RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Go, change the world

SCHEME & SYLLABUS

SECOND YEAR B.E. PROGRAMS

COMPUTER SCIENCE AND ENGINEERING

BACHELOR OF ENGINEERING (B.E.)

2022 SCHEME

Computer Science & Engineering

ACADEMIC YEAR 2023-24

DEPARTMENT VISION

To achieve leadership in the field of Computer Science& Engineering by strengthening fundamentals and facilitating interdisciplinary sustainable research to meet the ever growing needs of the society.

DEPARTMENTMISSION

- To evolve continually as a centre of excellence in quality education in computers and allied fields.
- To develop state-of-the-art infrastructure and create environment capable for interdisciplinary research and skill enhancement.
- To collaborate with industries and institutions at national and international levels to enhance research in emerging areas.
- To develop professionals having social concern to become leaders in top-notch industries and/or become entrepreneurs with good ethics.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

PEO1: Develop Graduates capable of applying the principles of mathematics, science, core engineering and Computer Science to solve real-world problems in interdisciplinary domains.

PEO2: To develop the ability among graduates to analyze and understand current pedagogical techniques, industry accepted computing practices and state-of-art technology.

PEO3: To develop graduates who will exhibit cultural awareness, teamwork with professional ethics, effective communication skills and appropriately apply knowledge of societal impacts of computing technology.

PEO4: To prepare graduates with a capability to successfully get employed in the right role /become entrepreneurs to achieve higher career goals or take up higher education in pursuit of lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	**System Analysis and Design** The student will be able to: 1. Recognize and appreciate the need of change in computer architecture, data organization and analytical methods in the evolving technology. 2. Learn the applicability of various systems software elements for solving design problems. 3. Identify the various analysis & design methodologies for facilitating development of high quality system software products with focus on performance optimization. 4. Display team participation, good communication, project management and document skills.
PSO2	**Product Development** The student will be able to: 1. Demonstrate the use of knowledge and ability to write programs and integrate them with the hardware/software products in the domains of embedded systems, databases/data analytics, network/web systems and mobile products. 2. Participate in planning and implement solutions to cater to business – specific requirements displaying team dynamics and professional ethics. 3. Employ state-of-art methodologies for product development and testing / validation with focus on optimization and quality related aspects.

Lead Society: Institute of Electrical and Electronics Engineers (IEEE)

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	PE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	PY	Physics
9.	CY	Chemistry
10.	MA	Mathematics
11.	AS	Aerospace Engineering
12.	AI & ML	Artificial Intelligence & Machine Learning
13.	BT	Biotechnology
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	CV	Civil Engineering
17.	EC	Electronics & Communication Engineering
18.	EE	Electrical & Electronics Engineering
19.	EI	Electronics & Instrumentation Engineering
20.	ET	Electronics & Telecommunication Engineering
21.	IM	Industrial Engineering & Management
22.	IS	Information Science & Engineering
23.	ME	Mechanical Engineering

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Computer Science & Engineering [CS]

THIRD SEMESTER									Max Marks CIE		SEE Duration (H)	Max Marks SEE	
Slo. No.	**BoS**	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**	**Category**	**Theory**	**Lab**	**Hours**	**Theory**	**Lab**
1	MAT	MAT231CT	Linear Algebra and Probability Theory	3	1	0	4	Theory	**100**	***	**3**	**100**	***
2	BT/ CV/ ME	XX232AT	Basket Courses - **Group A**	3	0	0	3	Theory	**100**	***	**3**	**100**	***
3	IS	IS233AI	Data Structure and Applications (Common to CS, IS, CD & CY)	3	0	1	4	Theory & Practice	**100**	**50**	**3**	**100**	**50**
4	CS	CS234AI	Applied Digital Logic Design and Computer Organisation (Common to CS, CD & CY)	3	0	1	4	Theory & Practice	**100**	**50**	**3**	**100**	**50**
5	CS	CS235AI	Operating Systems (Common to CS, IS, CD & CY)	3	0	1	4	Theory & Practice	**100**	**50**	**3**	**100**	**50**
6	CS	CS237DL	Design Thinking Lab	0	0	2	2	Practice	****	**50**	**2**	****	**50**
7	**CS**	**CS139AT**	**Bridge Course: C Programming**	**2**	**0**	**0**	**Audit**	**Audit Course**	**50**	***	***	***	***
				Total			**21**						

Slo. No.		Course Code	Course Title	Common to
1	MAT	MAT231AT	Linear algebra, fourier transforms and statistics	EC,EE, EI, ET
	MAT	MAT231BT	Statistics, laplace transform and numerical methods	AS, BT, CH, IM, ME
	MAT	MAT231CT	Linear algebra and probability theory	CD,CS,CY,IS
	MAT	MAT231DT	Applied mathematics for civil engineering	CV
	MAT	MAT231ET	Mathematics for artificial intelligence & machine learning	AI & ML

Group A: Basket Courses
(Students can select any ONE COURSE out of THREE COURSES in ODD Sem &
ONE COURSE out of remaining courses in EVEN Sem)

2	CV	CV232AT	Environment & Sustainability	3	0	0	3	Theory
	ME	ME232AT	Material Science for Engineers	3	0	0	3	Theory
	BT	BT232AT	Bio Safety Standards and Ethics	3	0	0	3	Theory

Design Thinking Lab
During III Sem: AI, BT, CD, CS, CY & IS. During IV Sem: AS, CH, CV, EC, EE, EI, ET, IM & ME.

Semester: III						
LINEAR ALGEBRA AND PROBABILITY THEORY **Category: PROFESSIONAL CORE COURSE** **(Theory)** **(Common to CD, CS, CY, IS)**						
Course Code	**:**	MAT231CT		**CIE**	**:**	**100 Marks**
Credits: L: T: P	**:**	3:1:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L+30T		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**09 Hrs**
Linear Algebra – I: Vector spaces, subspaces, linear dependence and independence, basis, dimension, four fundamental subspaces, rank-nullity theorem. Linear transformations - matrix representation, kernel and image of a linear transformation, dilation, reflection, projection, and rotation matrices. Implementation using MATLAB.	
Unit – II	**09 Hrs**
Linear Algebra - II: Inner Products, orthogonal matrices, orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization. Eigen values and Eigen vectors (recapitulation), diagonalization of a matrix (symmetric matrices) and singular value decomposition. Implementation using MATLAB.	
Unit –III	**09 Hrs**
Random Variables: Random variables-discrete and continuous, probability mass function, probability density function, cumulative distribution function, mean and variance. Two or more random variables - Joint probability mass function, joint probability density function, conditional distribution and independence, Covariance and Correlation. Implementation using MATLAB.	
Unit –IV	**09 Hrs**
Probability Distributions and Sampling Theory: Discrete and continuous distributions - Binomial, Poisson, Exponential and Normal. Sampling theory - Sampling, sampling distributions - Simple random sampling (with replacement and without replacement). Standard error, sampling distributions of means ($\int$ known), sampling distributions of proportions, sampling distribution of differences and sums. Implementation using MATLAB.	
Unit –V	**09 Hrs**
Inferential Statistics: Principles of Statistical Inference, Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors, level of significance, Tests involving the normal distribution, one –tailed and two – tailed tests, P – value, Special tests of significance for large and small samples (F, Chi – square, Z, t – test). Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the fundamental concepts of linear algebra, random variables, distributions, sampling and inferential statistics.
CO2:	Compute the solution by applying the acquired knowledge of linear algebra, random variables, distributions, sampling and inferential statistics to the problems of engineering applications.
CO3:	Analyze the solution of the problems obtained from appropriate linear algebra and probability techniques to the real-world problems arising in many practical situations.
CO4:	Interpret the overall knowledge of linear algebra, random variables, probability distributions, sampling theory and inferential statistics gained to engage in life – long learning.

Reference Books	
1	Linear Algebra and its Applications, David C. Lay, 3rd Edition, 2002, Pearson Education India, ISBN-13: 978-81-7758-333-5.
2	Linear Algebra with Applications, Steven J. Leon, 9th Edition, 2014, Pearson, ISBN: 13:978-0321962218.
3	Probability & Statistics for Engineers & Scientists, Ronald E. Walpole & Raymond H. Myers, 9th Edition, 2016, Pearson Education, ISBN-13: 978-0134115856.
4	Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, 6th Edition, 2014, John Wiley & Sons, ISBN:13 9781118539712, ISBN (BRV):9781118645062.
5	Higher Engineering Mathematics, B.V. Ramana, 11th Edition, 2010, Tata McGraw-Hill, ISBN: 13-978-07-063419-0; ISBN: 10-0-07-063419-X.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video based seminar/presentation/demonstration (10), MATLAB (20). **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**
RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: Question 3 or 4	16
5 & 6	Unit 3: Question 5 or 6	16
7 & 8	Unit 4: Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

Semester: III/ IV

ENVIRONMENT & SUSTAINABILITY

Category: BASKET COURSES - GROUP A

(Theory)

(Common to all Programs)

Course Code	:	**CV232AT**	**CIE**	:	**100 Marks**
Credits: L:T:P	:	3:0:0	**SEE**	:	**100 Marks**
Total Hours	:	45L	**SEE Duration**	:	**3.00 Hours**

Unit-I — **10 Hrs**

ENVIRONMENT AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity.

ENVIRONMENTAL POLLUTION

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollution. Solid, Hazardous and E-Waste management.

Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

Unit – II — **09 Hrs**

RENEWABLE SOURCES OF ENERGY

Energy management and conservation, New Energy Sources: Need of new sources. Different types of new energy sources.

Energy Cycles, carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socioeconomical and technological change.

Applications of - Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

Unit –III — **09 Hrs**

SUSTAINABILITY AND MANAGEMENT

Introduction to Environmental Economics, Environmental Audit, Development, GDP, Sustainability - concept, needs and challenges-economic, social and aspects of sustainability - from unsustainability to sustainability-millennium development goals and protocols

Sustainable Development Goals - targets, indicators and intervention areas Climate change - Global, Regional and local environmental issues and possible solutions. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry.

Unit –IV — **09 Hrs**

SUSTAINABILITY PRACTICES

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment.

Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports.

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Unit –V — **08 Hrs**

Corporate Social Responsibility (CSR) - Meaning & Definition of CSR, History & evolution of CSR. Concept of Charity, Corporate philanthropy, Corporate Citizenship, CSR-an overlapping concept. Concept of sustainability & Stakeholder Management. Relation between CSR and Corporate governance; environmental aspect of CSR; Chronological evolution of CSR in India.

Sustainability Reporting: Flavor of GRI, Dow Jones Sustainability Index, CEPI. Investor interest in Sustainability.

Course Outcomes: After completing the course, the students will be able to:	
CO1	Understand the basic elements of Environment and its Biodiversity.
CO2	Explain the various types of pollution and requirement for sustainable strategy for present scenario.
CO3	Evaluate the different concepts of sustainability and its significance for welfare of all life forms.
CO4	Recognize the role of Corporate social responsibility in conserving the Environment.

Reference Books	
1.	'Environmental Science and Engineering', Benny Joseph, Tata McGraw-Hill, New Delhi, 2016. ISBN-13 - 978-9387432352
2.	'Introduction to Environmental Engineering and Science', Gilbert M.Masters, Wendell P Ela, 3rd Edition, Pearson Education, 2006. ISBN-13 - 978-0132339346
3.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4.	A Handbook of Corporate Governance and Social Responsibility (Corporate Social Responsibility), David Crowther and Guler Aras, Gower Publishing Ltd, ISBN - 13 - 978-0566088179

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#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
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3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
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5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

Semester: III / IV						
MATERIALS SCIENCE FOR ENGINEERS **Category: BASKET COURSES - GROUP A** **(Theory)** **(Common to all Programs)**						
Course Code	**:**	ME232AT		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
The Fundamentals of Materials The electronic structure of atoms, types of atomic and molecular bonds: ionic bond, covalent bond, metallic bond, secondary bonds, mixed bonding, hybridization. Energy bands in metals, insulators, and semiconductors. Basic crystallography. Defects and dislocations. Types of materials: polymers, metals and alloys, ceramics, semiconductors, composites.	
Unit – II	**10 Hrs**
Material behaviour Thermal properties: thermal conductivity, thermoelectric effects, heat capacity, thermal expansion coefficient, thermal shock, thermocouple. Electrical Properties: dielectric behaviours and temperature dependence of the dielectric constant, insulating materials, ferroelectricity, piezoelectricity, super conductor. Optical properties: luminescence, optical fibers, Mechanical Properties: Stress-strain diagram, elastic deformation, plastic deformation, hardness, viscoelastic deformation, impact energy, fracture toughness, fatigue.	
Unit –III	**10 Hrs**
Materials and their Applications Semiconductors, dielectrics, optoelectronics, structural materials, ferrous alloys, nonferrous alloys, cement, concrete, ceramic, and glasses. Polymers: thermosets and thermoplastics, composites: fibre-reinforced, aggregated composites, electronic packaging materials, biomaterials, processing of structural materials.	
Unit –IV	**07 Hrs**
Heat Treatment Post processing heat treatment of electronic devices: thermal oxidation, diffusion, rapid thermal processing. Heat treatment of ferrous materials: annealing, spheroidizing, normalizing, hardening, tempering. formation of austenite, construction of Time Temperature Transformation (TTT) curves. Special heat treatment processes: carburizing, nitriding, cyaniding, flame, and induction hardening. Defects in heat treatment.	
Unit-V	**07 Hrs**
Nanomaterials Synthesis of nanomaterials: ball milling, sol-gel, vapour deposition growth, pulse laser, magnetron sputtering, lithography. Nano porous materials: zeolites, mesoporous materials, carbon nanotubes, graphene, nano FRPs, nano fabrics, bioresorbable and bio-erodable materials, nano ceramic, nano glasses, nano biomaterials, nano implant associated materials. Characterisation of nano structures, spectroscopic techniques, automatic force microscopy.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Understand the classification of materials, their atomic structure, and properties.
CO2	Investigate the properties and applications of different materials.
CO3	Analyse the effect of different heat treatment processes.
CO4	Recognize different types of nanomaterials, synthesis methods and characterisation techniques.

Reference Books	
1.	Material Science and Engineering, William D Callister, 6th Edition, 1997, John Wiley and Sons, ISBN: 9812-53-052-5
2.	Introduction to Physical Metallurgy, Sydney H Avner, 1994, Mc. Graw Hill Book Company, ISBN: 0-07-Y85018-6
3.	Material Science and Engineering, William F Smith, 4th Edition, 2008, Mc. Graw Hill Book Company, ISBN: 0-07-066717-9
4.	A.S. Edelstein and R.C. Cammarata, Nanomaterials: Synthesis, Properties and Applications, CRC Press 1996, ISBN:978-0849322749

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7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

Semester: III / IV						
BIO SAFETY STANDARDS AND ETHICS **Category: BASKET COURSES - GROUP A** **(Theory)** **(Common to all Programs)**						
Course Code	:	**BT232AT**		**CIE**	:	**100 Marks**
Credits: L: T:P	:	**3:0:0**		**SEE**	:	**100 Marks**
Total Hours	:	**45L**		**SEE Duration**	:	**3 Hours**

Unit-I	**09 Hrs**
Biohazards, Bio safety levels and cabinets: Introduction to Biohazards, Biological Safety levels, Bio safety Cabinets, Study of various types of Bio safety cabinets. Various parameters for design of Biosafety cabinets (Materials used for fabrication, sensors, filters, pumps, compressors)	
Unit – II	**08 Hrs**
Biosafety Guidelines: Biosafety guidelines of Government of India, GMOs & LMOs, Roles of Institutional Biosafety Committee, RCGM (Review Committee on Genetic Manipulation), GEAC (Genetic Engg Approval Committee) for GMO applications in food and agriculture. Overview of National Regulations and relevant International Agreements including Cartagena Protocol.	
Unit –III	**10 Hrs**
Food safety standards: FSSAI (Food Safety and Standards Authority of India), Functions, License, types of FSSAI Licences and compliance rules. **Food Hygiene:** General principles of food microbiology and overview of foodborne pathogens, sources of microorganisms in the food chain (raw materials, water, air, equipment, etc.) Quality of foods, Microbial food spoilage and Foodborne diseases, Overview of beneficial microorganisms and their role in food processing and human nutrition, Food Analysis and Testing, General principles of food safety management systems, Hazard Analysis Critical Control Point (HACCP).	
Unit –IV	**09 Hrs**
Food Preservations, processing, and packaging Food Processing Operations, Principles, Good Manufacturing Practices HACCP, Good production, and processing practices (GMP, GAP, GHP, GLP, BAP, etc) Overview of food preservation methods and their underlying principles including novel and emerging methods/principles Overview of food packaging methods and principles including novel packaging materials.	
Unit-V	**09 Hrs**
Food safety and Ethics: Food Hazards, Food Additives, Food Allergens Drugs, Hormones, and Antibiotics in Animals. Factors That Contribute to Foodborne Illness, Consumer Lifestyles and Demand, Food Production and Economics, History of Food Safety, The Role of Food Preservation in Food Safety. Ethics: Clinical ethics, Health Policy, Research ethics, ethics on Animals. Biosafety and Bioethics.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Have a comprehensive knowledge of Biohazards and bio safety levels
CO2	Understand the biosafety guidelines and their importance to the society
CO3	Acquire knowledge with respect to the Food standards, Hygiene, food processing and packing
CO4	Appreciate the food safety, Ethics, biosafety and bio ethics

Reference Books	
1.	Deepa Goel, Shomini Parashar IPR, Biosafety and Bioethics 1st Edition, 2013, ISBN: 978-8131774700.
2.	Cynthia A Roberts, The Food Safety, Oryx Press, 1st Edition, 2001, ISBN: 1–57356–305–6.
3.	Hal King, Food Safety Management Systems, Springer Cham, 2020, ISBN: 978-3-030-44734-2.
4.	Alastair V. Campbell , Bioethics: The Basics,Routledge; 2nd Edition, 2017, ISBN: 978-0415790314.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
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3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) **ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

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3 & 4	Unit 2: (Internal Choice)	16
5 & 6	Unit 3: (Internal Choice)	16
7 & 8	Unit 4: (Internal Choice)	16
9 & 10	Unit 5: (Internal Choice)	16
	TOTAL	**100**

Semester: III						
DATA STRUCTURES AND APPLICATIONS **Category: PROFESSIONAL CORE COURSE** **(Theory and Lab)** **(Common to CS, IS, CD &CY)**						
Course Code	:	**IS233AI**		**CIE**	:	**100 + 50 Marks**
Credits: L:T:P	:	**3:0:1**		**SEE**	:	**100 + 50 Marks**
Total Hours	:	**45L+30P**		**SEE Duration**	:	**3 + 3 Hours**

Unit-I	**09 Hrs**
Introduction: Introduction to Data structures, Types of Data Structures, Linear & non-linear Data Structures **Stacks:** Stack definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation **Recursion:** Introduction to Recursion, Factorial function, Binary search, Towers of Hanoi problem, Role of the stack during execution	
Unit – II	**09 Hrs**
Queues: Representation of queue, operations, circular queues. Application of Queue: Message queue using circular queue. **Dynamic Memory allocation:** malloc(), calloc(),free(), realloc() **Linked Lists:** Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, getnode, freenode, and header node.	
Unit –III	**09 Hrs**
Circular Singly Linked List (CSLL): Definition, Various operations, Application: Queue implementation. Doubly Linked List (DLL), Circular Doubly Linked List (CDLL). Applications: Polynomial multiplication, Addition of long positive integers. **Trees:** Recursive Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST), Expression Trees (ET).	
Unit –IV	**09 Hrs**
Various Operations on BT, BST, ET: Insertion, Deletion, Display and Traversals. Applications: Tree Sort, Infix, Postfix and Prefix. **Heap:** Definition, Construction, Applications of Heap: Heap Sort, Priority Queue.	
Unit –V	**09 Hrs**
Threaded Binary Tree: Types and application. Balanced tree: AVL trees, B+ tree, Splay and Tries. Graph: Preliminaries; Matrix and Adjacency List representation of Graphs. **Hashing:** Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Apply the knowledge of computing to define the various data structures and its operations.
CO 2	Analyse a problem and identify the suitable data structure to develop solution.
CO 3	Investigate &Design solution to a given problem using modern tools and appropriate data structure
CO 4	Implement solutions for real-time applications
CO 5	Demonstrate Good Coding Practices engaging in lifelong learning

Reference Books	
1.	Data Structures using C and C++, Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum, 2nd Edition, 2009, PHI/Pearson.
2.	Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised Edition, 2013, AddisonWesley, ISBN-13: 9780132847377
3.	Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education
4.	Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, Illustrated Edition, Computer Science Press.

LABORATORY COMPONENT

PART A

Note: The following programs can be executed on C/C++/Python/Java or any equivalenttool/language

Practice Programs:

Implementation and execution of following programs to understand basic concept and working of various data structures.

1. To solve tower of Hanoi problem.
2. To Implement a Stack using an Array
3. To Implement a Queue using an Array
4. To implement Stack using multiple Queues
5. To implement Queue using multiple Stacks
6. To Search for an Element in a Linked List
7. To reverse a Linked List
8. To Detect the Cycle in a Linked List
9. To Print Height and Depth of given Binary Tree
10. To Implement Binary Search Tree and tree traversals

Lab Programs:(At-least two application from each of the following data structure)

1. **Application of Stack**
   a) Implementation of Infix to Postfix conversion
   b) Implementation of Infix to Postfix conversion
   c) Implementation of evaluation of postfix expression
   d) Implementation of evaluation of prefix evaluation

2. **Application of Queue**
   a) Implement Circular Buffer or Ring Buffer
   b) Implement Priority Queue to Add and Delete Elements
   c) Implementation of multiple stacks and queues
   d) Implementation of maze problem

3. **Application of List**
   a) Implementation of sparse matrix multiplication.
   b) Implementation of polynomials operations (addition, subtraction) using Linked List.
   c) Implementation of Linked Lists menu driven program (stack and queue)
   d) Implementation of Double ended queue using Linked Lists.

4. **Application of Heap, Tries and Hash Table**
   a) Implementation of Double hashing technique
   b) Implementation of priority queue using Binary Heap
   c) Implementation of Heapsort
   d) Implementation of dictionary using Tries

5. **Application of Trees**
   a) Implementation of conversion of Prefix to Postfix / Infix to Postfix /Postfix to Prefix using Expression Tree.

b) Implementation of various operations on Binary Tree like – creating a tree, displaying a tree, copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.

c) Implementation of various operations on Binary Search Tree like – Inserting a node, Deleting A node, Displaying a tree, Tree Sort

d) Implementation of B+ tree

RUBRICFOR THE CONTINUOUS INTERNAL EVALUATION		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10) **Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: III						
APPLIED DIGITAL LOGIC DESIGN AND COMPUTER ORGANISATION **Category: PROFESSIONAL CORE COURSE** **(Theory and Practice)** **(Common to CS, CD & CY)**						
Course Code	**:**	**CS234AI**		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**3 : 0 : 1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**45L + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**9 Hrs**
Arithmetic: Addition and Subtraction of Signed Numbers, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication, Bit-Pair Recoding of Multipliers, Integer Division, Floating-Point Numbers and their single precision representation. **Simplification:** Karnaugh Maps and Quine Mc-Cluskey method to obtain minimal Expressions for Complete Boolean and Incomplete Boolean Expressions.	
Unit – II	**9 Hrs**
Binary Adders and Subtractors: Binary parallel adder, Carry Look Ahead Adders, decimal adder, Magnitude Comparator, Decoders,Encoders, Multiplexers. **Logic Design Using Sequential Circuits:** Flip-Flops and Applications - The Basic Bistable Elements, Latches, Timing Considerations, Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops), EdgeTriggered Flip-Flops, Characteristic Equations, Registers - SISO, SIPO, PISO, PIPO and Universal Shift Register.	
Unit –III	**9 Hrs**
Applications of FlipFlops: Binary Ripple Counters, Synchronous Binary Counters, Counters basedon Shift Registers. Design of Synchronous Counters and Self-Correcting Counters **Study and design of Synchronous Sequential Networks:** Synchronous Sequential Networks - Structure and operation of Clocked synchronous Sequential Networks, Analysisof Clocked Synchronous Sequential Networks, Modelling clocked synchronous sequential network behaviour, StateTable Reduction, The State Assignment.	
Unit –IV	**9 Hrs**
Basic Structure of Computers: Functional Units, Basic Operational Concepts, Performance – Technology and Parallelism. **Instruction Set Architecture:** Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language- Assembler Directives, Assembly and Execution of Programs. Stacks, Subroutines- Subroutine Nesting and the Processor Stack, Parameter Passing, The Stack Frame	
Unit –V	**9 Hrs**
Basic Processing Unit: Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control. **The Memory System:** Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Memory Hierarchy, Cache Memories- Mapping Functions, Examples of Mapping Techniques, Performance Considerations.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply design requirements for digital systems and Computer organization
CO 2	Analyse the models used for designing various Combinational and Sequential circuits
CO 3	Develop applications of synchronous sequential networks using flip flops, registers and counters
CO 4	Design optimized modern processors and memories for given specifications
CO 5	Investigate techniques of digital system design for building industry relevant real-world systems usingelectronic components and modern tools

Reference Books	
1	Carl Hamacher , ZvonkoVranesic, SafwatZaky, NaraigManjikian "Computer Organization and Embedded Systems", Mc Graw Hill, 6th Edition, 2012, ISBN-13: 978-0-07-338065-0
2	Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, 2003 ISBN-13: 0-07- 252503-7
3	David A. Patterson and John L. Hennessy, "Computer Organization and Design", Elsevier, 5th Edition, 2014, ISBN-13: 978-0-12-407726-3.
4	M. Morris Mano, "Digital Logic and Computer Design", 2016 Pearson India Education Services

LABORATORY COMPONENT

PART- A: Experiments

Conduction of laboratory exercises using digital trainer kit/FPGA/Appropriate simulator

Ex. No.		Description
1	Realization of Excess-3 Code converter with Parallel Adder and Subtractor using 4-bit adder, using the IC – 7483.	
2.	Realization of Full Adder and Full Subtract or using Multiplexers, using IC 74153.	
3	Design and realization One Bit and Two-Bit Magnitude Comparator using logic Gates.	
4	a)	Realization of Binary to Gray Code Converter using decoders, using the IC 74139.
	b)	Realization of single digit Seven segment display using the BCD to seven segment decoders, using the IC–7447 and Realization of Priority Encoder using IC–74147.
5.	Design and Realization of Master-Slave JK Flip Flop using only NAND Gates.	
6	a)	Realization of Synchronous Up-Down programmable counter using IC 74192.
	b)	Realization of Asynchronous decade counter and its variations using IC 7490
7	a)	Design and realization of sequence generator using IC 7495.
	b)	Realization of Ring counter and Johnson counter using IC 7495.
8	Design of Mod-N Synchronous Up counters using IC 74112 / 7476 / Simulation	

PART- B: Innovative Experiments (IE) / Open Ended Experiments

Design a 4/8-bit CPU using the LOGISIM simulator, for the following specifications.

1) Program Counter (Assume 256 locations of program/code memory)
2) Instruction Register (Assume instruction size as 16 bit)
3) General Purpose Registers (RISC type-R0-R7): Use Harvard & Multiple Bus Architecture
4) ALU (to support 4-bit integer arithmetic operations & 4-bit logical operations)
5) Memory – 1024 locations of ROM (to store instructions of size 16 bit) and 256 RAM (to store 4-bit data)
6) Implement the following instructions namely: MOV, ADD, SUB, LOAD, STORE, AND, XOR, NOT, BRANCH, BRANCH ON CONDITION.
7) Result to be displayed on 7-segment displays / reg tab of LOGISIM

RUBRICFOR THE CONTINUOUS INTERNAL EVALUATION		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10)**Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREESub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: III						
OPERATING SYSTEMS **Category: PROFESSIONAL CORE COURSE** **(Theory and Practice)** **(Common to CS, IS, CD & CY)**						
Course Code	**:**	**CS235AI**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**45L + 30P**		**SEE Duration**	**:**	**3 + 3 Hours**

Unit-I	**10 Hrs.**
Introduction- Perspectives Business domain: Virtualization and Cloud Computing Application: Traditional computing, Mobile computing, Distributed systems **Introduction** Operating System introduction, Operating System structure, Operating system Operations. **System Structures** Operating system services, System Calls, Types of System calls **Process Management** Process concept, Process scheduling, Operations on processes	
Unit – II	**08 Hrs.**
Multithreaded programming Overview, Multicore programming, Multithreading models, Thread libraries - pthreads **CPU scheduling and Process Synchronization** Basic concepts, scheduling criteria, scheduling algorithms-FCFS, SJF, RR, priority, Real-time CPU scheduling	
Unit –III	**09 Hrs.**
Process Synchronization Background, The Critical section problem, Peterson's Solution **Process Synchronization** Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization **Case study:** Implementation of classic synchronization problem using semaphores	
Unit –IV	**08 Hrs.**
Main Memory Management Background, Swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table. **Virtual memory** Background, Demand Paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing	
Unit –V	**10 Hrs.**
File Systems File Naming, File Structure, File Types, File Access, File Attributes, File Operations, An example program using File-System calls, File-System Layout, Implementing Files. **The Virtual File System:** The role of the Virtual File System (VFS), VFS data structure, Filesystem Types, Filesystem handling, Pathname lookup, Implementation of VFS System calls, File Locking.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Demonstrate the fundamental concepts of operating system like process management, file management, memory management and issues of synchronization.
CO 2	Analyze and interpret operating system concepts to acquire a detailed understanding of the course.
CO 3	Apply the operating systems concepts to address related new problems in computer science Domain.
CO 4	Design or develop solutions using modern tools to solve applicable problems in operating systems domain.
CO5	Extend the theoretical knowledge acquired through the course to demonstrate skills like investigation, effective communication, working in team/Individual, following ethical practices by implementing operating system concepts/applications and engage in lifelong learning.

Reference Books	
1.	Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin , Greg Gagne, 9th Edition, Incorporated, 2018, John Wiley & Sons, ISBN 978-1-265-5427-0
2.	Modern operating systems, Tanenbaum, Andrew, 4th Edition, Pearson Education, Inc 2009. ISBN 013359162X, 978-0133591620
3.	UNIX System Programming Using C++, Terrence Chan, 2011, Prentice Hall India, ISBN: 9788120314689 978-8120314689.
4.	Operating systems - A concept based Approach, D.M Dhamdhere, 3rd Edition, 2017, Tata McGraw-Hill, ISBN: 1259005585, 978-1259005589
5.	"xv6: a simple, Unix-like teaching operating system", https://pdos.csail.mit.edu/6.828/2014/xv6/book-rev8.pdf
6.	Understanding the LINUX Kernal, Daniel P Bovet and Marco Cesati, 3rd Edition, 17 November 2005, O'Reilly Publication, 9780596554910, 0596554915. (For Virtual File System of fifth unit)

Laboratory Component
PART A 1. Implementation of basic UNIX commands using file APIs- Write a program to implementcommands ls(-l option), cp, rm and mv using UNIX file APIs. 2. Apply the concepts of Process control system calls to build applications to demonstrate use of fork, execve, wait, getpid, exit system calls 3. Apply the pthread library to build Applications to demonstrate use of pthread library functions to create and manage threads. 4. Apply the concepts of Process/Thread synchronization to build Applications to demonstrate process/thread synchronization using semaphores and mutex. Implement Dining philosophers problem, reader-writer and producer-consumer. 5. Apply the concepts of Process/Thread synchronization for file access to build applications to demonstrate process/thread synchronization using file locks. 6. Apply the concepts of Static and Shared libraries to write a program to create and use static and shared libraries. Demonstrate the advantage of shared libraries over static libraries in terms of memory usage.

PART B
Open Ended Project

The students are expected to implement a mini project using operating system concepts and APIs/system calls. They are required to form a team with constraint of maximum 3 persons in a team, select a problem/application of their choice to implement and to take confirmation from faculty in charge before starting the project. The objectives of project implementation are:

- Explore and understand underlying architecture, kernel structure and associated components for implementation of the project.
- Design and implement the solution using appropriate tools and platform.
- Documentation and submission of report

Sample projects can be kernel implementation from scratch, compiler implementation, assembler implementation, iOS system level programs, Android OS system level programs, Embedded OS system level programs, Raspberry Pi OS implementation, File System implementation and similar such projects.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION		
#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. Each quiz is evaluated for 10 marks adding up to 20 MARKS	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50Marks**, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10) Designing & Modeling (10)**Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks. THE FINAL MARKS WILL BE 50MARKS	**50**
	MAXIMUM MARKS FOR THE CIE (THEORY AND PRATICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of questions covering entire syllabus	20
	PART B (Maximum of THREESub-divisions only)	
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7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: III						
DESIGN THINKING LAB **Category: PROFESSIONAL CORE COURSE** **(Practical)**						
Course Code	:	CS237DL		**CIE**	:	50 Marks
Credits: L:T:P	:	0:0:2		**SEE**	:	50 Marks
Total Hours	:	56P		**SEE Duration**	:	2 Hours

Guidelines for Design Thinking Lab:

1. The Design Thinking Lab (DTL) is to be carried out by a team of two-three students.
2. Each student in a team must contribute equally in the tasks mentioned below.
3. Each group has to select a theme that will provide solutions to the challenges of societal concern. Normally three to four themes would be identified by the by the department
4. Each group should follow the stages of Empathy, Design, Ideate, prototype and Test for completion of DTL.
5. After every stage of DTL, the committee constituted by the department along with the coordinators would evaluate for CIE. The committee shall consist of respective coordinator & two senior faculty members as examiners. The evaluation will be done for each student separately.
6. The team should prepare a Digital Poster and a report should be submitted after incorporation of any modifications suggested by the evaluation committee.

The Design Thinking lab tasks would involve:

1. Carry out the detailed questionnaire to arrive at the problem of the selected theme.
   The empathy report shall be prepared based on the response of the stake holders.
2. For the problem identified, the team needs to give solution through thinking out of the box innovatively to complete the ideation stage of DTL
3. Once the idea of the solution is ready, detailed design has to be formulated in the Design stage considering the practical feasibility.
4. If the Design of the problem is approved, the team should implement the design and come out with prototype of the system.
5. Conduct thorough testing of all the modules in the prototype developed and carry out integrated testing.
6. Demonstrate the functioning of the prototype along with presentations of the same.
7. Prepare a Digital poster indicating all the stages of DTL separately. A Detailed project report also should be submitted covering the difficulties and challenges faced in each stage of DTL.
8. Methods of testing and validation should be clearly defined both in the Digital poster as well as the report.

The students are required to submit the Poster and the report in the prescribed format provided by the department.

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Interpreting and implementing the empathy, ideate and design should be implemented by applying the concepts learnt.
CO2	The course will facilitate effective participation by the student in team work and development of communication and presentation skills essential for being part of any of the domains in his / her future career.
CO3	Appling project life cycle effectively to develop an efficient prototype.
CO4	Produce students who would be equipped to pursue higher studies in a specialized area or carry out research work in an industrial environment.

Scheme of Evaluation for CIE Marks:

Evaluation will be carried out in three phases:

Phase	Activity	Weightage
I	Empathy, Ideate evaluation	10M
II	Design evaluation	15M
III	Prototype evaluation, Digital Poster presentation and report submission	25M
	Total	**50M**

Scheme of Evaluation for SEE Marks:

Sl. No.	Evaluation Component	Marks
1.	Written presentation of synopsis: Write up	5M
2.	Presentation/Demonstration of the project	15M
3.	Demonstration of the project	20M
4.	Viva	5M
5.	Report	5M
	Total	**50M**

Semester: III						
BRIDGE COURSE: C PROGRAMMING (Mandatory Audit Course) (Common to all Programs)						
Course Code	:	**CS139AT**		**CIE**	:	**50 Marks**
Credits: L:T:P	:	**2:0:0(Audit)**		**SEE**	:	**--**
Total Hours	:	**30L**		**SEE Duration**	:	**--**

Unit-I	**6 Hrs**
Introduction to Programming Definition of a computer. Components of computer system, Programming Languages. Design and implementation of efficient programs. Program Design Tools: Algorithms, Flowcharts and Pseudo codes. Types of Errors.	
Unit – II	**6 Hrs**
Introduction to C Introduction, structure of a C program, Writing the first program, Files used in a C program. Compiling and executing C Programs using comments, C Tokens, Character set in C, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O statements in C. Operators in C, Type conversion and type casting, scope of variables.	
Unit –III	**6 Hrs**
Decision Control and Looping Statements Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements **Arrays** Introduction, Declaration of Arrays, Accessing elements of an array, Storing values in arrays, Operations on Arrays- Traversing, Inserting and Deletion of element in an array. Two dimensional arrays- Operations on two dimensional arrays.	
Unit –IV	**6 Hrs**
Strings Introduction, Operations on strings- finding length of a string, converting characters of a string into uppercase and lowercase, Concatenating two strings, appending a string to another string, comparing two string, reversing a string. String and character Built in functions. **Functions** Introduction, Using functions, Function declaration/function prototype, Function definition, Function call, Return statement.	
Unit-V	**6 Hrs**
Functions Passing parameters to a function, Built-in functions. Passing arrays to functions. Recursion. **Structures and Pointers** Introduction: Structure Declaration, Typedef declaration, initialization of structures, accessing members of a structures, Introduction to pointers, declaring pointer variables.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Analyse problems and design solution using program design tools.
CO 2	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO 3	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology
CO 4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

Reference Books	
1.	Programming in C, Reema Thareja, 2018, Oxford University Press. ISBN: 9780199492282.
2.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
3.	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.
4.	Algorithmic Problem Solving, Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5

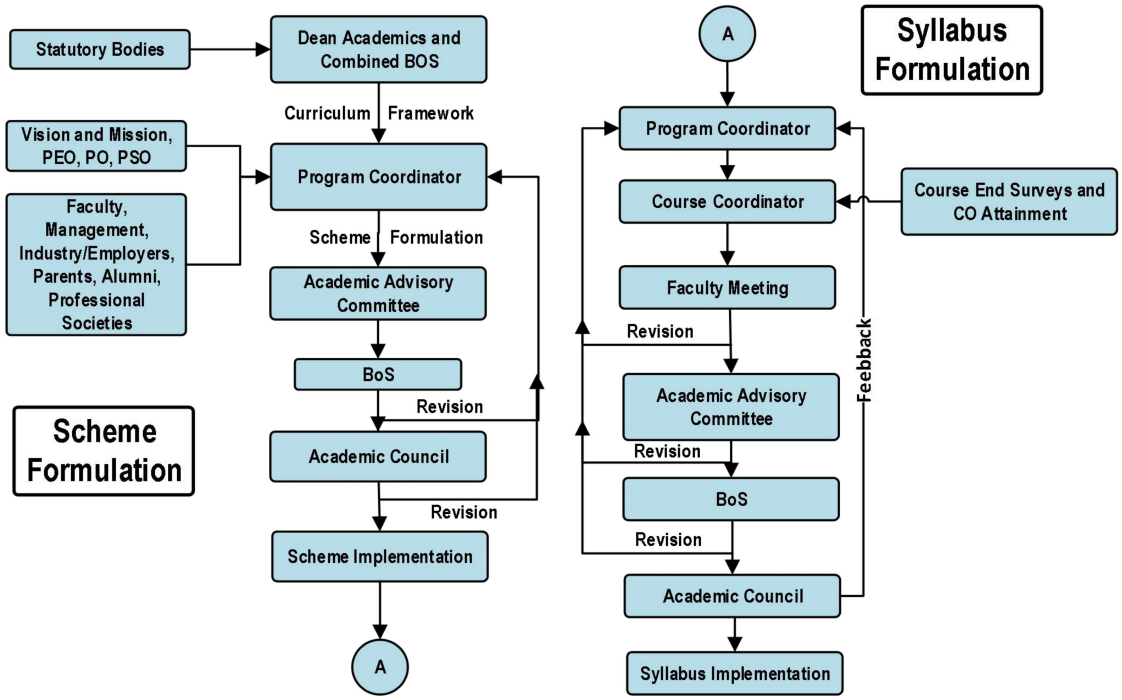
PRACTICE PROGRAMS

Implement the following programs using cc/gcc compiler

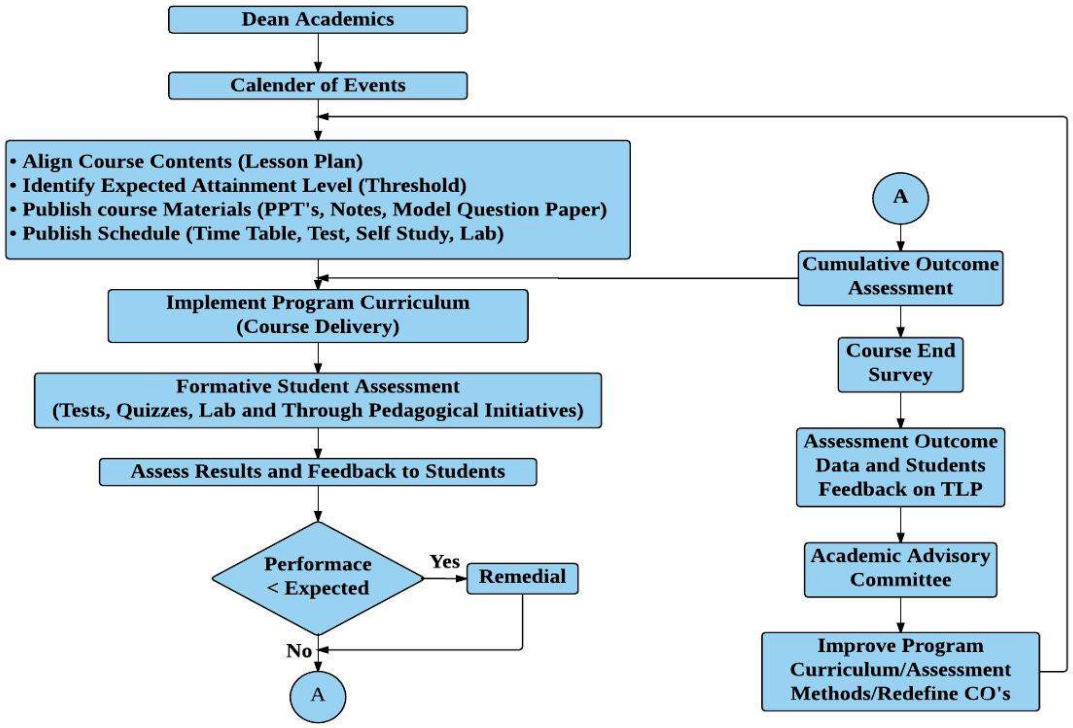
1. Familiarization with programming environment: Concept of creating, naming and saving the program file in gedit/vi editor, Concept of compilation and execution, Concept of debugging in GDB environment.
2. Implementation and execution of simple programs to understand working of
   - Formatted input and output functions- printf() and scanf().
   - Escape sequences in C.
   - Using formula in a C program for specific computation: For example: computing area of circle, converting Celsius to Fahrenheit, area of a triangle, converting distance in centimeters to inches, etc.
   - Preprocessor directives (#include, #define).
3. Execution of erroneous C programs to understand debugging and correcting the errors like:
   - Syntax / compiler errors.
   - Run-time errors.
   - Linker errors.
   - Logical errors.
   - Semantical errors.
4. Implementation and execution of simple programs to understand working of operators like:
   - Unary.
   - Arithmetic.
   - Logical.
   - Relational.
   - Conditional.
   - Bitwise.
5. Develop a C program to compute the roots of the equation ax2 + bx + c = 0.
6. Develop a C program that reads N integer numbers and arrange them in ascending or descending order using selection sort and bubble sort technique.
7. Develop a C program for Matrix multiplication.
8. Develop a C program to search an element using Binary search and linear search techniques.
9. Using functions develop a C program to perform the following tasks by parameter passing to read a string from the user and print appropriate message for palindrome or not palindrome.
10. Develop a C program to compute average marks of 'n' students (Name, Roll_No, Test Marks) and search a particular record based on 'Roll_No'.
11. Develop a C program using pointers to function to find given two strings are equal or not.
12. Develop a C program using recursion, to determine GCD , LCM of two numbers and to perform binary to decimal conversion.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 05 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	10
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO** tests will be conducted. Each test will be evaluated for 25 Marks, adding upto 50 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 20 MARKS.**	20
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (10) & Phase II (10) ADDING UPTO 20 MARKS.**	20
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

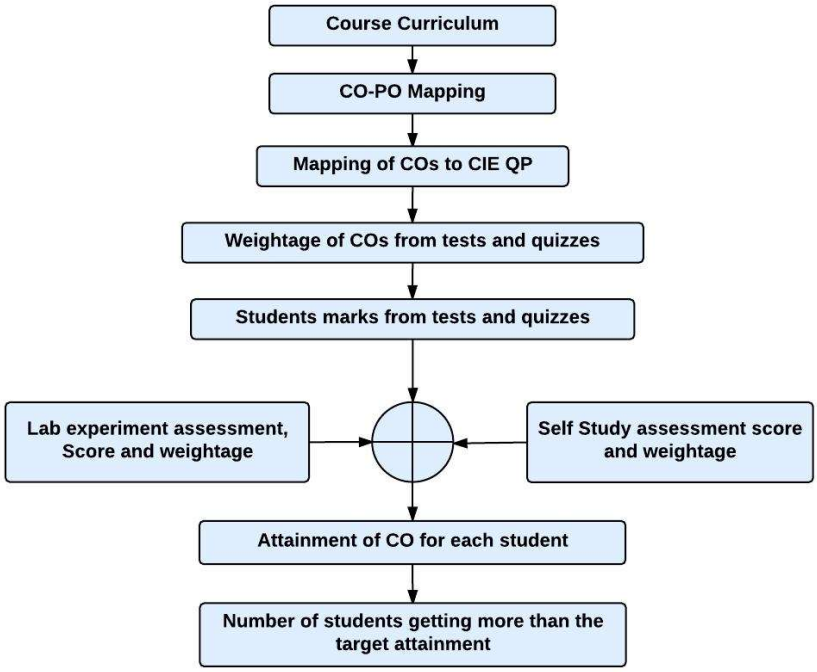
Curriculum Design Process



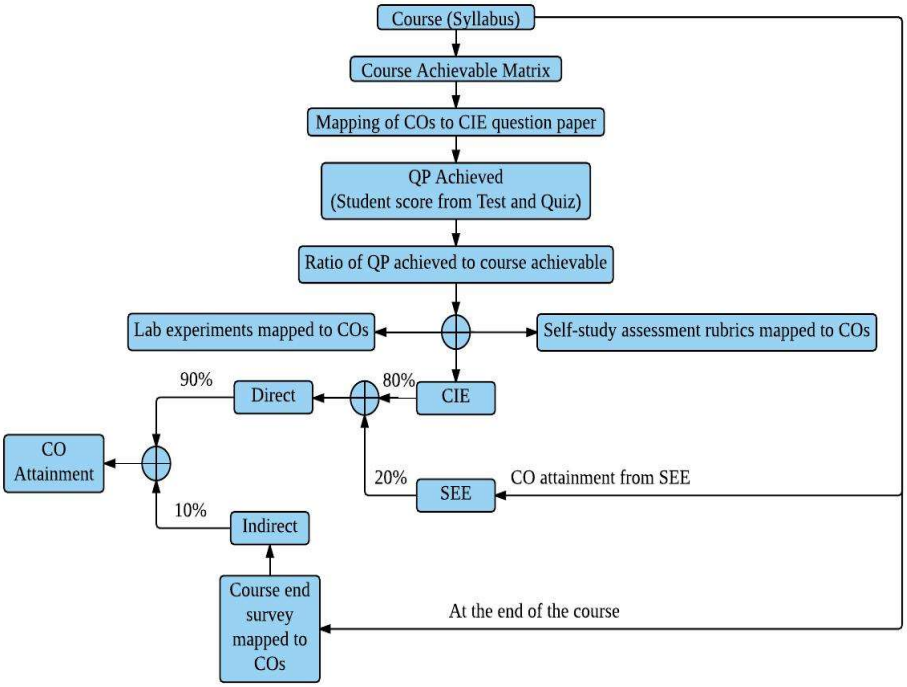
Academic Planning And Implementation



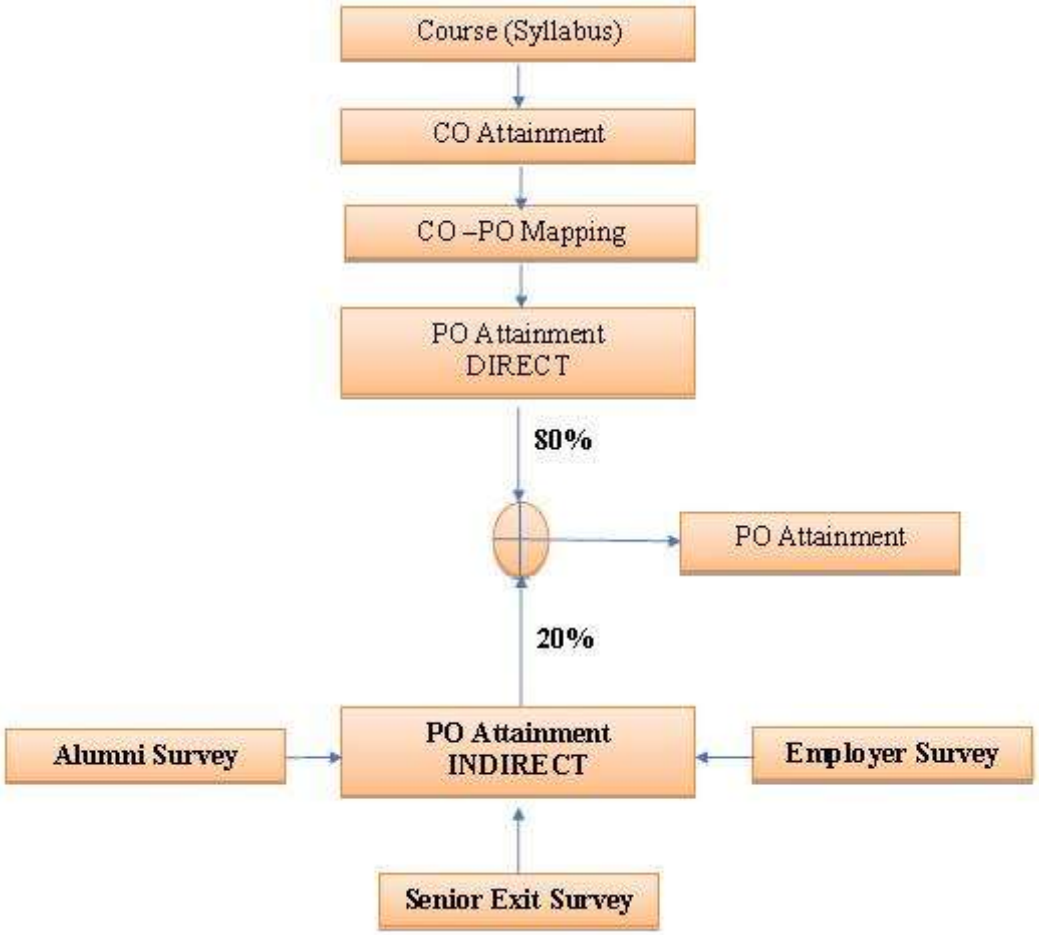
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



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PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the 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.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.