	Ad-hoc Networks	**3-0-0**	3	50	100	3	-	-
18UCSE709	PE	Operations Research	**3-0-0**	3	50	100	3	-	-
18UCSE710	PE	Multicore Architecture and Programming	**3-0-0**	3	50	100	3	-	-
18UCSE711	PE	Internet of Things	**2-0-2**	3	50	100	3	-	-
18UXXO7XX	OE	Open Elective – 2	**3-0-0**	3	50	100	3	-	-
Total			**14 - 0 - 6**	**19**	**350**	**400**	**-**	**150**	**-**

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VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)
18UCSC800	PC	Distributed Systems and Applications	**4 - 0 - 0**	4	50	100	3	-	-
18UCSL801	PC	Independent study	**0 - 0 - 2**	1	50	-	-	-	-
18UCSL802	PC	Major Project Phase - 2	**0 -0 - 14**	7	50	-	-	50	3
Elective Courses (Two electives are to be chosen by the students)									
18UCSE803	PE	Cryptography and Network Security	**3 - 0 - 0**	3	50	100	3	-	-
18UCSE804	PE	Cloud Computing	**3 - 0 - 0**	3	50	100	3	-	-
18UCSE805	PE	Network Management	**3 - 0 - 0**	3	50	100	3	-	-
18UCSE806	PE	Mobile Applications Development	**3 -0 - 0**	3	50	100	3	-	-
18UCSE807	PE	Ontology and Semantic Web	**3 - 0 - 0**	3	50	100	3	-	-
18UCSE808	PE	Data Science	**3 - 0 - 0**	3	50	100	3	-	-
18UCSO8XX	OE	Open Elective	**3 – 0 - 0**	3	50	100	3	-	-
Total			**10 – 0 – 16**	**18**	**250**	**300**	**--**	**50**	**--**

Note: BS- Basic Science, **PC**- Program Core, **HU**- Humanity Science, **CIE**- Continuous Internal Examination, **SEE**- Semester End Examination, **L**- Lecture, **T**-Tutorials, **P**-Practicals. *SEE for theory is conducted for 100 marks and is reduced to 50 marks.

The following are the open electives offered by the department (this list is subject to change depending on the market need and requirement).

Open Electives:

1. Introduction to Data Structures and Algorithms
2. Programming in Java/Python
3. Database Management Systems

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VII SEMESTER

18UCSC700 Artificial Intelligence and Machine Learning (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- To introduce the basic concepts, theories and state-of-the-art techniques of artificial intelligence and machine learning.
- Enable student with knowledge enough to be a self-learner in exploring the application of machine learning /AI algorithms in the different fields of science, medicine, finance etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the world, behavior of agents and problem-solving aspects of agents.	-	3,4	1,2
CO-2	**Demonstrate** the representation and usage of knowledge using First order logic.	-	3,4	1,2
CO-3	**Explain** the decision-making process with incomplete, inconsistent and everchanging facts.	-	3,4	-
CO-4	**Explain** machine learning concepts and range of problems that can be handled by machine learning.	-	3,4	-
CO-5	**Apply** the concepts of and the machine learning to the real-world problems.	-	-	3,4,5

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	1.0	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

1. Logic
2. Discrete Mathematics
3. Programming Fundamentals

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Contents:

Unit-I

Introduction: AI Problems Underlying Assumption, AI Techniques, Criteria for Success

State Space Search & Heuristic Search Techniques: Defining the Problems as A State Space Search, Production Systems, Production Characteristics, Issues in The Design Of Search Programs.

Generate And-Test: Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, and Means-ends Analysis. **11 Hrs**

Unit-II

Knowledge Representation: Issues, Representations and Mappings, Approaches to Knowledge Representation.

Using Predicate Logic: Representation Simple Facts in Logic, Representing, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules, Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. **11 Hrs**

Unit-III

Statistical Reasoning, Probability and Uncertainty: Bayes' Theorem, Full joint probabilistic distribution, Bayesian Networks and Probabilistic inferences, Dumpster Shafer Theory.

Forms of learning: Issues in designing a learning system. Assumptions of Common Machine Learning Models. **10 Hrs**

Unit-IV

Linear Regression: Multivariate Regression, Logistic regression, Polynomial Regression.

Linear Models for Classification: Decision Trees, Regression Trees, K-nearest neighbors (KNN) algorithm. Bias Variance Trade off. **10 Hrs**

Unit-V

Perceptron: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Support Vector Machines, Introduction, Early Models, Unsupervised learning and clustering – k-means clustering, hierarchical clustering. **10 Hrs**

Reference Books:

1) Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.

2) Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

3) Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman "The Elements of Statistical Learning".

4) Christopher Bishop, "Pattern Recognition and Machine Learning"

5) Mitchell Tom "Machine Learning", McGraw Hill, 1997.

18UCSC701 Advanced Computer Architecture (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the different computer architecture designs in the present scenario by considering performance parameters. Further, the concept of parallel processing and the relationship between parallelism and performance of different parallel architectures and software tools are emphasized. The concepts in memory hierarchy design and storage systems are also discussed.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the various performance characteristics of computer architectures with respect to theory of parallelism.	**4**	**1**	**-**
CO-2	**Explain** the working principles of processors, Memory hierarchy, Memory Consistency models.	**-**	**3**	**2**
CO-3	**Analyze** various cache memory organizations, **identify** the characteristics of shared memory organization and **illustrate** sequential and weak consistency models.	**5**	**1**	**13,16**
CO-4	**Identify** the generations of multi-computer architectures and **Analyze** the concept of message passing mechanisms.	**3**	**2**	**13,16**
CO-5	**Detect** the instruction level parallelism and **explain** the role of compiler in exploitation of ILP.	**2**	**3**	**1**

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.6	2.0	2.5	3.0	3.0	-	-	-	-	-	-	-	1.0	-	-	1.0

Pre-requisites: Knowledge of

- Computer Organization
- High level Programming
- Assembly Language Programming

Contents:

Unit-I

Theory of Parallelism: Parallel Computer Models,The State of Computing, Multiprocessors and Multicomputer, Multi-vector and SIMD Computers, Program and Network Properties,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. **12 Hrs**

Unit-II

Hardware Technologies: Processors and Memory Hierarchy: Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology **9 Hrs**

Unit-III

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models.

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design **9 Hrs**

Unit-IV

Parallel and Scalable Architectures: Multiprocessors and Multi computers - Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multi computers, Message-Passing Mechanisms. **10 Hrs**

Unit-V

Software for parallel programming: Parallel Program Development and Environments: Parallel Programming Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism: Computer Architecture, Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism, Operand Forwarding, Reorder Buffer, Register Renaming, Tomasulo's Algorithm, Branch Prediction, Limitations in Exploiting Instruction Level Parallelism, Thread Level Parallelism. **12 Hrs**

Reference Books:

1) Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability", 3rd Edition, McGraw Hill Education, 2015

2) John L. Hennessy and David A. Patterson "Computer Architecture: A quantitative approach" 5th Edition, Morgan Kaufmann, Elseveir 2013.

3) Richard Y.Kain, "Advanced Computer Architecture: A System's Design Approach", Pearson Publications, 2015

4) John D. Carpinelli, "Computer Systems Organization and Architecture", Pearson Publications, 2001

18UCSL702	Artificial Intelligence and Machine Learning Laboratory	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course is in line with the theory course Artificial Intelligence & Machine Learning (18UCSC700). It focuses on hands on experience on creation of data models, database design, programming using appropriate technology.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs(1-12) / PSOs(13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Represent** the Knowledge for the given scenario using appropriate tools techniques and language.	-	3,4,5	-
CO-2	**Identify** data preprocessing requirement of a given data set for the learning algorithms.	-	3,4,5	-
CO-3	**Demonstrate** of the strengths and weaknesses of regression and classification approaches in machine learning.	-	3,4,5	-
CO-4	**Demonstrate** unsupervised algorithms for clustering requirement on a data set from the real world using python.	-	3,4,5	-
CO-5	**Represent** the Knowledge for the given scenario using appropriate tools techniques and language.	-	3,4,5	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	-	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

1. Logic
2. Discrete Mathematics
3. Programming Fundamentals

Course Contents

This course is in line with the theory course Artificial Intelligence & Machine Learning (18UCSC700). There will be one problem with the **Knowledge**

Representation and four problems on **Machine Learning** (Linear Regression, Multilinear regression, Polynomial regression, Decision Tree, K-means clustering). The problems to be composed by the faculty are announced to the students. The student will analyze the problem, justify the requirement of AI Approach for the solution, choose the platform or technology for implementations and demonstrate all the steps involved like pre-processing the dataset, importing the dataset, Spitting the dataset into the training set and test set, training the model on the training dataset, predicting the test set results, Visualising the Training set results, Visualising the test set results, etc where ever applicable. The students will submit implementation, conduction and observation write up for each problem. An internal examination and 5 problems work will be used to grade the student's performance in this course.

Associated Lab Works (Sample)

1. Represent facts and relationships of any famous epic of your choice using first order logic, implement and demonstrate some queries.
2. Build a decision tree for the case of SDMCET students' performance based on the IA-1, IA-2, IA-3, CTA, Attendance, SEE marks (optional) and classifying them into one of the Grade S, A, B, C, D, E & F. Study of precision of classification by including the 10th, 12th and CET/COMED-K into consideration.
3. Given the features of an email like , Sender's email ID, Number of typos in the email, Occurrence of words like "offer", "prize", "free Gift", classify the email as Spam or not. Use the feature vector to train a Logistic classifier which emits a score in the range 0 to 1. If the score is more than 0.5, we label the email as spam. Otherwise, we don't label it as spam.
   (https://magoosh.com/).
4. Linear or polynomial regression to predict the salary of a person given the designation, no of years of experience, location of work, previous financial years profit etc.
5. A Hospital Care chain wants to open a series of Emergency-Care wards within a region. We assume that the hospital knows the location of all the maximum accident-prone areas in the region. They have to decide the number of the Emergency Units to be opened and the location of these Emergency Units, so that all the accident-prone areas are covered in the vicinity of these Emergency Units. The challenge is to decide the location of these Emergency Units so that the whole region is covered. Here is when K-means Clustering comes to rescue! (https://www.edureka.co/blog/k-means-clustering/)

18UCSL703	Major Project – Phase 1	(0-0-4) 2

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

Understand the domain through proper modeling and analysis using the state-of-art technology. Then apply relevant Software Engineering Principles to develop modular and robust applications through the use of Standards and tools. At the end build appropriate test cases, verification and validation techniques in order to make the project reliable and maintainable.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the problem and **formulate** the problem statement.	1, 8, 2,12	-	-
CO-2	**Analyze** the problem scenario and **Design** the solutions to complex engineering problem using software engineering principles or appropriate research methodology.	3,5, 8, 13,12	11, 16	6, 7
CO-3	**Identify** and **Implement** a feasible solution using appropriate technology, tools, procedures and techniques.	4,5, 8, 14,12	16	-
CO-4	**Verify** and **Validate** the proposed system for correctness and to demonstrate compliance with the design and hence the stated requirements/ research gap.	5, 8, 15,12	-	-
CO-5	**Prepare** the report and **communicate** effectively through presentation.	8, 9,10	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	3.0	3.0	3.0	3.0	3.0	1.0	1.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0

Prerequisites: Different programming languages / tools, Software Engineering Principles

Marks Weightage and Various parameters for project evaluation for both CIE and SEE level @ 7th and 8th Semester:

Sl.No.	**Parameter for Assessment**	**% Weight For CIE and SEE**

		7th Sem	8th Sem
1	**Requirements Analysis (SRS):** Abstract and Detailed.	20	10
2	**Design Specification:** Use of UML diagrams, architecture diagram, ER diagram, Patterns etc. Proper cohesiveness and coupling of various components in the system design.	35	10
4	Use of Tools and standards.	5	5
5	**Implementation:** Code documentation, style, robustness, maintainability, Testability, Usability (User Experience) etc.	10	20
6	**Testing:** for every scenario of all use cases identified.	10	10
7	**Final Oral Presentation** (viva-voce) (IEEE Standards for slides, oral presentation techniques, etc.)	10	10
8	**Project Reports** - Final and Intermediate if any: preparation using LATEX and plagiarism check	10	20
9	**Preparation of Learning Materials** (.doc & .pdf) & **Videos**: Uploading through Department Channel on YouTube. **Knowledge Transfer**: through conduction of workshop and training programs	-	10
10	**Publication of paper / Equivalent Effort** (@IEEE or equivalent or higher)	-	5

References:

1. Grady Booch, “Object-Oriented Analysis and Design with Applications”, Second Edition, Addison-Wesley Publications.
2. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Third Edition, Springer Publications.
3. Project Manual, prepared by the CSE Department, S D M College of Engineering and Technology, Dharwad

18UCSL704 Internship 2 Credits

Contact Hours: 4 weeks

Course Learning Objectives (CLOs): Internship provides an opportunity to get industry exposure to real time scenarios that include professional skill development programs and adhere to the professional standards.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explore** the domain knowledge	1, 8, 2,12	-	-
CO-2	**Apply** the knowledge and skills in the professional career.	3,5, 8, 13,12	11, 16	6, 7
CO-3	**Prepare** a technical report	4,5, 8, 14,12	16	-
CO-4	**Demonstrate** the knowledge gained through presentation.	5, 8, 15,12	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	3.0	3.0	3.0	3.0	1.0	1.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0

Prerequisites: Knowledge of both theory and practical courses learnt in all the previos semesters and relevant value-added information.

ELECTIVES

18UCSE705 Computer Graphics (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course introduces fundamental principles of computer graphics, its architecture and how transformations of objects are carried out. It facilitates students to identify good design principles to solve challenges involved in simulating real world objects/conditions. It also provides the students to learn and apply the aspects of interaction with computer and exposes them to open-source tools like OpenGL.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs(13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the principles of Computer Graphics Architecture used in industry relevant tool like OpenGL.	-	13,14	1,2,12

CO-2	**Explain** the design objectives of APIs used in OpenGL.	-	14,12	1,5
CO-3	**Apply** input interaction techniquesused in graphics environment.	14	2	-
CO-4	**Apply** affine transformations to solve problems relating to object transformations.	13	14	1
CO-5	**Discriminate** the views of objects in parallel and perspective projections under various lighting conditions.	-	13	14
CO-6	**Formulate** mathematical strategies for scan conversion algorithms to realize basic primitives, and **represent** curve and surfaces.	13,14	-	1,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	1.5	-	-	1.0	-	-	-	-	-	-	1.3	2.5	2.1	-	-

Pre-requisites: Knowledge of

- Basic Engineering Graphics
- Linear Algebra (Scalars, Vectors, Matrices)
- Algorithms and C programming.

Contents:

Unit-I

Introduction : Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics. Graphics Programming: The Sierpinski gasket; Programming two dimensional applications

Input and Interaction: Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations. **9 Hrs**

Unit-II

Geometric Objects and Transformations: Scalars, points, and vectors; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling; Transformations in homogeneous coordinates; Concatenation of transformations; Interfaces to three-dimensional applications. **9 Hrs**

Unit-III

Viewing and Lighting : Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL, Hidden surface removal; Parallel-projection matrices; Perspective-projection matrices.
OpenGL: Introduction to OpenGL; Programming two-dimensional Application; The OpenGL API; Primitives and Attributes; Color; Control Functions. **7 Hrs**

Unit-IV

Basic Raster Graphics Algorithms for drawing 2D primitives : Scan converting lines, circles, Filling Rectangles, Polygons; Clipping in a raster world; Clipping lines, polygons; Anti-aliasing **7 Hrs**

Unit-V

Lighting and Shading: Light and matter; Light sources; The Phong lighting model.
Representing Curves and Surfaces: Parametric Cubic Curves – Hermite Curves, Bézier Curves. **7 Hrs**

Conduction of Practical Sessions: Practical Sessions to be held with the focus of learning Open Source Tools like OpenGL and its API features. For the successful completion of the course, students are expected to undertake project to explore advanced features of Open Source Tools like OpenGL.

Reference Books:

1) Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", 5th Edition, Addison-Wesley, 2008
2) James D Foley, Andries Van Dam, Steven K Feiner & John F Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Addison-Wesley, 1997.
3) Edward Angel & Dave Shreiner, "Interactive Computer Graphics A Top-Down Approach with Shader-Based OpenGL", 6th Edition, Addison-Wesley, 2012
4) F.S. Hill, Jr., "Computer Graphics Using OpenGL", 2nd Edition, Pearson Education, 2005
5) Donald Hearn and Pauline Baker, "Computer Graphics- OpenGL Version", 2nd Edition, Pearson Education, 2003

18UCSE706 Software Testing (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course discusses the notations and terminologies used in software testing with Principles of programming, Software Development Process from the perspective of quality, maintenance, testing, programming style. Further, it focuses on System quality through: requirements, design, coding, verification and validation procedures and applications, case studies, use of tools / programming techniques for design and implementation.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Map** inputs to the expected outputs of the system by understanding the system behavior represented in the form of: requirements and design specifications / Models.	1, 13	-	-
CO-2	**Design** test cases based on requirement specifications.	2, 14	1	-
CO-3	**Design** test cases based on traditional design specifications.	-	3, 13	-
CO-4	**Design** test cases based on Object specifications/Models (UML).	13	3	-
CO-5	**Write** script in any programming Language/Tools to implement test cases designed.	14	15	-
CO-6	**Design** test cases based on various testing strategies to check the correctness of computer program.	-	15, 13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.5	3.0	2.0	-	-	-	-	-	-	-	-	-	2.5	3.0	2.0	-

Pre-requisites: Knowledge of

- Programming language
- Software Engineering
- Object Oriented System Analysis and Design

Contents:

Unit-I

Programming Practice: A Testing Perspective: Programming Principles & Guidelines, Coding Processes, Refactoring, Verifications & Metrics, Style- Names, Expression and Statements, Consistency and Idioms, Function Macros, Debugging, Performance, Portability

Basics of Software Testing: Human Errors and Testing, Software Quality, Requirements, Behavior and Correctness, Correctness versus Reliability, Testing and Debugging, Test Metrics, Software and Hardware Testing, Testing and Verification, Defect Management, Execution History, Test generation Strategies, Static Testing. Model-Based Testing and Model Checking, Control-Flow Graph, Types of Testing, The Saturation Effect. **9 Hrs**

Unit-II

Test Generation from Requirements: Introduction; The Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis, Category-Partition Method, Cause-Effect Graphing, Test Generation from Predicates. **7 Hrs**

Unit-III

Dependence, Data Flow Models and Data Flow Testing: Definition-Use pairs; Data flow analysis; Classic analysis; From execution to conservative flow analysis; Data flow analysis with arrays and pointers; Inter-procedural analysis; Overview of data flow testing; Definition- Use associations; Data flow testing criteria; Data flow coverage with complex structures; The infeasibility problem. **7 Hrs**

Unit-IV

Structural Testing: Overview; Statement testing; Branch testing; Condition testing, Path testing; Procedure call testing; Comparing structural testing criteria; The infeasibility problem.

Test Case Selection and Adequacy Test Execution: Overview; Test specification and cases; Adequacy criteria; Comparing criteria; Overview of test execution; From test case specification to test cases; Scaffolding; Generic versus specific scaffolding; Test oracles; Self-checks as oracles; Capture and replay **9 Hrs**

Unit-V

Testing Object Oriented Software: Issues in Testing OO Software, Intra Class Testing, Testing with State Machine Models, Inter-Class Testing, Structural Testing of Class **7 Hrs**

Reference Books:

1) Brain W. Kernighan & Rob Pike, “The Practice of Programming”, Pearson education, 2008.
2) Pankaj Jalote & Narosa, “An Integrated Approach to Software Engineering”, 3rd Edition, Publishing House.
3) Edward Kit, “Software Testing in the Real World”, Pearson Education, 2006
4) Aditya P Mathur, “Foundations of Software Testing”, Pearson Education, 2008.
5) Mauro Pezze, Michal Young, John Wiley & Sons, “Software Testing and Analysis: Process, Principles and Techniques”, 2008.

18UCSE707	Web Technology	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course emphasizes on practice-based learning. It enables the students to understand the web application architecture and use the state-of-the-art technology to provide web-based solutions.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs(13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Design** and **develop** a static web pages using XHTML.	5	2,3,13,14,15	12
CO-2	**Design** and **develop** dynamic web application to validate and store data using markup languages like-XML, DTD & XSD.	5	2,3,13,14,15	12
CO-3	**Design** and **develop** an interactive web application using JavaScript and XHTML with CSS.	5	2,3,13,14,15	12
CO-4	**Design** and **develop** dynamic web application using server-side programming and Database connectivity.	5	2,3,13,14,15	12
CO-5	**Develop** a web service to represent the data in the standard formats for the given requirements.	5	2,3,13,14,15	12
CO-6	**Explain** the future of World Wide Web and its associated trending technologies.	-	5, 13	1,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	2.0	2.0	-	3.0	-	-	-	-	-	-	1.0	2.0	2.0	2.0	-

Pre-requisites: Knowledge of

- Programming language (any)
- Database Management Systems

Contents:

Unit-I

Introduction to Web: WWW1.0, HTML, HTML5, XHTML, XML, XSD, DTD, DOM-XML. **8 Hrs**

Unit-II

Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.
Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **8 Hrs**

Unit-III

Introduction to JavaScript: Basics, Strings, Arrays, Functions, Objects in JavaScript, building simple applications using JavaScript and HTML. **8 Hrs**

Unit-IV

Introduction to PHP: Introduction to PHP, Datatypes, Control Statements, Loops, Functions, Embedding PHP in HTML & MySQL. **8 Hrs**

Unit-V

Introduction to Web 2.0: Overview of WWW 2.0, JSON, Web Services - SOAP & WSDL, RESTful.
Introduction to AJAX: Basics of AJAX, Asynchronous and Synchronous message transformation.
Future of Web: Overview of Semantic Web, Applications of Semantic Web, Virtual Reality, Web OS. **7 Hrs**

Reference Books:

1) Robert W. Sebesta, Programming the World Wide Web, 7/E Pearson Education, 2012.
2) Luke Welling, Laura Thomson, PHP and MySQL Web Development, 5th Edition, Pearson Education, 2016.
3) Nicholas C Zakas, Professional JavaScript for Web Developers, 3rd Edition, Wrox/Wiley India, 2012.
4) Nicholas C Zakas et al, Professional AJAX, Wrox, 2007.
5) Karin K. Breitman, Marco Antonio Casanova and Walter Truszkowski, Semantic Web: Concepts, Technologies and Applications, Springer International Edition, 2007.

18UCSE708	Adhoc Networks	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course covers major aspects of wireless ad hoc networks, from design through performance issues to application requirements. It starts with characteristics features, applications of wireless ad hoc networks, different types of routing protocols and understanding the security issues and various QoS requirements.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the design issues of protocol stack.	-	3,13	-
CO-2	**Compare** the architecture and working of various MAC layer protocols.	-	16	1,14
CO-3	**Apply** the knowledge of different routing mechanisms for the better routing decisions in WANETs.	3,13,16	-	-
CO-4	**Apply** the knowledge of different transport layer protocols for ensuring reliable communication in WANETs.	3,13	16	15
CO-5	**Identify** the challenges in security and QoS issues in WANETs and explain suitable solutions for the same.	-	2	1,16

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	2.0	2.7	-	-	-	-	-	-	-	-	-	2.7	1.0	1.0	1.7

Pre-requisites: Knowledge of

- Data Communications
- Computer Networks
- C programming

Contents:

Unit-I

Adhoc Networks: Introduction, Issues in Adhoc wireless networks, Adhoc wireless internet.

MAC–1: MAC Protocols - Introduction, Issues in designing a MAC protocol, Design goals of a MAC protocol for Adhoc wireless networks. **7 Hrs**

Unit-II

MAC–2: Classification of MAC protocols, Contention based protocols with reservation mechanisms; Contention based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. **7 Hrs**

Unit-III

Routing: Proactive and Reactive Routing Protocols, Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols. **9 Hrs**

Unit-IV

Transport Layer: Protocols - Introduction, Issues in designing a transport layer protocol, Design goals of a transport layer protocol, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols. **9 Hrs**

Unit-V

Security: Introduction, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing.

QoS: Introduction, Issues and challenges in providing QoS, Classification of QoS solutions, MAC layer solutions, network layer solutions. **7 Hrs**

Reference Books:

1) C. Siva Ram Murthy & B. S. Manoj, "Adhoc Wireless Networks", 2nd Edition, Pearson Education, 2005.
2) Ozan K. Tonguz and Gianguigi Ferrari & John Wiley, "Ad hoc Wireless Networks", 2006.
3) Xiuzhen Cheng, Xiao Hung, Ding Zhu Du, & Kluwer, "Ad hoc Wireless Networking", Academic Publishers, 2004.
4) C.K. Toh, "Adhoc Mobile Wireless Networks, Protocols and Systems", Prentice Hall PTR, 2007.

18UCSE709 Operations Research (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Apply the fundamental techniques (graphical method, simplex method, dual simplex method) of operations research to solve real world problems.
- Estimate the transportation and assignment costs.
- Design, code, test, and debug programs to solve problems in the domain of operations research.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** real-world problems in the form of mathematical model and	-	2	1

	solve using graphical method.			
CO-2	**Formulate** real-world problems in the form of mathematical model and **solve** using simplex and artificial variables techniques.	-	1,2,3	-
CO-3	**Solve** LP problems using dual simplex method and **perform** sensitivity analysis.	-	1,2,3	16
CO-4	**Build** Models to **Solve** Transportation and Assignment problems.	-	1,2	5,16
CO-5	**Solve** a given problem using game theory techniques.	-	1,2	5

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.8	2.0	2.0	-	1.0	-	-	-	-	-	-	-	-	-	-	1.0

Pre-requisites: Knowledge of

- Algebra
- Probability

Contents:

Unit-I

Introduction: Definitions and various phases of operations research, Role of computers in operations research, Formulating a problem as a mathematical model in the form of linear programming (LP) problem – Minization and Maximization Types, Solving LP problems using Graphical method. **7 Hrs**

Unit-II

Simplex Method: Canonical and Standard forms of LP problem, The simplex method – examples, Artificial variables Techniques (Big M and Two Phase method) - examples. **7 Hrs**

Unit-III

Advanced Topics in Linear Programming: Duality, Dual Simplex Method, Economic interpretation of duality, Sensitivity analysis, Dynamic Programming. **9 Hrs**

Unit-IV

Transportation Model: Introduction, Formulation, Methods for Initial Basic Feasible solution, Improving the basic feasible solution using Stepping Stone and MODI methods.

Assignment Model: Introduction, Formulation, Comparison with transportation model, Hungarian method. **9 Hrs**

Unit-V

Game Theory: Introduction, Formulation, Strategies – Pure and Mixed, Methods for solving Game theory problems – Saddle point, Rule of Dominance, Arithmetic method,

Graphical method. **7 Hrs**

Reference Books:

1) Er. Premakumar Gupta and Dr. D.S.Hira, "Operations Research", S Chand Publications, 2014.
2) Frederick S. Hillier and Gerald J. Lieberman, "Introduction to Operations Research", 8th Edition, Tata McGraw Hill, 2005.
3) Wayne L. Winston, "Operations Research Applications and Algorithms", 4th Edition, Thomson Course Technology, 2003.
4) Hamdy A T, "Operations Research: An Introduction", 9th Edition, Pearson Publishers, 2014

18UCSE710 Multi Core Architecture and Programming (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Basic concepts in multicore architecture.
- Synchronization and coordination mechanisms available on latest multicore machines.
- Effective concurrent program writing to enhance the performance for windows, C# & .net and Linux programming platforms.
- Introductory knowledge in Open MP libraries and pthreads.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the need for multicore architecture for modern day applications	1	2	13
CO-2	**Write** a program using pthread libraries and Open MP features to solve problems that needs thread models.	2	5	13
CO-3	**Write** a program to solve problems using parallel programming constructs.	-	4	5
CO-4	**Design** a solution for the problem using APIs for Win32, MFC and .NET;	-	5	-
CO-5	**Apply** standard solutions to some common parallel programming	2	3	1

	problems like data Race conditions, Dead locks,Live locks, Memory Issues etc.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.7	2.0	2.0	2.7	-	-	-	-	-	-	-	1.0	-	-	-

Pre-requisites: Knowledge of

- Microprocessor
- Operating Systems
- C programming

Contents:

Unit-I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.

System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **8 Hrs**

Unit-II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. **8 Hrs**

Unit-III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. Threading APIs: Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking. **8 Hrs**

Unit-IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance. **8 Hrs**

Unit-V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency. **7 Hrs**

Reference Books:

1. Shameem Akhter & Jason Roberts "Multicore Programming Increased Performance through Software Multi-threading", Intel Press, 2006
2. The Software Optimization Cookbook – Intel Press 2007
3. M.Shyamala Devi, "Multicore Architectures and Programming", Sahara Publications, 2016
4. Krishna Sankar P & Shangarnarayanee N P, "Multi-Core Architectures and Programming", AR Publications, 2016.

18UCSE711 Internet of Things (2-0-2) 3

Contact Hours: 39 (26T + 13L)

Course Learning Objectives (CLOs): This course provides the basic understanding of IoT technology, communication protocols, sensor networks and its applications. It focuses on setting up IoT ecosystem to implement use cases by applying the key concepts of IoT.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the working of IoT and its enabling technologies.	-	5	1, 12
CO-2	**Explain** the use cases of IoT	-	5	1, 12

	andthe useof sensors & actuators in IoT ecosystem.			
CO-3	**Compare** and **contrast** IoT & M2M and **explain** the generic design methodology for IoT system.	-	5, 13	1, 12
CO-4	**Develop** IoT applications using Arduino by making use of sensors and modules.	13	14	1, 5, 9, 15
CO-5	**Develop** IoT applications using Raspberry Pi microcontroller by making use of sensors and modules.	13	14	1, 5, 9, 15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	-	-	-	1.6	-	-	-	1.0	-	-	1.0	2.7	2.0	1.0	-

Pre-requisites: Knowledge of Programming and Basics of Computer Networking

Contents:

Unit-I

Introduction to Internet of Things (IoT): Introduction, Physical and Logical Design of IoT, IoT Enabling Technologies, IoT levels and Deployment templates **7 Hrs**

Unit-II

Domain Specific IoTs: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health &Lifestyle

IoT Sensors and Actuators: Introduction, IoT sensors, RFID, Video Tracking, IoT Actuators **8 Hrs**

Unit-III

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring **7 Hrs**

Unit-IV

Arduino Programming: Features of Arduino, Arduino UNO, Arduino IDE, Arduino sketch structure, Arduino function libraries, Blinking LED example; Operators, control statements, loops, arrays, string, interrupts, Traffic Control System example

Integration of Sensors, Actuators and modules with Arduino: Sensor Types, Sensor Interface with Arduino, Interfacing DHT, LM35, LDR, Accelerometer and HC-

SR04 sensors with Arduino; Actuators, Types of Motor Actuators, Servo motor, Servo library on Arduino; HC05 Bluetooth module, Features, Interfacing HC05 with Arduino, Controlling LED using Bluetooth; ESP8266 wifi module, Features, Send LM35 sensor data to cloud using wifi module **2L + 7P Hrs**

Unit-V

Raspberry Pi: Introduction, Specifications, Basic Architecture, Pin configuration, Blinking LED example; Capture image using Raspberry Pi

Implementation of IoT with Raspberry Pi: Temperature dependent auto cooling system; interfacing DHT, LM35, LDR, Accelerometer and HC-SR04 sensors with Raspberry Pi; Send LM35 sensor data to cloud using wifi module. **2L + 6P Hrs**

Conduction of Practical Sessions:

Practical sessions shall include experiments on the following:

1) Use of Arduino board and coding to blink built-in as well as external LEDs
2) Interfacing temperature, humidity, soil moisture, light intensity, accelerometer, ultrasonic and obstacle detection sensors with Arduino and displaying the results
3) Connecting modules like Bluetooth and Wi-Fi to Arduino and sending the sensed data to cloud for storage and analytics.
4) Use of Raspberry Pi as a surveillance system

Reference Books:

1) Arshdeep Bahga, Vijay Madisetti ,"Internet of Things – A Hands-on Approach", Universities Press, 2015

2) Ammar Rayes, Samer Salam, "Internet of Things From Hype to Reality – The Road to Digitalization", Second Edition, , Springer Nature Switzerland AG 2017, 2019

Additional References:

3) NPTEL course on "Introduction to internet of things" by Prof. Sudip Misra

VIII SEMESTER

18UCSC800 Distributed Systems and Applications (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course is at undergraduate level for 4 credits with emphasis on the principles of distributed systems and to design the solutions for message passing, clock synchronization, consistency and fault tolerance at basic level.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the characteristics and functioning of communication protocols in distributed systems.	-	1,2,13	-
CO-2	**Comprehend** the need for synchronization strategies in a distributed system and **Implement** a synchronization algorithm.	13,14	1,3,5,15	2
CO-3	**Explain** principles of consistency and replication strategies in a distributed system.	-	1,2,13	-
CO-4	**Elucidate** the principles of fault tolerance strategies in a distributed system.	-	1,2,13	-
CO-5	**Explain** the characteristics of distributed file system and **Implement** the file system operations of a distributed operating system.	13,14	1,3,5,15	2

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.0	1.6	2.0	-	2.0	-	-	-	-	-	-	-	2.4	3.0	2.0	-

Pre-requisites: Knowledge of

- Computer Networks
- Operating Systems

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Contents:

Unit-I

Introduction: Need for distributed system and applications, process and communication model (in terms of IPCs RPCs, RMIs and software agents), architecture & design patterns. **10 Hrs**

Unit-II

Naming: Terminologies and different types of naming services.

Synchronization : Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, Election Algorithms **12 Hrs**

Unit-III

Consistency and Replication: Introduction, Data-centric Consistency Models, Client-centric Consistency Models, Replica Management. **10 Hrs**

Unit-IV

Fault Tolerance & Security: Introduction, Process Resilience, Reliable Client-Server Communication, Reliable Client-Server Communication, Security and design issues in distributed system. **10 Hrs**

Unit-V

Distributed file systems: client-server architectures, cluster-based distributed file systems, symmetric architectures and processes. **10 Hrs**

Reference Books:

1. Andrew S Tanenbaum & Maarten van Steen, "Distributed Systems Principles and Paradigms", 2nd Edition, Pearson Prentice Hall, 2007.
2. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly, 2015,
3. George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair, "Distributed Systems Concepts and Design", 5th Edition, Addison-Wesley, 2012.
4. Ghosh, Sukumar. Distributed systems: an algorithmic approach. Chapman and Hall/CRC, 2006.

18UCSL801 Independent Study (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course is a one credit self-learning based research / Development oriented activity leading to publication or a study of subjects outside regular UG course offerings; enabling the students to engage in independent and life-long learning in the broadest context of trends of technological change and communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being

able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Learn** a technical report independently through self learning mode.	12	2,3,5,8	-
CO-2	**Prepare** a technical report with a given specification and standards.	10	5	-
CO-3	**Present** effectively the knowledge through verbal and written communication mode.	10	5	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	2.0	2.0	-	2.0	-	-	2.0	-	3.0	-	3.0	-	-	-	-

Course Guidelines:

Students are expected to pick a research oriented activities or study of subjects outside current Body-of-Knowledge of Computer Science & Engineering at SDMCET. Prior to registration, a detailed plan of work should be submitted by the student to the committee appointed by DUGC for approval. The various rules to be followed are listed below:

1. This course is offered at 7th semester. Student from 5th and 6th semester can also register only if their CGPA is 9 and above. Duration may be spread across two semesters. But, physically this course will be reflected in the 8th semester scheme and grade sheet.
2. Guide for this course is must and will be chosen by students by interacting with faculty.
3. In consultation with Guide, Students will prepare the courses description and its outcomes, which he/she promises to accomplish and is to be finally approved by DUGC.
4. Grading is done by the Guide based on the seminar and the report submitted by the students; which are to be in line with the policy established by DUGC's Grade Committee from time to time. Other assessment tool may include demonstration, seminar, quiz, tests, Viva-Voce, publications etc. as the case is. If the Guide wishes, they can form their own examination body for evaluation with the approval of the committee on the behalf of DUGC.

5. Work worth of minimum of 26-30 Hrs spread across 10 to 12 weeks starting from the date of registration is to be ensured by the Guide.
6. Course content should belong to the Body-of-Knowledge (As per ACM, 2008 or its extensions).

Department of CSE will encourage the students to publish a paper in a reputed journal/conference or get certification through the use of well recognized MOOCS like NPTEL, Coursera, Swayam. Udacity etc…for their self-study and demonstrate highest level of ethics and professional practices.

18UCSL802 Major Project Phase – 2 (0-0-14) 7

Contact Hours: 78

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:
Understand the domain through proper modeling and analysis using the state-of-art technology. Then apply relevant Software Engineering Principles to develop modular and robust applications through the use of Standards and tools. At the end build appropriate test cases, verification and validation techniques in order to make the project reliable and maintainable.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the problem and **formulate** the problem statement.	1, 8, 2,12	-	-
CO-2	**Analyze** the problem scenario and **Design** the solutions to complex engineering problem using software engineering principles or appropriate research methodology.	3,5, 8, 13,12	11, 16	6, 7
CO-3	**Identify** and **Implement** a feasible solution using appropriate technology, tools, procedures and techniques.	4,5, 8, 14,12	16	-
CO-4	**Verify** and **Validate** the proposed system for correctness and to demonstrate compliance with the design and hence the stated requirements/ research gap.	5, 8, 15,12	-	-
CO-5	**Prepare** the report and **communicate** effectively through presentation.	8, 9,10	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping	3.0	3.0	3.0	3.0	3.0	1.0	1.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0

Level																

For details, refer the contents related to **Major Project – Phase 1** (**18UCSL703**).

ELECTIVES

18UCSE803 Cryptography and Network Security (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Principles of Cryptographic algorithms including secret key cryptography, hashing and public key algorithms.
- Use of cryptographic techniques to establish security in modern information- and communication systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Compare** and **contrast** different symmetric key encryption techniques to achieve data confidentiality.	-	1, 2	-
CO-2	**Apply** different security solutions for a given system using private and public key cryptography.	13	1, 2	-
CO-3	**Identify** the need for key management and message authentication; critically **compare** various key management, and authentication services and mechanisms.	-	3	-
CO-4	**Identify** and **explain** the requirement and usage of security services and mechanisms for various network security applications.	2	-	1
CO-5	Critically **compare** system threats and countermeasures.	-	-	13
CO-6	**Implement** a given cryptographic algorithm using higher level programming languages.	4, 5, 15	14	

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.7	2.3	2.0	3.0	3.0	-	-	-	-	-	-	-	2.0	2.0	3.0	-

Pre-requisites: Knowledge of

- Computer Networks
- Discrete Structures

Contents:

Unit-I

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES. **8 Hrs**

Unit-II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm.

Other Public-Key Cryptosystems: Diffie hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp **8 Hrs**

Unit-III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication.

User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication,remote user Authentication using Symmetric encryption, Mutual Authentication,one-way Authentication,Kerberos, Motivation, Kerberos version 4, Kerberos version 5 **8 Hrs**

Unit-IV

Wireless network security: 802.11i pseudorandom Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview

Transport Level Security: Web Security Considerations, Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Transport Layer Protocol, Connection Protocol. **8 Hrs**

Unit-V

Electronic Mail Security: Pretty good privacy, notation, operational description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality.

IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database. **7 Hrs**

Reference Books:

1. William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education, 2014.
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, McGraw-Hill Education (India) Pvt. Ltd., 2013
3. Bruce Schinner, "Applied Cryptography", 2nd Edition, PHI publication 2007.
4. Radia Perlman, Mike Speciner, & Charlie Kaufman, "Network Security: Private communication in a Public World", 2nd Edition, Pearson Education Asia, 2002.

18UCSE804 Cloud Computing (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning objectives:

Understand the cloud computing paradigm. Recognize its various forms and implement some cloud computing features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** cloud computing philosophy & computing paradigms.	-	1,4	5
CO-2	**Distinguish** and **demonstrate** cloud service models and their risks.	-	2,4,5	-
CO-3	**Explain** and **use** SLA life cycle and agreement structure to build simple applications.	-	4,8	7
CO-4	**Explain** and **build** simple security models using cloud security principles.	-	1,2,4	5
CO-5	**Develop** and **deploy** cloud solution for the given application scenario.	1, 2, 3	4, 5	7

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.3	2.3	3.0	2.0	1.5	-	1.0	2.0	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

- Operating Systems, Computer Architecture, Computer Networks & Web Technologies.
- Programming languages- Java, Web programming

Contents:

Unit-I

Introduction: Paradigms in Computing, Parallel Computing, Distributed Computing, Grid Computing, Service Computing; Service Oriented Architecture (SOA), Web Services. **7 Hrs**

Unit-II

Basics of Cloud Computing: Definition, Characteristics, Architecture, Components, Service Models, and Deployment Models.
Virtualization: Server, Storage, Network, Desktop Hypervisor, Virtual Machine, Multi-tenancy, Opportunities and Risks. **7 Hrs**

Unit-III

Service Level Agreement (SLA): Definition, Types of SLA, SLA Life Cycle, Issues Related to Cloud SLA, SLA Frameworks: WS-Agreement, WSLA, WSOL, Slang, Bilateral Protocol; Translation of SLAs into Monitoring Specifications, Dynamic Creation of Monitoring Infrastructures, Penalty Management, Runtime Prediction.
7 Hrs

Unit-IV

Cloud Security: Cloud Security Fundamentals, Vulnerability Assessment, Security and Privacy in Cloud.
Cloud Computing Security Architecture: Identity Management and Access Control, Autonomic Security; VM Specific Security Techniques. **9 Hrs**

Unit-V

Cloud Application Programming Models: Cloud File Systems: GFS and HDFS, BigTable, HBase and Dynamo; Map Reduce Programming Model, Hadoop: Hadoop Fundamentals, Hama and other Hadoop Related Services. Cloud Application Development Platforms: Xen Hypervisor, Amazon Web Service, Windows Azure, Google App Engine, Eucalyptus, Open Stack, Open Nebula. **9 Hrs**

Experiments

1. Use of Cloud Web Services
2. Experiment on Cloud Storage using mobile
3. Explore Cloud platform like Amazon Web Service, Windows Azure, Google App Engine etc.

Reference Books:

1. A. T. Velte, “Cloud Computing - A Practical Approach”, McGraw Hills 2010
2. Tanenbaum & V. Steen, “Distributed Systems: Principles and Paradigms”, 2nd Edition, Pearson, 2015
3. David E.Y. Sarna, “Implementing and Developing Cloud Computing Applications”, CRC Press, 2011
4. R. Krutz & R. D. Vines, “Cloud Security”, Wiley-India, 2010
5. T. White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Media, 2015
6. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, “Cloud Computing for Dummies”, Wiley India Edition
7. Rajkumar Buyya, James Broberg & Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, Willey 2014.
8. Dan C Marinescu, “Cloud Computing Theory and Practice”, Elsevier (MK), 2013.

18UCSE805 Network Management (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course, at under graduate level for 3 credits, explains the issues for network management arising from a range of security threats, including viruses and denial-of-service attacks. Develop a strategy for ensuring appropriate levels of security in a system designed for a particular purpose.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** network communication architecture and goals	2,13	-	-
CO-2	**Explain** and **apply** Management information Tree (MIT)	13,14	3, 4	5
CO-3	**Explain** structure of management through Management Information Base	13	4	3
CO-4	**Explain** Remote Monitoring, and concept of broadband, security.	-	4,5	7
CO-5	**Design** and **develop** network management solutions for the given scenario like Inventory management, fault location and management, performance management, accounting management, report management.	-	10	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	3.0	2.0	2.0	1.5	-	1.0	-	-	2.0	-	-	3.0	3.0	-	-

Pre-requisites: Knowledge of Computer Networks

Contents:

Unit-I

Introduction: Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1 Terminology, Symbols and Conventions, Objects and Data Types, Object Names, An Example of ASN.1Prere from ISO 8824; Encoding Structure; Macros, Functional Model. **8 Hrs**

Unit-II

SNMPv1 Network Management : Organization and Information Models : Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview, The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base **8 Hrs**

Unit-III

SNMPv1 Network Management: Communication and Functional Models: The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, and Functional Model.

SNMP Management- RMON: Remote Monitoring, RMON SMI and MIB, RMONI1 RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2.

8 Hrs

Unit-IV

Broadband Network Management: ATM Networks: Broadband Networks and Services, ATM Technology – Virtual Path Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base, The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface: Customer Network Management of

Public Networks, M4 Interface: Public Network Management, Management of LAN Emulation. ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management ADSL Network Management Elements **8 Hrs**

Unit-V

Network Management Tools: Introduction to various network management tools. Server Management: Application Servers, Web Server. Device configuration like Fire wall settings, Hot Spot, Gate Ways, Switches etc. **7 Hrs**

Experiments:

1. Analyze bandwidth throughput etc. for a given network.
2. Analyze different protocols performance like TCP and UDP for a given point-to-point network.
3. Analyze routing protocol performance.

Reference Books:

1. Mani Subramanian, "Network Management Principles and Practice", 2nd Edition, Pearson Education Publication, 2010.
2. Jianguo Ding, "Advances in Network Management", 1st Edition, Auerbach Publications, 2016.
3. Allan Leinwand, Karen Fang Conroy, & Karen Fang, "Network Management: A Practical Perspective", Addison Wesley, 1996
4. Alexander Clemm, "Network Management Fundamentals", Cisco, 1st Edition, 2016.

18UCSE806 Mobile Applications Development (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Familarize with mobile apps development aspects.
- Design and develop mobile apps, using Android as development platform, with key focus on user experience design, native data handling and background tasks and modifications.
- Appreciation of naunces such as native hardware play, location awareness, graphics, and multimedia.
- Perform testing, signing, packaging and distribution of mobile apps.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12)/ PSOs (13-16)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	**Explain** the android platform architecture.	5,13	7	3
CO-2	**Acquire** the knowledge of UI components and life cycle of activity with respect to android platform.	5	4	13
CO-3	**Design** and **develop** apps using native data handling on-devices like file I/O, SQLite, and enterprise data access.	14	3,13	7
CO-4	**Design** and **develop** spruce apps to demonstrate the use of various components involved in android platform.	13,14	3,13	7
CO-5	**Explain** and **apply** use of testing tools to test mobile apps.	15	16	5
CO-6	**Explain** the concept of versioning and distributing apps to mobile market place.	14	5	16

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	-	1.6	2.0	2.3	-	1.3	-	-	-	-	-	2.2	3.0	3.0	1.5

Pre-requisites: Knowledge of Java (J2SE) and basic RDBMS.

Contents:

Unit-I

Getting started with Mobility: Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development. **7 Hrs**

Unit-II

Building blocks of mobile apps: App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity – states and life cycle, interaction amongst activities, App functionality beyond user interface – Threads, Async task, Services – states and life cycle, Notifications, Broadcast recievers, Telephony and SMS APIs, Native data handling – on device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). **9 Hrs**

Unit-III

Sprucing up mobile apps: Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelorometer and gyroscope) **9 Hrs**

Unit-IV

Testing mobile apps: Debugging mobile apps, White box testing, Black box testing,

and test automation of mobile apps, Junit for Android, Robotium, MonkeyTalk **7 Hrs**

Unit-V

Taking mobile apps to Market: Versioning, signing and packaging mobile apps, distributing apps on mobile market place. **7 Hrs**

Practical / Project work: Students should implement (and learn to use the tools to accomplish this task) the following during Practical hours:
1. Understand the app idea and design user interface/wireframes of mobile app.
2. Set up the mobile app development environment.
3. Develop and debug mobile app components – User Interface, Services, Notifications, Broadcast recievers, data components.
4. Usingemulator to deploy and run mobile apps.

5. Testing mobile app – unit testing, black box testing and test automation.

Reference Books:

4) Donn Felker, Joshua Dobbs, and Barry Burd, "Android Application Development for Dummies", Wiley Publishing Inc, 2011

5) Reto Meier, "Professional Android 2 Application Development", Wrox Publisher, 3rd Edition, 2012.

18UCSE807 Ontology & Semantic Web (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Theoretical and practical aspects of ontology in semantic web.
- Concepts of RDF and web ontology language.
- Various patterns for developing and reusing ontologies.
- Models for knowledge management architecture in semantic web.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the working principles, architecture of semantic web and the importance of markup languages.	1	-	-
CO-2	**Design** and **analyze** ontologies using web ontology language.	-	3	-

CO-3	**Apply** the logic with web ontology language.	15	-	5
CO-4	**Analyze** scalable architectures and semantic web services.	-	2	-
CO-5	**Explain** the evolution of ontologies with semantic interpretation of information.	-	12	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.0	2.0	-	1.0	-	-	-	-	-	-	2.0		-	3.0	-

Pre-requisites: Knowledge of HTML and Java

Contents:

Unit-I

The semantic web vision: Today's web, Semantic web Technologies, A layered approach, Structured web documents in XML, Introduction to RDF, RDF syntax, RDF schema, Axiomatic statements for RDF and RDF schema, Direct inference system on RDF and RDF schema. **9 Hrs**

Unit-II

Ontology and Web ontology Language: Introducing OWL, Discovering the Various Species of OWL, Exploring the Foundations of OWL Understanding OWL Essentials, Making Simple Assertions, Inconsistency, Examining Property Characteristics, Complex Classes, Understanding Why OWL Is Different, Developing OWL Ontologies. **8 Hrs**

Unit-III

Ontology building and inference by logic: Monotonic rules - syntax and semantics, Nonmonotonic rules - syntax, Rule markup in XML, Constructing and reusing ontologies, Semantic web knowledge management architecture, Querying using SPARQL, Jena ontology API, Reasoners. **8 Hrs**

Unit-IV

Ontology scalable architectures and Discovering the semantic web services: Discovering the Roles, Creating Semantics for Enterprise Systems, Scaling Semantic Web Tools, Patterns of Architectural Usage and Applicationdevelopment using OWL API. **7 Hrs**

Unit-V

Ontology evolution and Semantic knowledge: Ontology population and enrichment, Semantic representation of multimedia content, Ontology based semantics extraction from text and Images. A survey of semantic image and video annotation tools, Overview of linked data. **7 Hrs**

Reference Books:

1. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", 2nd Edition, MIT Press, Cambridge, MA 2008
2. Jeffrey T.Pollock, "Semantic Web For Dummies", Wiley Publishing, Inc 2009
3. John Hebeler, Matthew Fisher, Ryan Blace, & Andrew Perez-Lopez, "Semantic Web Programming", Wiley Publishing, Inc.
4. Georgios Paliouras, Constantine Spyropoulos, & George Tsatsaronis (Eds.) "Knowledge-Driven Multimedia Information Extraction and Ontology Evolution", Springer, 2011

18UCSE808 Data Science (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course is a 3 credit undergraduate course focusing on the data and types, data preprocessing. The details of R language are discussed to enable the students to perform data analytics. It also discusses the supervised and unsupervised learning.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the flow process for processing data science problems and the data types.	-	1, 2	13
CO-2	**Apply** the preprocessing methods to the raw data to make it available for analysis.	1, 2	-	-
CO-3	**Use** the R language to perform the data visualization and the analysis using fundamental statistical technques.	3	-	12
CO-4	Explain the machine learning technques.	-	1, 2	13
CO-5	Explain the unsupervised learning technques.	-	1, 2	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.3	2.3	3.0	-	-	-	-	-	-	-	-	1.0	1.0	-	-	-

Pre-requisites: Knowledge of Statistics

Contents:

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Unit-I

Introduction: Evolution, Roles, Stages in Data Science Project, Applications, Data Security and Privacy Issues

Data: Data types - Structured and Unstructured, Challenges with Unstructured data, Social media data, Multi modal data, Data Storage and Presentation **7 Hrs**

Unit-II

Data Preprocessing: Cleaning, Integration, Transformation, Reduction, Discretization.

Techniques: Correlation, Regression. Exploratory Analysis. **7 Hrs**

Unit-III

R Language: Basics, Control structures, Functions, Impoting Data.

Graphics and Data Visualization: Installing gglot2, Loading the data, Plotting the Data.

Statistics and Machine Learning: Basic Statistics, Regression, Clustering **9 Hrs**

Unit-IV

Machine Learning: Introduction, Regression, Classification, Gradient Descent. **8 Hrs**

Unit-V

Unsupervised Learning: Introduction, Agglomerative Clustering, Reinforcement Learning **8 Hrs**

Reference Books:

1) Chirag Shah, “A Hands on Introduction to Data Science”, Cambridge University Press, 2020

2) Laura Igual and Santi Segui, “Introduction to Data Science”, Springer International Publications, 2017

3) Richord Cotton “Learning R”, O’Reilly Publications, 2013.