RV COLLEGE OF ENGINEERING®

Go, change the world

RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU, Belagavi)
Approved by AICTE, New Delhi, Accredited By NBA, New Delhi
RV Vidyaniketan Post, 8th Mile, Mysuru Road, Bengaluru- -560 059.

Bachelor of Engineering (B.E)

COMPUTER SCIENCE & ENGINEERING

(2018 Scheme)

III & IV Semester

ACADEMIC YEAR 2020-2021

Estd.1963

Go, change the world

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RV Vidyaniketan Post, 8th Mile, Mysuru Road, Bengaluru- -560 059.

2020 Ranked 70th in Engineering Category

Accredited by NBA

One of the most preferred Technical Institutions

PROGRAMS OFFERED

B.E. Programs : AS, BT, CH, CS, CV, EC, EE, EI, ET, IM, IS, ME.
M.Tech (16), MCA, M.Sc. (Engg.)

Ph.D. Programs : All Departments are recognized as Research Centres by VTU

- Best NCC Institution for Karnataka & Goa Directorate for the year 2017-19
- Five RVCE Alumni cleared civil Services Exam in 2019-20
- Ranked in top 10 Pvt. College in the country by various magazines
- Ranked 3rd in Sports & Cultural Activities under VTU (2018-19)

Use of ICT in Teaching Learning Process

Holistic development of students through NCC, NSS Cultural activities, Community service & Sports.

Established Centre of Excellence in Macroelectronics & Internet of things

MoUs: 96+with Industries / Academic Institutions in India & abroad

Executed more than Rs. 40 crores worth sponsored research projects & consultancy works since 3 Years

UPSC Results (2019) : RVCE - Alumni

Name	:	Rahul Sharanappa Shankanur
Rank	:	17
Branch	:	ECE
Batch	:	2012

Name	:	Raghavendra
Rank	:	739
Branch	:	ECE
Batch	:	2012

Name	:	Harshavardhana B.J.
Rank	:	352
Branch	:	CSE
Batch	:	2015

Human Resource

RVCE - Greaves Cotton Ltd Centre of excellence in e-mobility

RV-Mercedes Benz Centre for Automotive Mechatronics

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R.V. Vidyaniketan Post, Mysore Road

Bengaluru – 560 059

Bachelor of Engineering (B.E.)
Scheme and Syllabus of III & IV Semesters

2018 SCHEME

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

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.

DEPARTMENT MISSION

- 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 takeup 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.	CV	Civil Engineering
9.	ME	Mechanical Engineering
10.	EE	Electrical & Electronics Engineering
11.	EC	Electronics & Communication Engineering
12.	IM	Industrial Engineering & Management
13.	EI	Electronics & Instrumentation Engineering
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	ET	Electronics & Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PY	Physics
21.	CY	Chemistry
22.	MA	Mathematics

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RV COLLEGE OF ENGINEERING®

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COMPUTER SCIENCE AND ENGINEERING

THIRD SEMESTER CREDIT SCHEME

Sl. No.	Course Code	Course Title	BoS	Credit Allocation			Total Credits
				L	T	P	
1.	18MA31A*	Linear Algebra, Laplace Transform and Combinatorics	MA	4	1	0	**5**
2.	18BT32A**	Environmental Technology	BT	2	0	0	**2**
3.	18IS33	Data Structures and its Applications (Common to CS & IS)	IS	3	0	1	**4**
4.	18CS34	Operating Systems	CS	3	0	1	**4**
5.	18CS35	Foundations Of Computer Systems Design	CS	4	0	1	**5**
6.	18CS36	Discrete Mathematical Structures (Common to CS & IS)	CS	3	0	0	**3**
7.	18DCS37***	Bridge Course: C Programming	CS	2	0	0	**0**
8.	18HS38A / 18HS38V	Kannada Course: **AADALITHA KANNADA (18HS38A) / VYAVAHARIKA KANNADA (18HS38V)**	HSS	1	0	0	**1**
Total Number of Credits				**20**	**1**	**3**	**24**
Total number of Hours/Week				**20+2***	**2**	**7.5**	

*ENGINEERING MATHEMATICS - III

Sl.No	COURSE TITLE	COURSE CODE	BRANCHES
1.	Linear Algebra, Laplace Transform and Combinatorics	18MA31A	CS & IS
2.	Discrete and Integral Transforms	18MA31B	EC,EE,EI,TE
3.	Engineering Mathematics –III	18MA31C	AS, BT,CH,CV,IM,ME

**

Sl.No	COURSE TITLE	COURSE CODE	BRANCHES
1.	Environmental Technology	18BT32A	All circuit Branches
2.	Biology for Engineers	18BT32B	BT & AS
3.	Engineering Materials	18ME32	ME, CH & IM

*** Bridge Course: Audit course for lateral entry diploma students

Sl.No	COURSE TITLE	COURSE CODE	BRANCHES
1	Bridge Course Mathematics	18DMA37	AS,BT,CH,CV,EC,EE,EI, IM,ME&TE
2	Bridge Course C Programming	18DCS37	CS & IS

There are two text books prescribed by VTU for the Kannada Course:

1. Samskruthika Kannada **(AADALITHA KANNADA-18HS38A);**
2. Balake Kannada **(VYAVAHARIKA KANNADA-18HS38V);**

The first text book is prescribed for the students who know Kannada to speak, read and write **(KARNATAKA STUDENTS)**. The second text book is for students who do not understand the Kannada language (**NON-KARNATAKA STUDENTS)**

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COMPUTER SCIENCE AND ENGINEERING

FOURTH SEMESTER CREDIT SCHEME							
Sl. No	**Course Code**	**Course Title**	**BOS**	**Credit Allocation**			**Total Credits**
				L	**T**	**P**	
1.	18MA41A*	Graph Theory, Statistics and Probability Theory	MA	4	1	0	**5**
2.	18BT42B**	Biology for Engineers	BT	2	0	0	**2**
3.	18CS43	Design And Analysis Of Algorithms (Common to CS & IS)	CS	3	0	1	**4**
4.	18CS44	Microcontrollers and Embedded Systems	CS	3	0	1	**4**
5.	18CS45	Object Oriented Programming Using JAVA (Common to CS & IS)	CS	3	0	1	**4**
6.	18CS46	Computer Networks	CS	3	0	0	**3**
7.	18CS47	Design Thinking Lab	CS	0	0	2	**2**
8.	18DMA48***	Bridge Course: Mathematics	MA	2	0	0	**0**
9.	18HS49	Professional Practice-I Communication Skills	HSS	0	0	1	**1**
Total Number of Credits				**18**	**1**	**6**	**25**
Total number of Hours/Week				**18+2**	**2**	**12.5+2.5**	

* ENGINEERING MATHEMATICS – IV

Sl.No	COURSE TITLE	COURSE CODE	BRANCHES
1.	Graph Theory, Statistics and Probability Theory	18MA41A	CS & IS
2.	Linear Algebra, Statistics and Probability Theory	18MA41B	EC,EE,EI,TE
3.	Engineering Mathematics -IV	18MA41C	AS, CH, CV, ME

**

Sl.No	COURSE TITLE	COURSE CODE	BRANCHES
1.	Engineering Materials	18EC42	EC,EE,EI,TE
2.	Biology for Engineers	18BT42B	Circuit branches (CS & IS)
3.	Environmental Technology	18BT42A	All Non circuit branches

*** Bridge Course: Audit course for lateral entry diploma students

Sl.No	COURSE TITLE	COURSE CODE	BRANCHES
1	Bridge Course Mathematics	18DMA48	CS & IS
2	Bridge Course C Programming	18DCS48	AS,BT,CH,CV,EC,EE,EI,IM,ME & TE

Note: Internship to be taken up during the vacation period after the 4th semester.

Semester: III						
LINEAR ALGEBRA, LAPLACE TRANSFORM AND COMBINATORICS (Theory) (Common to CS & IS)						
Course Code	**:**	18MA31A		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	4:1:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	52L+13T		**SEE Duration**	**:**	**3.00 Hours**
Course Learning Objectives: The students will be able to						
1	Understand the basic concepts of vector spaces such as independence, basis, dimensions, orthogonality and linear transformations in engineering applications.					
2	Demonstrate the concepts of Laplace transform to solve differential equation and convolution of functions.					
3	Apply the knowledge of counting in problems of enumeration, generating function and number theory.					
4	Solve the problems on concepts of integers and number theoretic functions which are used in cryptography.					
5	Use of mathematical IT tools to analyze and visualize the above concepts.					

Unit-I	**10 Hrs**
Linear Algebra – I: Vector spaces, subspaces, linear dependence, basis and dimension, four fundamental subspaces. Rank and nullity theorem (without proof). Linear transformations - projection, rotation and reflection matrices, matrix representation, kernel and image of a linear transformation.	
Unit – II	**11 Hrs**
Linear Algebra - II: Orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization, Eigen values and Eigen vectors (recapitulation), diagonalization of a matrix (symmetric matrices), singular value decomposition. SVD applied to digital image processing (using MATLAB).	
Unit –III	**11 Hrs**
Laplace and Inverse Laplace Transform: Existence and uniqueness of Laplace transform (LT), transform of elementary functions. Properties - linearity, scaling and s – domain shift, differentiation in the s – domain, division by t, differentiation and integration in the time domain, transform of periodic functions (square wave, saw-tooth wave, triangular wave, full and half wave rectifier). Inverse Laplace transform - properties, evaluation using different methods, convolution theorem (without proof), problems. Solution of ordinary differential equations.	
Unit –IV	**10 Hrs**
Number Theory: Divisibility, the greatest common divisor, properties of prime numbers, the fundamental theorem of arithmetic, modular arithmetic, remainder arithmetic, multiplicative inverses and cancelling, Euler's theorem. Turing's code, RSA Public key encryption.	
Unit –V	**10 Hrs**
Enumeration and Generating Functions: The principles of inclusion and exclusion and generalization, derangements, rook polynomials, generating functions - definition and example, partitions of integers, exponential generating functions. Counting, arrangements with forbidden positions.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamental concepts of linear algebra, Laplace and inverse Laplace transforms, number theory and enumeration.
CO2:	Solve the problems of vector spaces, linear transformations, Laplace transform, gcd and generating functions.
CO3:	Apply the acquired knowledge to solve the problems of factorization, transform of special functions and exponential generating functions.
CO4:	Evaluate solution of differential equations using Laplace transform, decomposition of a matrix, public key encryption.

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	Discrete and Combinatorial Mathematics, Ralph P. Grimaldi, 5th Edition, 2006, Pearson Education, ISBN-13: 978-81-7758-424-0.
3	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978- 81-933284-9-1.
4	Linear Algebra and its Applications, Gilbert Strang, 4th Edition, 2006, Cengage Learning India Edition, ISBN: 81-315-0172-8.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	3	-	-	-	-	-	-	-	1	-	1
CO3	3	3	1	-	2	-	-	-	-	1	-	1
CO4	3	3	2	1	2	-	-	-	-	1	-	1

High-3 : Medium-2 : Low-1

Semester III						
ENVIRONMENTAL TECHNOLOGY (Theory) (Common to All Circuit Branches)						
Course Code	**:**	18BT32A		**CIE Marks:**	**:**	**50**
Credits: L:T:P	**:**	2:0:0		**SEE Marks:**	**:**	**50**
Total Hours	**:**	26L		**SEE Duration (Theory):**	**:**	02 Hours

Course learning objectives: The student will be able to	
1	Understand the various components of environment and the significance of the sustainability of healthy environment.
2	Recognize the implications of different types of the wastes produced by natural and anthropogenic activity.
3	Learn the strategies to recover the energy from the waste.
4	Design the models that help mitigate or prevent the negative impact of proposed activity on the environment.

Unit I	**5 Hrs**
Introduction: Environment - Components of environment, Ecosystem. Impact of anthropogenic activities on environment (agriculture, mining and transportation), Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.	
Unit II	**6 Hrs**
Environmental pollution: Air pollution – point and non point sources of air pollution and their controlling measures (particulate and gaseous contaminants). Noise pollution, Land pollution (sources, impacts and remedial measures). **Water management**: Water conservation techniques, water borne diseases & water induced diseases, arsenic & fluoride problems in drinking water and ground water contamination, advanced waste water treatment techniques.	
Unit III	**6 Hrs**
Waste management, Solid waste management, e waste management & biomedical waste management – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes. **Energy** – Different types of energy, conventional sources & non conventional sources of energy, solar energy, hydro electric energy, wind energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	
Unit IV	**5 Hrs**
Environmental design: Principles of Environmental design, Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), soilless cultivation (hydroponics), organic farming, use of biofuels, carbon credits, carbon foot prints, Opportunities for green technology markets, carbon sequestration.	
Unit V	**4 Hrs**
Resource recovery system: Processing techniques, materials recovery systems, biological conversion (composting and anaerobic digestion). Thermal conversion products (combustion, incineration, gasification, pyrolysis, use of Refuse Derived Fuels). Case studies of Biomass conversion, e waste.	

Course outcomes: After completing the course, the students will be able to	
CO1	Identify the components of environment and exemplify the detrimental impact of anthropogenic activities on the environment.
CO2	Differentiate the various types of wastes and suggest appropriate safe technological methods to manage the waste.
CO3	Aware of different renewable energy resources and can analyse the nature of waste and propose methods to extract clean energy.
CO4	Adopt the appropriate recovering methods to recover the essential resources from the wastes for reuse or recycling.

Reference Books	
1.	Gilbert, M.M. Introduction to environmental engineering and science, Pearson Education. India: 3rd Edition (2015). ISBN: 9332549761, ISBN-13: 978-9332549760.
2.	Howard S. Peavy, Donald R. Rowe and George Tchobanoglous. 2000. Environmental Engineering, McGraw Hill Education, First edition (1 July 2017). ISBN-10: 9351340260, ISBN-13: 978-9351340263
3.	G. Tyler Miller (Author), Scott Spoolman (Author), (2012) Environmental Science – 15th edition, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044
4.	Vijay Kulkarni and T. V. Ramachandra 2009. Environment Management. TERI Press; ISBN: 8179931846, 9788179931844

Continuous Internal Evaluation (CIE); Theory (50 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks which will be reduced to 15marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 25 marks each and the sum of the marks scored from three tests is reduced to 30. The marks component for is experiential learning 05.

The total CIE for theory is 15(Q)+30(T)+05(EL) =50 marks

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 08marks adding up to 40 marks. Each main question may have sub questions. The question from Units I,IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

.CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	1	2	2	-	-	-	-	-	-	-	-	1
CO4	-	1	1	3	-	-	-	-	-	-	-	1

High-3: Medium-2: Low-1

Semester: III						
DATA STRUCTURES AND ITS APPLICATIONS (Theory and Practice) (Common to CS and IS)						
Course Code	**:**	18IS33		**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	:	3:0:1		**SEE Marks**	**:**	**100 + 50**
Total Hours	:	39L + 35P		**SEE Duration**	**:**	**3 Hrs+3 Hrs**

Course Learning Objectives: The students will be able to

1.	Learn the fundamental data structures and identify data structuring strategies that are appropriate to a given contextual problem and able to design, develop, test and debug in C language considering appropriate data structure.
2.	Illustrate and implement data types such as stack, queue and linked list and apply them for the given problem.
3.	Understand and distinguish the conceptual and applicative differences in trees, binary trees, binary search trees, AVL and splay trees. Apply the correct tree for the given application.
4.	Create and use appropriate data structures in C programs for solving real life problems.

Unit – I	**8 Hrs**
Introduction Introduction to File Management,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	**8 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** Inserting and removing nodes from a list, getnode and freenode operations, Implementation (insertion, deletion and display) of single Linked list.	
Unit – III	**8 Hrs**
Advanced Linked list: Double linked list, circular linked list and header nodes.Application of lists: Polynomial multiplication using single linked list, addition of long positive integers using circular single linked list. **Trees** Implementation (Insertion, deletion and display) of Binary Trees, Binary search trees (BST) implementation	
Unit – IV	**8 Hrs**
Advanced Trees Threaded Binary Trees: Insertion Operation0 Balanced tree: AVL trees, B+ tree, Splay and Tries. **Application of tree:** Expression trees, tree sort, Infix, Postfix and Prefix traversals.	

Unit – V	7 Hrs
Heap Heap construction, deletion, Implementation of priority queue. **Hashing** Collision concept, Implementation (Insertion and deletion) using Linear Probing, separate chaining, quadratic probing, double hashing.	

Laboratory Component **PART-A**	
1	Use Stack operations to do the following: i) Assign to a variable name Y the value of the third element from the top of the stack and keep the stack undisturbed. ii) Given an arbitrary integer n pop out the top n elements. A message should be displayed if an unusual condition is encountered. iii) Assign to a variable name Y the value of the third element from the bottom of the stack and keep the stack undisturbed. (Hint: you may use a temporary stack)
2	Write a C program that parses Infix arithmetic expressions to Postfix arithmetic expressions using a Stack.
3	Write a C program to simulate the working of Messaging System in which a message is placed in a circular Queue by a Message Sender, a message is removed from the circular queue by a Message Receiver, which can also display the contents of the Queue.
4	Implement a program to multiply two polynomials using single linked list.
5	Write a C program to implement addition of long positive integers using circular single linked list with header node.
6	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the output.
7	Write a C program to create Binary Tree and provide insertion and deletion operations and to traverse the tree using In-order, Preorder and Post order (recursively)
8	Given a String representing a parentheses-free infix arithmetic expression, implement a program to place it in a tree in the infix form. Assume that a variable name is a single letter. Traverse the tree to produce an equivalent postfix and prefix expression string.
9	Write a C program to implement Hashing using Linear probing. Implement insertion, deletion, search and display.
10	Write a C program to implement priority queue to insert, delete and display the elements.
PART – B	
Student will design, develop and implement an application using the appropriate data structure. Some example applications are listed below: • Huffman coding • Dictionary implementation for Indian Languages • Stemmer implementation for Indian language • Word frequency finder. • Bitmap Image Compression. • Binary Tree (Graphical Implementation) • To store a set of programs which are to be given access to a hard disk according to their priority • For representing a city region telephone network. • To store a set of fixed key words which are referenced very frequently. • To represent an image in the form of a bitmap.	

- To implement back functionality in the internet browser.
- To store dynamically growing data which is accessed very frequently, based upon a key value.
- To implement printer spooler so that jobs can be printed in the order of their arrival.
- To record the sequence of all the pages browsed in one session.
- To implement the undo function.
- To store information about the directories and files in a system.

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Understand and explore the fundamental concepts of various data structures.
CO 2:	Analyze and represent various data structures and its operations.
CO 3:	Design algorithms using different data structures like Stack, Queue, List, Tree and hashing.
CO 4:	Implement programs with suitable data structure based on the requirements of the real-time application.

Reference Books:	
1.	Data Structures using C and C++, Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum, 2nd Edition, 2009, PHI/Pearson, ISBN-13: 978-8131703281.
2.	Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised edition; 2013, Addison-Wesley, ISBN-13: 978-8131714744
3.	Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education, ISBN-13: 978-0198099307
4.	Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, Illustrated Edition, Computer Science Press, ISBN-13: 978-0716780427
5.	Sweebok: Guide to the software engineering body of knowledge, Pierre Bourque, Richard E. Fairley, Version 3, IEEE society project.
ICT Tools 1. Conduct quiz using tool like Hackerrank or Hackerearth 2. All students must compulsorily take the 30-day-code challenge from August 2019. https://www.hackerrank.com/domains/tutorials/30-days-of-code	

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The Average Marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a Test (T) is conducted for 10 marks. The students are encouraged to implement additional Innovative Experiments (IE) in the lab and are rewarded for 10 marks. Total

marks for the laboratory is 50.
Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks
SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	3	3	1	1	1	-	-	-	-	-	2
CO2	1	2	2	1	1	1	-	-	-	-	-	2
CO3	1	2	2	1	1	1	-	-	-	-	-	2
CO4	1	3	3	1	1	1	-	-	-	-	-	2

High-3: Medium-2: Low-1

Semester: III						
OPERATING SYSTEMS (Theory & Practice)						
Course Code	**:**	18CS34		**CIE Marks**	**:**	**100+50**
Credits: L:T:P	:	3:0:1		**SEE Marks**	**:**	**100+50**
Total Hours	:	39L + 35P		**SEE Duration**	**:**	**3 Hrs + 3 Hrs**

Course Learning Objectives: The students will be able to

1.	Know and understand the classes of operating system, design architecture and system calls.
2.	Understand the concept of *processes, threads and their scheduling mechanisms.*
3.	Model, abstract, and implement efficient software solutions for process synchronization using semaphores and monitors.
4.	Know resource allocation issues and deadlock handling mechanism used by an operating system.
5.	Acquire a detailed understanding of operations in *memory management.*
6.	Study *the important files system used in popular operating systems.*
7.	Relate the concepts studied to one used in practice by taking a case study of two major operating systems.

Unit – I	**8 Hrs**
Introduction to operating systems , Processes and Threads Goals of Operating system; Classes of Operating System; Dual mode of operation; Approaches to OS design and implementation: Microkernel, Layered, modular Approach; P**rocess**- Process concept, Process scheduling, **Threads** - Overview, Multithreading models, Pthreads, threading issues **System Calls/APIs:** fork, vfork, exec, wait, getpid, getppid, Pthreads API to create and manage threads. **Linux case study :** design principles (21.2), kernel modules(21.3)	
Unit – II	**8 Hrs**
CPU scheduling and Process Synchronization CPU scheduling - Basic concepts, scheduling criteria, scheduling algorithms-FCFS, SJF, RR, priority **Process Synchronization** Background, The Critical section problem, Peterson's Solution, Synchronization hardware, Semaphores, Classic problems of synchronization. **System Calls/APIs** POSIX APIs create and manage semaphores: sem_init, sem_wait, sem_post, sem_destroy **Linux case study:** process management(21.4), process scheduling (21.5)	
Unit – III	**8 Hrs**
Main Memory Management Address binding, Logical versus physical-address space, dynamic loading, Dynamic linking and shared libraries, Swapping, Contiguous allocation, Paging, Segmentation **Virtual memory** Demand paging, Page replacement algorithms: FIFO page replacement, Optimal page replacement, LRU page replacement	
Unit – IV	**8 Hrs**
Virtual memory LRU approximation page replacement, Allocation of frames, Thrashing. Linux case study: Memory management(21.6)	

Disk Scheduling and File system Interface	
Disk Scheduling, Unix kernel support for files, file allocation methods, File system APIs: open, read, write, link, unlink, stat Case study: FAT, NTFS and Ext filesystems	
Unit – V	**7 Hrs**
Deadlocks System model, Deadlock characterization, Methods for handling deadlocks, deadlock prevention**,** Deadlock avoidance: Banker's algorithm, Deadlock detection and recovery from deadlock	

Laboratory Component

PART A

1. **Implementation of basic UNIX commands using file APIs**- Write a program to implement commands ls(-l option), cp, rm and mv using UNIX file APIs.
2. **Process control system calls**-Application to demonstrate use of fork, execve, wait, getpid, exit system calls
3. **Thread creation and management using Pthread Library** - Application to demonstrate use of pthread library functions to create and manage threads.
4. **Process scheduling and process priority** – Modify the default scheduling algorithm for MINIX or XV6 operating system.
5. **Process/Thread synchronization** - Application to demonstrate process/thread synchronization using semaphores and mutex. Implement Dining philosophers problem, reader-writer and producer-consumer.
6. **Process/Thread synchronization for file access -** Application to demonstrate process/thread synchronization using file locks.
7. **Deadlock**- Write a program that implements the Bankers' algorithm for deadlock avoidance. The program should check for safe sequence and resource request algorithm.
8. **Memory management:** Write a program to simulate Buddy memory allocation algorithm.
9. **Static and Shared libraries:** 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.

Note: The lab program 1, 2, 3, 9 must be compiled using make utility tool.

PART B

Open Ended Experiments

The students are expected to implement a mini project using operating system concepts and APIs/system calls learned in the theory. The primary emphasis of the experiment is to understand and gain knowledge of operating system concepts so as to apply these concepts in implementing solutions to real world problems.

Students are required to form a team, with constraint of maximum 3 persons in a team. Students have to select the problem/application of their choice and get confirmed with faculty handling the course. Few sample topics are listed below.

Open ended

1. To extend/modify XV6 operating system
2. To extend/modify MINIX operating system
3. XV6 System call tracing
4. Building a new userspace filesystem.
5. Implement a mini shell
6. Implement a garbage collector
7. Implement malloc and calloc using mmap and munmap system calls

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Understand and explore the fundamental concepts of various operating system services.
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 to solve applicable problems in operating systems domain.

Reference Books:	
1.	Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin , Greg Gagne, 8th Edition, Incorporated, 2010, John Wiley & Sons, ISBN 0470233990, 9780470233993.
2.	UNIX System Programming Using C++, Terrence Chan, 1999, Prentice Hall India, ISBN: 81-203-1468-9.
3.	Operating systems - A concept based Approach, D.M Dhamdhere, 3rd Edition, 2008, Tata McGraw-Hill, ISBN: 9781259005589, 1259005585.
4.	"xv6: a simple, Unix-like teaching operating system", https://pdos.csail.mit.edu/6.828/2014/xv6/book-rev8.pdf

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The Average Marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a Test (T) is conducted for 10 marks. The students are encouraged to implement additional Innovative Experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**
CO4	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**

High-3: Medium-2: Low-1

Semester: III						
FOUNDATIONS OF COMPUTER SYSTEMS DESIGN (Theory and Practice)						
Course Code	**:**	18CS35		**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	:	4:0:1		**SEE Marks**	**:**	**100 + 50**
Total Hours	:	52L + 35P		**SEE Duration**	**:**	**3Hrs+3hrs**
Course Learning Objectives: The students will be able to						
1.	Understand the fundamentals of computer System, its organization and appreciate the functionalities of basic processing unit and its control system in processing the Instruction.					
2.	Develop a clear understanding on the Memory System and its design.					
3.	Optimize and design combinational and sequential circuits					
4.	Experimentally validate the combinational and sequential circuits logic circuits					

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 and double precision representation. **Logic Design with MSI Components :** Karnaugh Maps to obtain minimal Expressions for Complete Boolean and Incomplete Boolean Expressions Binary Adders, Substractors, Comparators, Decoders, Encoders, Multiplexers	
UNTI II	**12 Hrs**
Flip-Flops and Applications: The Basic Bistable Elements, Latches, Timing Considerations, Master-Slave Flip-Flops (Pulse-triggerred Flip-Flops), Edge – Triggerred Flip-Flops, Characteristics Equations, Registers- SISO,SIPO,PISO,PIPO and Universal Shift Register . **Counters:** Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers,. Design of Synchronous and Asynchronous Counters	
Unit – III	**12 Hrs**
Synchronous Sequential Networks: Structure and operation of Clocked synchronous Sequential Networks, Analysis of Clocked Synchronous Sequential Networks, Modelling clocked synchronous sequential network behaviour, State Table Reduction, The State Assignment, Completing the design of clocked synchronous sequential networks **Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Performance – Technology and Parallelism.	
Unit – IV	**9 Hrs**
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	**10Hrs**
The Memory System: Basic Concepts, Semiconductor RAM Memories, Cache Memories-Mapping Functions, Examples of Mapping Techniques, Performance Considerations **Basic Processing Unit** Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control.	

Laboratory Component

PART A

1. i.Realization of Excess-3 Code converter with Parallel Adder and Subractor using IC –7483.
   ii.Realization of Binary to Gray Code Converter and vice-versa using IC 74139.
2. Realization of Full Adder and Full Subtractor using IC 74153.
3. Design and realization One Bit and Two Bit Magnitude Comparator using Basic Gates
4. i.Realize decoder using IC-7447
   ii.Realize encoder using IC-74147
5. Design and Realization of Master-Slave JK Flip Flop using NAND Gates only.
6. i.Realization of Up-Down programmable counter using IC 74192 and IC 74193.
   ii.Realization of decade counter and its variations using IC 7490.
7. i.Realization of Ring counter and Johnson counter using IC 7495.
   ii.Design and realization of sequence generator using IC 7495.
8. Design of Mod-N Synchronous Up counter using IC 7476.

PART B

Design a 4-bit CPU by interfacing registers, an ALU and a memory chip incorporating the following features

1. Implement minimum five instructions namely MOV, ADD, SUB, LOAD, STORE, AND, NOT, OR, RETURN, CALL etc.
2. Assume minimum two General Purpose Registers (R1 and R2) excluding Special Purpose Registers like PC, PSW.
3. Assume 8 bit address and 4 bit data path
4. Adopt appropriate memory chip to be addressed by 8 bit address decoder
5. Result to be displayed on 7-segment displays
6. Design an ALU to execute above said instructions

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Understand and explore the modelsof combinational and sequential circuits, operation and Organization of computer system.
CO 2:	Identify the design requirements in organizing system memory and MSI components
CO 3:	Apply the concept of simplification to realize digital circuits
CO 4:	Analyse the importance of various data representations in digital circuits
CO 5:	Design different techniques to realize the digital circuits for various system components.

Reference Books:	
1.	Computer Organization and Embedded Systems, Carl Hamacher , ZvonkoVranesic, SafwatZaky, NaraigManjikian, 6th Edition, 2012, Mc Graw Hill, ISBN-13: 978-0-07-338065-0, ISBN-10: 0-07-338065-2.
2.	Computer Organization and Design, David A. Patterson and John L. Hennessy, 5th Edition, 2014, Elsevier, ISBN13: 978-0-12-407726-3.
3.	Digital Principles and Design, Donald D.Givone, 2003, Tata McGraw-Hill, ISBN-13: 0-07-252503-7.
4.	Digital Principles and Applications, Donald P Leach, Malvoni, GautamSaha, 7th Edition 2010, Tata McGraw Hill, ISBN-13: 978-0070141704.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The Average Marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a Test (T) is conducted for 10 marks. The students are encouraged to implement additional Innovative Experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**			**1**	**-**	**-**	**-**	**-**	**1**		**-**	
CO2		**1**			**-**	**-**	**-**	**-**		**1**	**-**	
CO3	**1**		**1**	**1**	**-**	**-**	**2**	**-**		**1**	**-**	**2**
CO4	**1**			**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
CO5	**1**	**1**	**2**	**3**	**-**	**-**	**2**	**-**	**2**	**2**	**-**	**1**

High-3: Medium-2: Low-1

SEMESTER: III						
DISCRETE MATHEMATICAL STRUCTURES (Theory) (Common to CS and IS)						
Course Code	**:**	18CS36		**CIE Marks**	**:**	**100**
Credits: L:T:P	:	3:0:0		**SEE Marks**	**:**	**100**
Total Hours	:	39L		**SEE Duration**	**:**	**3Hrs**
Course Learning Objectives: The students will be able to						
1.	Provide foundational introduction to fundamental discrete mathematics concepts					
2.	Cultivate a sense of familiarity and ease in working with mathematical notation and common concepts in discrete mathematics.					
3.	Teach the basic results in number theory, logic, combinatorics, group and coding theory.					
4.	Cultivate clear thinking and develop ability for creative problem solving.					

Unit – I	**8 Hrs**
Fundamental Principles of Counting: The Rule of Sum and Product, Permutations, Combinations, The Binomial Theorem, Combinations with repetition **Mathematical Induction, Recursive Definitions, Recurrence Relations** Method of mathematical induction, Recursive definition, First order linear recurrence relation-Formulation problems and examples, Second order linear homogeneous recurrence relations with constant coefficients	
Unit – II	**7 Hrs**
Fundamentals of Logic: Basic Connectives and Truth Tables, Tautologies, Logical Equivalence: The laws of logic, Logical Implications, Rules of inference. Open Statement, Quantifiers, Definition and the use of Quantifiers, Definitions and the proofs of theorems.	
Unit – III	**8 Hrs**
Relations Properties of relations, Composition of Relations, Partial Orders, Hasse Diagrams, Equivalence Relations and Partitions. **Functions** Functions-plain, One-to-one, onto functions, Sterling numbers of the second kind, Function composition and Inverse function, Growth of function.	
Unit – IV	**8 Hrs**
Language and Finite State Machine: Set Theory of strings, Finite State machine**,** Introduction to Finite Automata, Basic concepts of Automata theory, Deterministic Finite Automata, Non-Deterministic Finite Automata, Finite Automata with epsilon-transitions, Equivalence of NFA & DFA.	
Unit – V	**8 Hrs**
Groups theory: Definition, Examples and Elementary properties, Abelian groups, Homomorphism isomorphism, cyclic groups, cosets and Lagrange's theorem. **Coding Theory:** Elementary coding theory, the hamming metric, the parity-Check and Generator Matrices	

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Understand and explore the fundamental concepts of discrete mathematical structure.
CO 2:	Apply the concepts of discrete mathematical structures for effective computation and relating problems in computer science domain.
CO 3:	Analyse the concepts of discrete mathematics to various fields of computer science.
CO 4:	Design solutions for complex problem using different concepts of discrete mathematical structure as a logical predictable system.

Reference Books:	
1.	Discrete and Combinatorial Mathematics- An Applied Introduction, Ralph P. Grimaldi and B V Ramana, 5th Edition – 2017, Pearson Education, Asia, ISBN 978-0321385024.
2.	Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay and R. Manohar, 1st Edition 2017, Tata – McGraw Hill, ISBN 13:978-0074631133.
3.	Discrete Mathematics and its Applications, Kenneth H. Rosen, 6th Edition, 7th Edition 2017, Tata – McGraw Hill, ISBN-(13): 978-0070681880.
4.	An Introduction To Formal Languages & Automata, Peter Linz, 6th Edition, 2016, Jones & Bartlett, ISBN: 978-9384323219.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO2	**3**	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**2**	**-**	**-**	**2**
CO3	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO4	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**2**	**1**	**-**	**1**

High-3: Medium-2: Low-1

Semester: III						
C PROGRAMMING **Bridge Course** **(Common to all branches)**						
Course Code	**:**	18DCS37		**CIE Marks**	**:**	**50**
Credits: L:T:P	:	2:0:0		**SEE Marks**	**:**	**50**
Audit Course				**SEE Duration**	**:**	**2.00 Hours**

Course Learning Objectives: The students will be able to

1.	Develop arithmetic reasoning and analytical skills to apply knowledge of basic concepts of programming in C.
2.	Learn basic principles of problem solving through programming.
3.	Write C programs using appropriate programming constructs adopted in programming.
4.	Solve complex problems using C programming.

Unit – I	**4Hrs**
Introduction to Reasoning, Algorithms and Flowcharts: Skill development – Examples related to Arithmetical Reasoning and Analytical Reasoning. Fundamentals of algorithms and flowcharts **Introduction to C programming:** Basic structure of C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types.	
Unit – II	**4Hrs**
Handling Input and Output Operations Formatted input/output functions, Unformatted input/output functions with programming examples using different input/output functions. **Operators and Expressions** Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and decrement operators, Conditional operators, Bit-wise operators, Arithmetic expressions. Evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity.	
Unit – III	**6Hrs**
Programming Constructs **Decision Making and Branching** Decision making with 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, The '*?:'* operator, The '*goto'* statement. **Decision making and looping**The while statement, The do while statement, The 'for' statement, Jumps in loops**.**	
Unit – IV	**6 Hrs**
Arrays One dimensional arrays, Declaration of one dimensional arrays. Initialization of one dimensional arrays, Two dimensional arrays, Initializing two dimensional arrays. **Character Arrays and Strings** Declaring and Initializing String Variables, Reading Strings from Terminal, Writing strings to screen, String handling functions.	

Unit – V	**8 Hrs**
User-defined functions Need for User Defined Functions, Definition of functions, Return values and their types, Function calls, Function declaration. Examples. **Introduction to Pointers:** Introduction, Declaration and initialization of pointers. Examples **Structures and Unions:** Introduction, Structure and union definition, Declaring structure and union variables, Accessing structure members. Example programs.	

PRACTICE PROGRAMS	
1.	Familiarization with programming environment, concept of naming the program files, storing, compilation, execution and debugging. Taking any simple C- code.(Example programs having the delimeters, format specifiers in printf and scanf)
2.	Debug the errors and understand the working of input statements in a program by compiling the C-code.
3.	Implement C Program to demonstrate the working of operators and analyze the output.
4.	Simple computational problems using arithmetic expressions and use of each operator (+,-,/,%) leading to implementation of a Commercial calculator with appropriate message: a) Read the values from the keyboard b) Perform all the arithmetic operations. c) Handle the errors and print appropriate message.
5.	Write a C program to find and output all the roots if a given quadratic equation, for non-zero coefficients. (Using if…*else* statement).
6a. **6b.**	Write a C program to print out a multiplication table for a given NxN and also to print the sum table using skip count 'n' values for a given upper bound. Write a C program to generate the patterns using for loops. Example: (to print * if it is even number) 1 ** 333 **** 55555
7a. **7b.**	Write a C program to find the Greatest common divisor(GCD)and Least common multiplier(LCM) Write a C program to input a number and check whether the number is palindrome or not.
8.	Develop a C program for one dimensional, demonstrate a C program that reads N integer numbers and arrange them in ascending or descending order using bubble sort technique.
9.	Develop and demonstrate a C program for Matrix multiplication: a) Read the sizes of two matrices and check the compatibility for multiplication. b) Print the appropriate message if the condition is not satisfied and ask user to re-enter the size of matrix. c) Read the input matrix d) Perform matrix multiplication and print the result along with the input matrix.
10.	Using functions develop a C program to perform the following tasks by parameter passing concept: a) To read a string from the user Print appropriate message for palindrome or not palindrome

11a. **11b.**	Write a C program to find the length of the string without using library function. Write a program to enter a sentence and print total number of vowels.
12.	Design a structure 'Complex' and write a C program to perform the following operations: i. Reading a complex number. ii. Addition of two complex numbers. iii. Print the result.
13.	Create a structure called student with the following members student name, rollno, and a structure with marks details in three tests. Write a C program to create N records and a) Search on roll no and display all the records. b) Average marks in each test. c) Highest marks in each test.

Course Outcomes: After Completing the course, the students will be able to	
CO 1:	Understand and explore the fundamental computer concepts and basic programming principles like data types, input/output functions, operators, programming constructs and user defined functions.
CO 2:	Analyze and Develop algorithmic solutions to problems.
CO 3:	Implement and Demonstrate capabilities of writing 'C' programs in optimized, robust and reusable code.
CO 4:	Apply appropriate concepts of data structures like arrays, structures implement programs for various applications

Reference Books	
1.	Programming in C ,P. Dey, M. Ghosh, First Edition,2007,Oxford University press, ISBN (13): 9780195687910.
2.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, Second Edition, 2005,Prentice Hall, ISBN (13): 9780131101630.
3.	Turbo C: The Complete Reference, H. Schildt, 4th Edition, 2000,Mcgraw Hill Education, ISBN-13: 9780070411838.
4.	Understanding Pointers in C,Yashavant P. Kanetkar, 4th Edition,2003,BPB publications, ISBN-13: 978-8176563581
5.	C IN DEPTH, S.K Srivastava, Deepali Srivastava, 3rd Edition,2013, BPB publication, ISBN9788183330480

Continuous Internal Evaluation (CIE); Theory (50 Marks)

CIE is executed by way of Quizzes (Q), Tests (T**)**and lab Practice (P). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks the sum of the marks scored from quizzes would be reduced to 10 marks. The two tests are conducted for 30 marks each and the sum of the marks scored from two tests is reduced to 30. The programs practiced would be assessed for 10 marks (Execution and Documentation).

Total CIE is 10(Q) + 30(T) + 10(P) = 50 Marks.

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marksis executed by means of an examination. The Question paper for the course consists of five main questions, one from each unit for 10 marks adding up to 50 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	1	-	-	-	1	-	-	1
CO2	3	3	3	2	2	-	-	-	1	-	-	1
CO3	3	3	3	-	-	-	-	-	2	2	1	2
CO4	3	3	3	-	-	-	1	-	2	2	1	2

High-3: Medium-2 : Low-1

Semester: III						
VYAVAHARIKA KANNADA **(Common to all branches)**						
Course Code	**:**	18HS38V		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	**50 Marks**
Total Hours	**:**	16Hrs		**CIE Duration**	**:**	**90 Minutes**

Course Learning Objectives of Vyavaharika Kannada: The students will be able to

1	Motivate students to learn Kannada language with active involvement.
2	Learn basic communication skills in Kannada language (Vyavaharika Kannada).
3	Importance of learning local language Kannada.

VYAVAHARIKA KANNADA (BALAKE Kannada)

(to those students who does not know Kannada)

Unit-I	**4Hrs**

Parichaya(Introduction):
Necessity of learning local language, Tips to learn the language with easy methods, Hints for correct and polite conversation, History of kannada language.

Unit – II	**4Hrs**

Kannada alphabtets and Pronunciation:
Kannada aksharmale, Kannada stress letters (vattakshara), Kannada Khagunitha, Pronunciation, memorisation and usage of the Kannada letters.

Unit – III	**4Hrs**

Kannada vocabulary for communication:
Singular and Plural nouns, Genders, Interrogative words, Antonyms, Inappropriate pronunciation, Number system, List of vegetables, Fractions, Menu of food items, Names of the food items, words relating to time, words relating to directions, words relating to human's feelings and emotion, Parts of the human body, words relating to relationship.

Unit –IV	**4Hrs**

Kannada Grammar in Conversations:
Nouns, Pronouns, Use of pronouns in Kannada sentences, Adjectives and its usage, Verbs, Adverbs, Conjunctions, Prepositions, Questions constructing words, Simple communicative sentences in kannada. Activities in Kannada, Vocabulory, Conversation.

Course Outcomes: After completing the course, the students will be able to

1	Usage of local language in day today affairs.
2	Construction of simple sentences according to the situation.
3	Usage of honorific words with elderly people.
4	Easy communication with everyone.

Reference Books:

1	Vyavaharika Kannada patyapusthaka, L. Thimmesh, and V. Keshavamurthy, Prasaranga Visveshvaraya University, Belgaum.
2	Kannada Kali**,** K. N. Subramanya, S. Narahari, H. G. Srinivasa Prasad, S. Ramamurthy and S. Sathyanarayana, 5th Edition, 2019, RV College of Engineering Bengaluru.
3	Spoken Kannada**,** Kannada Sahithya Parishat, Bengaluru.

ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ (Kannada Version)	
ಅಧ್ಯಾಯ – I	**4Hrs**
ಸ್ಥಳೀಯ ಅಥವಾ ಪ್ರಾದೇಶಿಕ ಭಾಷಾ ಕಲಿಕೆಯ ಅವಶ್ಯಕತೆ, ಭಾಷಾ ಕಲಿಕೆಯ ಸುಲಭ ವಿಧಾನಗಳು, ಸಂಭಾಷಣೆಗಾಗಿ ಸುಲಭ ಸೂಚ್ಯಗಳು ಕನ್ನಡ ಭಾಷೆಯ ಇತಿಹಾಸ.	
ಅಧ್ಯಾಯ – II	**4Hrs**
ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ ಹಾಗೂ ಉಚ್ಚಾರಣೆ: ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ, ಒತ್ತಕ್ಷರ, ಕಾಗುಣಿತ, ಉಚ್ಚಾರಣೆ, ಸ್ವರಗಳು ಉಚ್ಚಾರಣೆ, ವ್ಯಂಜನಗಳ ಉಚ್ಚಾರಣೆ.	
ಅಧ್ಯಾಯ – III	**4Hrs**
ಸಂಭಾಷಣೆಗಾಗಿ ಕನ್ನಡ ಪದಗಳು: ಏಕವಚನ, ಬಹುವಚನ, ಲಿಂಗಗಳು (ಸ್ತ್ರೀಲಿಂಗ, ಪುಲ್ಲಿಂಗ) ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು, ವಿರುದ್ಧಾರ್ಥಕ ಪದಗಳು, ಅಸಮಂಜಸ ಉಚ್ಚಾರಣೆ, ಸಂಖ್ಯಾ ವ್ಯವಸ್ಥೆ, ಗಣಿತದ ಚಿಹ್ನೆಗಳು, ಭಿನ್ನಾಂಶಗಳು. ತರಕಾರಿಗಳ ಹೆಸರುಗಳು, ತಿಂಡಿಗಳ ಹೆಸರುಗಳು, ಆಹಾರಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು, ಕಾಲ/ಸಮಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು, ದಿಕ್ಕುಗಳ ಹೆಸರುಗಳು, ಭಾವನೆಗೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು, ಮಾನವ ಶರೀರದ ಭಾಗಗಳು, ಸಂಬಂಧದ ಪದಗಳು, ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಯಲ್ಲಿ ಬಳಸುವಂತಹ ಪದಗಳು.	
ಅಧ್ಯಾಯ – IV	**4Hrs**
ಸಂಭಾಷಣೆಯಲ್ಲಿ ಕನ್ನಡ ಬಳಕೆ: ನಾಮಪದಗಳು, ಸರ್ವನಾಮಗಳು, ನಾಮವಿಶೇಷಣಗಳು, ಕ್ರಿಯಾಪದಗಳು, ಕ್ರಿಯಾವಿಶೇಷಣಗಳು, ಕನ್ನಡದಲ್ಲಿ ಸಂಯೋಜನೆಗಳು, ಉಪಸರ್ಗಗಳು, ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು, ವಿಚಾರಣೆಯ / ವಿಚಾರಿಸುವ / ಬೇಡಿಕೆಯ ವಾಕ್ಯಗಳು. ಕನ್ನಡದಲ್ಲಿ ಚಟುವಟಿಕೆಗಳು, ಶಬ್ದಕೋಶ, ಸಂಭಾಷಣೆ.	
ವ್ಯವಹಾರಿಕ ಕನ್ನಡದ ಕಲಿಕಾ ಫಲಿತಾಂಶಗಳು :	
CO1:	ನಿತ್ಯ ಜೀವನದಲ್ಲಿ ಆಡುಭಾಷೆಯ ಬಳಕೆ.
CO2:	ಸಂದರ್ಭ, ಸನ್ನಿವೇಶಕ್ಕನುಗುಣವಾಗಿ ಸರಳ ಕನ್ನಡ ವಾಕ್ಯಗಳ ಬಳಕೆ.
CO3:	ಗೌರವ ಸಂಬೋಧನೆಯ ಬಳಕೆ.
CO4:	ಇತರರೊಡನೆ ಸುಲಭ ಸಂವಹನ.

ಆಧಾರ ಪುಸ್ತಕಗಳು :	
1	ವ್ಯವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕ, ಎಲ್.ತಿಮ್ಮೇಶ್ ಮತ್ತು ವಿ.ಕೇಶವಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿದ್ಯಾಲಯ, ಬೆಳಗಾಂ.
2	ಕನ್ನಡ ಕಲಿ, ಕೆ.ಎನ್.ಸುಬ್ರಹ್ಮಣ್ಯಂ, ಎನ್.ಎಸ್.ನರಹರಿ, ಎಚ್.ಜಿ.ಶ್ರೀನಿವಾಸ ಪ್ರಸಾದ್, ಎಸ್.ರಾಮಮೂರ್ತಿ ಮತ್ತು ಎಸ್.ಸತ್ಯನಾರಾಯಣ, 2ನೇ ಮುದ್ರಣ 2019, ರಾ.ವಿ.ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು.
3	ಮಾತನಾಡುವ ಕನ್ನಡ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.

Continuous Internal Evaluation (CIE); (50 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Activity. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks and the sum of the marks scored from two quizzes is reduced to 10. The two tests are conducted for 50 marks each and the sum of the marks scored from two tests is reduced to 30. The marks component for Activity is 10. **Total CIE is 10(Q) +30(T) +10(A) = 50 Marks.**

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of only objective type questions for 40 marks covering the complete syllabus. Part – B consists of essay type questions for 10 marks.

Semester: III

AADALITHA KANNADA
(Common to all branches)

Course Code	**:**	18HS38A		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	**50 Marks**
Total Hours	**:**	16Hrs		**CIE Duration**	**:**	**90 Minutes**

ಆಡಳಿತ ಕನ್ನಡ (ಕನ್ನಡಿಗರಿಗಾಗಿ)

ಆಡಳಿತ ಭಾಷಾ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು: ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ

1	ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2	ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
3	ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4	ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
5	ಭಾಷಾಂತರ, ಪ್ರಬಂದ,ರಚನೆ, ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ ತ್ತುಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಅಧ್ಯಾಯ –I	**4Hrs**

ಕನ್ನಡ ಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ:

ಪ್ರಸ್ತಾವನೆ–ಕನ್ನಡ ಭಾಷೆ, ಶ್ರಾವಣ (ಕವನ)– ದ.ರಾ.ಬೇಂದ್ರೆ (ಕವಿ), ಬೆಲ್ಜಿಯ ಹಾಡು (ಕವನ) –ಸಿದ್ದಲಿಂಗಯ್ಯ (ಕವಿ)
ಆಡಳಿತ ಭಾಷೆಕನ್ನಡ, ಆಡಳಿತ ಭಾಷೆಯ ಲಕ್ಷಣಗಳು, ಆಡಳಿತ ಭಾಷೆಯ ಪ್ರಯೋಜನಗಳು.

ಅಧ್ಯಾಯ –II	**4 Hrs**

ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ:

ಪ್ರಸ್ತಾವನೆ– ಕಾಗುಣಿತದ ತಪ್ಪು ಬಳಕೆಯಿಂದಾಗುವ ಲೋಪದೋಷಗಳು ಅಥವಾ ಸಾಧುರೂಪಗಳ ಬಳಕೆ, ಅಲ್ಪ ಪ್ರಾಣ ಮತ್ತು ಮಹಾಪ್ರಾಣಗಳ ಬಳಕೆಯಲ್ಲಿನ ವ್ಯತ್ಯಾಸದಿಂದಾಗುವ ಲೋಪದೋಷಗಳು, ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿನ ಲೋಪದೋಷಗಳು ಗೌರವ ಸೂಚಕಗಳ ಬಳಕೆ, ಭಾಷಾ ಬರಹದಲ್ಲಿ ಅನುಸರಿಸಬೇಕಾದ ಇನ್ನಿತರಕ್ರಮ, ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ –III	**4Hrs**

ಪತ್ರ ವ್ಯವಹಾರ:

ಪ್ರಸ್ತಾವನೆ– ಖಾಸಗಿ ಪತ್ರ ವ್ಯವಹಾರ, ಆಡಳಿತ ಪತ್ರಗಳು, ಅರ್ಜಿಯ ವಿವಿಧ ಬಗೆಗಳು ಮತ್ತು ಮಾದರಿಗಳು.

ಅಧ್ಯಾಯ –IV	**4Hrs**

ಪ್ರಬಂಧ, ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧರಚನೆ ಮತ್ತು ಭಾಷಾಂತರ:

ಕನ್ನಡ ಶಬ್ಧಸಂಗ್ರಹ, ಜೋಡಿನುಡಿಗಳು, ಅನುಕರಣಾವ್ಯಯಗಳು, ಸಮಾನಾರ್ಥಕ ಪದಗಳು, ನಾನಾರ್ಥಗಳು, ವಿರುದ್ಧಪದಗಳು, ತತ್ಸಮ–ತದ್ಭವಗಳು, ದ್ವಿರುಕ್ತಿಗಳು, ನುಡಿಗಟ್ಟುಗಳು, ಶಬ್ಧಸಮೂಹಕ್ಕೆ ಒಂದು ಶಬ್ಧ, ಅನ್ಯದೇಶೀಯ ಪದಗಳು, ದೇಶೀಯಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡದ ಕಲಿಕಾ ಫಲಿತಾಂಶಗಳು:

CO1:	ಕನ್ನಡ ಬರಹದಲ್ಲಿ ವ್ಯಾಕರಣದ ಬಳಕೆ.
CO2:	ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ಬರೆಯುವಿಕೆ.
CO3:	ಕನ್ನಡ ಸಾಹಿತ್ಯ ಹಾಗೂ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುವುದು.

ಆಧಾರ ಪುಸ್ತಕಗಳು :

1	ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕ, ಎಲ್.ತಿಮ್ಮೇಶ್ ಮತ್ತು ವಿ.ಕೇಶವಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿದ್ಯಾಲಯ, ಬೆಳಗಾಂ.
2	ಕನ್ನಡ ಅನುಭವ, ಕೆ.ಎನ್.ಸುಬ್ರಹ್ಮಣ್ಯಂ, ಎನ್.ಎಸ್.ನರಹರಿ, ಎಚ್.ಜೆ.ಶ್ರೀನಿವಾಸಪ್ರಸಾದ್, ಎಸ್.ರಾಮಮೂರ್ತಿ ಮತ್ತು ಎಸ್.ಸತ್ಯನಾರಾಯಣ, 2ನೇ ಮುದ್ರಣ 2019, ರಾ.ವಿ.ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು.

Continuous Internal Evaluation (CIE); (50 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Activity. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks and the sum of the marks scored from two quizzes is reduced to 10. The two tests are conducted for 50 marks each and the sum of the marks scored from two tests is reduced to 30. The marks component for Activity is 10. **Total CIE is 10(Q) +30(T) +10(A) = 50 Marks.**

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B is for 40 marks. It consists of simple grammar and essay type questions.

Semester: IV						
GRAPH THEORY, STATISTICS AND PROBABILITY THEORY (Theory) (Common to CS, IS)						
Course Code	**:**	18MA41A		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	4:1:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	52L+13T		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the basic concepts of graphs and their properties, operations of graphs, Hamiltonian and Euler graphs, trees and matrix representation of graph.
2	Apply the concepts of planar graph, matching and coloring in computer science engineering.
3	Demonstrate the understanding of descriptive statistics by practical application of quantitative reasoning and data visualization.
4	Use concepts of probability in the study of random phenomena, analyzing and interpreting data that involves uncertainties.
5	Use of mathematical IT tools to analyze and visualize the above concepts.

Unit-I	**10 Hrs**
Graph Theory – I: Definition and examples of graphs, properties of a graph, sub graphs, regular graphs, bipartite graphs, paths and cycles, operations on graphs (union, intersection, ring sum, Cartesian product), homomorphism and isomorphism of graphs. Eulerian graphs, Hamiltonian graphs, directed graphs, in degrees and out degrees in digraphs.	
Unit – II	**11 Hrs**
Graph Theory – II: **Matrix representation of Graph:** Adjacency matrix of a graph, incidence matrix of a graph and properties. **Trees:** Trees and properties of trees, spanning trees, minimum cost spanning trees (Kruskal's), fundamental cut-sets, fundamental cycles. **Matching and Factors:** Min-Max theorem, graph connectivity algorithms, independent sets, dominating sets, maximum bipartite matching. Travelling sales men problem, network flow, electrical network analysis, Hall's marriage problem, vector space associated with a graph.	
Unit –III	**11 Hrs**
Graph Theory – III: **Planar graphs:** Definition, characterization of planar graphs, Kuratowski's theorem, Euler's formula and consequences. **Coloring of graphs:** vertex coloring, five color theorem and four color theorem (without proof), bounds, chromatic polynomial, properties of chromatic polynomial, edge coloring, chromatic index. Greedy algorithm, scheduling problems.	
Unit –IV	**10 Hrs**
Statistics: Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Curve fitting by method of least squares, fitting of curves – polynomial, exponential, power function. Correlation and linear regression analysis – problems. Simulation using MATLAB.	
Unit –V	**10 Hrs**
Random Variables and Probability Distributions: Random variables-discrete and continuous, probability mass function, probability density function, cumulative density function, mean and variance. Discrete and continuous distributions - Binomial, Poisson, Exponential, Normal and Weibul. Simulation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamental concepts of properties and representation of graphs, different measures of statistical distribution using central moments.
CO2:	Solve the problems involving characterization and operations on graphs, fitting of a curve for the given data and functions of random variables.
CO3:	Apply the acquired knowledge to solve the problems on different types of graphs, correlation, regression and measures of probability distributions.
CO4:	Evaluate the solutions of application problems in graph theory and probability distributions.

Reference Books	
1	Graph Theory-Modelling, Applications and Algorithms, Geir Agnarsson & Raymond Greenlaw, 2008, Pearson Education, ISBN - 978-81-317-1728-8.
2	Theory and Problems of Probability, Seymour Lipschutz & Marc Lars Lipson, 2nd Edition, Schaum's Outline Series, ISBN: 0-07-118356-6.
3	Probability & Statistics for Engineers & Scientists, Ronald E. Walpole & Raymond H. Myers, 9th Edition, 2016, Pearson Education, ISBN-13: 978-0134115856.
4	Graph Theory with Applications to Engineering and Computer Science, Narsingh Deo, 1979, Prentice Hall India Learning Private Limited, ISBN-13: 978-8120301450.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	1	-	-	-	-	-	1	-	1
CO3	3	3	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	3	-	-	-	-	-	1	-	1

High-3: Medium-2 : Low-1

Semester: IV						
BIOLOGY FOR ENGINEERS (Theory) (Common to BT, CS and IS)						
Course Code	**:**	18BT42B		**CIE Marks**	**:**	**50**
Credits: L:T:P	:	2:0:0		**SEE Marks**	**:**	**50**
Total Hours	:	26L		**SEE Duration**	**:**	**2 Hrs**

Course Learning Objectives: The students will be able to

1	To familiarize engineering students with basic biological concepts
2	To involve students in an interdisciplinary vision of biology and engineering
3	To gain an understanding that the design principles from nature can be translated into novel devices and structures.
4	To gain an appreciation for how biological systems can be designed and engineered to substitute natural system

Unit-I	**5 Hrs**
Introduction: Hierarchy of Biomolecular structure: Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes, vitamins and hormones and its integration to metabolism.	
Unit-II	**6 Hrs**
Genetics and Information transfer: Mendelian inheritance and Gene interaction. Mechanics of cell division: Mitosis and meiosis. Gene disorders in humans. Molecular basis for coding and decoding. Basis for information transfer.	
Unit-III	**5 Hrs**
Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents). Nervous system (Artificial neural network) Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).	
Unit-IV	**5 Hrs**
Relevance of Biology as an interdisciplinary approach. Biological observation that led to major discoveries. Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro).	
Unit-V	**5 Hrs**
Bioinspired Algorithms and Applications. Genetic algorithm, Gene expression modelling. Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems. Dynamic Updating DNA Computing Algorithms. BeeHive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behavior.	

Course Outcomes: After completing the course, the students will be able to

CO1	Understand the concept of central dogma of molecular biology.
CO2	Explain the mechanism of replication, transcription and translation.
CO3	Compare and contrast between prokaryotic and eukaryotic molecular mechanisms and its regulation at various levels and disease related to perturbations.
CO4	Ability to think critically in reading, analyzing and articulating the biological information and the diseases related of the mis-expression from research journals.

Reference Books	
1.	Lewin's GENES XII, Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick, 2017, Jones and Bartlett Publishers, Inc., ISBN-10: 1284104494, ISBN-13: 978-1284104493
2.	Jenkins, C.H. Bioinspired Engineering, NY: Momentum press, 2012 ISBN: 97816066502259
3.	Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st Edition, 2016, CRC Press.13.978-1-4398-3477-0
4.	A Practical Guide to Bio-inspired Design, HashemiFarzaneh, Helena, Lindemann, Udo, Springer 2019, ISBN 978-3-662-57683-0

Continuous Internal Evaluation (CIE): Total marks: 50

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks which will be reduced to 15marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 25 marks each and the sum of the marks scored from three tests is reduced to 30. The marks component for experiential learning is 05.

The total CIE for theory is 15(Q) +30(T)+05(EL) =50 marks

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 08marks adding up to 40 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	1	2	2	-	-	-	-	-	-	-	-	1
CO4	-	1	1	3	-	-	-	-	-	-	-	1

High-3 : Medium-2 : Low-1

Semester: IV						
DESIGN AND ANALYSIS OF ALGORITHMS (Theory and Practice) (Common to CS and IS)						
Course Code	**:**	18CS43		**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	:	3:0:1		**SEE Marks**	**:**	**100 + 50**
Total Hours	:	39L + 35P		**SEE Duration**	**:**	**3 Hrs+3hrs**

Course Learning Objectives: The students will be able to

1.	To learn mathematical background for analysis of algorithm
2.	Analyse the asymptotic performance of algorithms.
3.	To understand the concept of designing an algorithm.
4.	Synthesize efficient algorithms in common engineering design situations.

Unit – I	**8 Hrs**
Introduction: Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Brute Force**: Selection Sort and Bubble Sort.	
Unit – II	**8 Hrs**
Divide and Conquer: Merge sort,Quicksort,Multiplication of long integers, Strassen's Matrix multiplication. **Decrease and Conquer:** Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.	
Unit – III	**7 Hrs**
Transform and Conquer: Presorting, Heaps and Heapsort, Problem reduction. **Space and Time Tradeoffs:** Sorting by Counting, Naive String Matching,Input Enhancement in String Matching: Horspool's andBoyer-Moore algorithm.	
Unit – IV	**8Hrs**
Dynamic Programming: Computing a Binomial Coefficient,Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions. **Greedy Technique:** Prim's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.	
Unit – V	**8Hrs**
Backtracking : N-Queen's Problem, Sum of Subset Problem. **Branch-and-Bound. :** Travelling Sales Person problem,0/1 Knapsack problem **NP and NP-Complete Problems** : Basic concepts, nondeterministic algorithms, P, NP, NP-Complete, and NP-Hard classes	

Laboratory Component
PART – A

Note: The following programs can be executed on C/C++/Python any equivalent tool/language

1. Write a program to sort a given set of elements using Merge sort method and find the timerequired to sort the elements.
2. Write a program to sort a given set of elements using Quick sort method and find the timerequired to sort the elements

3. Write a program to print all the nodes reachable from a given starting node in a graphusing Depth First Search method and Breadth First method. Also check connectivity of thegraph. If the graph is not connected, display the number of components in the graph.
4. Write a program to obtain the Topological ordering of vertices in a given digraph using
a)Vertices deletion method b)DFS method
5. Write a program to sort a given set of elements using Heap sort method. Find the timecomplexity.
6. Write a program to implement Horspool's algorithm for String Matching.
7. Write a program to implement 0/1 Knapsack problem using dynamic programming
8. Write a program to find Minimum cost spanning tree of a given undirected graph usingPrim's algorithm.
9. Write a program to find the shortest path using Dijkstra's algorithm for a weightedconnected graph.
10. Write a program to find a subset of a given set S = $\{S_1, S_2,.....,S_n\}$ of npositive integers whose sum is equal to a given positive integer d. For example, if S ={1, 2,5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, ifthe given problem instance doesn't have a solution.
11. Write a program to implement N -queens problem using backtracking
12. Write a program to solve TSP problem using branch and bound.

PART – B

Students have to solve a given problem using different design technique. The analysis with the comparison of the implemented algorithm has to be demonstrated. The problem types will be one among the following: (Any other problem can be included)

1. Sorting
2. String matching
3. Travelling salesman problem
4. Shortest Path
5. Knapsack Problem

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Understand and explore the asymptotic runtime complexity of algorithms by using mathematical relations.
CO 2:	Select and apply appropriate design techniques to solve real world problems.
CO 3:	Estimate the computational complexity of different algorithms.
CO 4:	Apply the efficient algorithm design approaches in a problem specific manner.

Reference Books:	
1.	Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2.	Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.
3.	Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

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Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The Average Marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a Test (T) is conducted for 10 marks. The students are encouraged to implement additional Innovative Experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
CO2	**2**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**-**
CO3	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO4	**2**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**

High-3: Medium-2: Low-1

Semester: IV						
MICROCONTROLLERS AND EMBEDDED SYSTEMS (Theory and Practice)						
Course Code	**:**	18CS44		**CIE Marks**	**:**	**100+50**
Credits: L:T:P	:	3:0:1		**SEE Marks**	**:**	**100+50**
Total Hours	:	39L + 35P		**SEE Duration**	**:**	**3 Hrs+3hrs**

Course Learning Objectives: The students will be able to

1.	Provide the student with the basic understanding of microcontroller and embedded systems design.
2.	Learn the addressing modes, instructions, and assembler directives and develop the ALP to solve problems.
3.	Develop embedded C programs for microcontrollers and run on the simulator, target board and various interfaced hardware devices.
4.	Use Microcontroller peripheral programming and embedded onboard and external serial protocols to design required embedded systems.

Unit – I	**7Hrs**
Prototyping Hardware-Software Ideas using Open Hardware Platforms Working with Arduino Hardware & Software, Block diagram and specifications of Arduino Uno, Digital and Analog Interfacing, Prototyping Traffic Light and Smart Street Light system using LEDs, Switches, Potentiometer, LDR and other sensors. Raspberry Pi, Block diagram and specifications of the board, Raspberry Pi Interfaces / GPIO header , Programming with PYTHON/C, Interfacing LEDs and Swiches. Basic building blocks of an IOT device. Prototyping of Remote Temperature & Humidity Monitoring/Recording system using Cloud.	
Unit – II	**8Hrs**
Introduction to Embedded Systems and ARM Processor/Controller Introduction, Microprocessor Versus Microcontroller, Definition, Desirable Features & General Characteristics of embedded systems, Embedded Systems Vs General Computing Systems, Model of an Embedded System, Classification of Embedded Systems. History of the ARM Processor, The ARM Core, The ARM Microcontroller, RISC vs CISC, The Features of ARM Processors, ARM Architecture : ISA, Operating Modes, Register Set, Mode Switching, Conditional Flags. Programming the ARM processor, ARM Assembly Language: Data Types, Data Alignment, and Assembly Language Rules.	
Unit – III	**8 Hrs**
ARM Instruction Set & Assembly Language Programming ARM Instruction Set : Data Processing Instructions, Shift and Rotate, Conditional Execution, Arithmetic Instructions, Logical Instructions, Compare Instructions, Multiplication , Division , Branch Instructions ,Load and Store Instructions. Assembly Language Program Development: Assembler Directives , Subroutines/Procedures, Assembly Language Programs for data transfer, expression evaluation, addition , average computation , searching and sorting.	
Unit – IV	**8Hrs**
Interfacing and Application Development Using ARM Microcontroller Introduction, Block Diagram of MCB 2140 compatible board, Features of the LPC 214X Family, Internal Block Diagram of LPC 2148, Memory, Memory Map, System Functions, and Internal Buses. LPC 2148 GPIO and External I/O interfacing Using GPIO Pins. Interfacing and Programming (using embedded C) with LEDs, Switches, Seven segment displays, LCD, Matrix Keypad, I2C based DAC, Stepper motor, DC Motor, Relay, Opto-isolators. Analog Interfacing using ADC Channels, interfacing with LDR and Temperature sensor. .	

Unit – V	8Hrs
Serial Protocols and Embedded System design using ARM-LPC2148 The Timer Unit, Programming Timers and writing Delay programs, Vectored Interrupt Controller and programming Timers with Interrupts, The Pulse Width Modulation Unit and Programming Using PWM Channels, UART – Registers, Baud rate calculation, RS-232 interface to PC, Programming Serial Port. Interfacing and Programming external IC's to LPC 2148 using serial protocols I2C Bus and SPI Buses. Case studies: Designing data acquisition system and Audio player using LPC 2148.	

Laboratory Component

1.

a) Prototyping Traffic Light and Smart Street Light System using Arduino board

b) Prototyping cloud based Temperature and Humidity Monitoring and Recording System using Rasberry Pie board.

2.

a) ARM ALP programs to perform block data transfer and searching operations

b) Using Logical Controller Interface, write embedded C programs to:

i. Implement BCD Up/Down counter.

ii. Read the status of 8 inputs bits from 8bit switch and display 'FF' if it is even parity otherwise display 00. Also display number of 1's in the input data on the LED outputs, using interface module.

iii. Read the status of two 8-bit inputs (X and Y) and display the result X*Y using the interface module

3.

a) ARM ALP programs to perform Arithmetic (addn/subn/mult/divn operations)

b) Using Seven Segment Display Interface, write embedded C programs to:

i. Display messages "FIRE" & "HELP" on 4 digit seven segment display alternately with a suitable delay.

ii. Display the given number on the seven segment display using look up table.

4.

a) ARM ALP programs to perform number conversions and expression evaluations.

b) Using Stepper Motor Interface & DC Motor Interface, write embedded C programs to:

i. Rotate stepper motor in clockwise direction for "M" steps, anti-clock wise direction for "N" steps

ii. Rotate the Stepper Motor, for the given RPM

iii. Control the speed of DC motor using PWM.

5.

a) ARM ALP programs to compute average & maximum/minimum values

b) Using DAC Interface, write embedded C program to:

i. Generate without rectification / full rectified/ half rectified sine waveforms.

ii. Generate square waveform for the given frequency

iii. Read the temperature from LM35 and display on LEDs/Terminal/LCD.

6.

a) ARM ALP programs to perform sorting operations

b) Using Keyboard Interface & Elevator Inteface, Develop embedded C programs to:

i. Identify the key press from 4x4 / 3x8 matrix keyboard using lookup table and display the key pressed on the Terminal

ii. Implement the logic of working of Elevator.

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Acquire the knowledge of Microcontrollers Architecture and embedded systems.
CO 2:	Develop programs for micro controller based applications in Assembly and Embedded C
CO 3:	Design skills to interfacing different Input / Output devices to Microcontroller.
CO 4:	Integrate Hardware and Software to Implement the required embedded smart systems.

Reference Books:	
1.	Embedded Systems – An integrated approach, Lyla B. Das, 1st Impression 2013, Pearson Education, ISBN- 978-81-317-8766-3.
2.	ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright, 2004, Elsevier, Morgan Kaufman publishers, ISBN-1558608745,9781558608740.
3.	Embedded Systems, Architecture, Programming and Design, Raj Kamal, 2nd Edition-Reprint 2011, Tata McGraw-Hill, ISBN-978-0-07-066764-8.
4.	Internet of Things – A Hands on approach, Arshdeep Bahga, Vijay Madisetti, 2016, Universities Press, ISBN – 978-81-7371-954-7.

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Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The Average Marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a Test (T) is conducted for 10 marks. The students are encouraged to implement additional Innovative Experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**3**	**2**	**3**	**1**	**1**	**-**	**3**	**2**	**2**	**2**
CO2	**3**	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**2**	**2**	**2**
CO3	**2**	**2**	**3**	**2**	**3**	**1**	**1**	**-**	**3**	**2**	**2**	**2**
CO4	**2**	**2**	**3**	**2**	**3**	**1**	**1**	**-**	**3**	**2**	**2**	**2**

High-3: Medium-2: Low-1

Semester: IV						
OBJECT ORIENTED PROGRAMMING USING JAVA (Theory and Practice) (Common to CS and IS)						
Course Code	**:**	18CS45		**CIE Marks**	**:**	**100 + 50**
Credits: L:T:P	:	3:0:1		**SEE Marks**	**:**	**100 + 50**
Total Hours	:	39L + 35P		**SEE Duration**	**:**	**3 Hrs+3 Hrs**

Course Learning Objectives: The students will be able to

1.	Understand fundamentals of Object Oriented Concepts – OOA, OOD and OOP, elements of Object Model, Classes and Objects
2.	Explore the features of Object-oriented Programming in Java including defining classes, invoking methods, using class libraries, etc.
3.	Develop the ability to program in Java to solve specified problems.
4.	Use the object oriented principles and design classes using appropriate tools of collaborating programming (versioning systems, code review).

Unit – I	**8 Hrs**
The Object Model **Foundations of the Object Model-** Object-Oriented Programming , Object-Oriented Design, Object-Oriented Analysis , Elements of the Object Model - Abstraction , Encapsulation , Modularity , Hierarchy; **Classes and Objects -**The Nature of an Object, Relationships among Objects, The Nature of a Class, Relationships among Classes, The Interplay of Classes and Objects **Java Programming Fundamentals**: Features, Data Types, Variables and Arrays , Operators , Control Statements, Class Fundamentals , Declaring Objects , Introducing Methods , Constructors, this keyword , Overloading Methods and Constructors, Static fields and Methods, Nested and Inner classes	
Unit – II	**7 Hrs**
Inheritance: Inheritance Basics, Using Super, Creating a Multi-Level Hierarchy, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Object Class. **Packages and Interfaces** Introduction to Packages, Access Protection, Importing Packages, Interfaces, Default Interface Methods.	
Unit – III	**8 Hrs**
Exception Handling : Exception-Handling Fundamentals – Exception Classes , Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating your own Exception Subclasses. **Multithreaded Programming :** The Java Thread Model , The Main Thread , Creating a Thread, Creating Multiple Threads, Using isAlive( ) and join( ) , Thread Priorities , Synchronization, Interthread Communication, Suspending, Resuming and Stopping Threads, Obtaining a Thread's State	
Unit – IV	**8 Hrs**
Lambda Expressions : Fundamentals, Block Lambda expressions, Generic Functional Interfaces, Passing Lambda Expressions as Arguments, Lambda Expressions and Exceptions. **Regular Expressions:** Regular Expressions Processing. **String Handling:** The String Constructors, String Length, Special String Operations, Character extraction, String Comparison, Searching Strings, Modifying Strings, Data Conversion Using ValueOf(), Changing the Case of Characters Within a String, Joining Strings	
Unit – V	**8 Hrs**

Collections : The Collection Interfaces , The Collection Classes , Accessing a Collection via an Iterator

JavaFX GUI Programming: Basic Concepts, Application Skeleton, Application Thread, JavaFx Controls : Using Buttons and Events, Using Image and ImageView, Radio Buttons, Check Box, TextField, ScrollPane, MenuBasics, Menu Bar ,Menu and MenuItem.

Laboratory Component

I **Familiarization with IDE** - compilation, debugging and execution considering simple Java programs.

Implement programs on Fundamentals of Java Programming: Data Types, Variables and Arrays , Operators , Control Statements:

i) Write a Java program to convert time in seconds to hours, minutes and seconds, and display the output in format HH:MM:SS

ii) Write a Java program which reads an integer n and find the number of combinations of a,b,c and d ($0 \leq a,b,c,d \leq 9$) where (a + b + c + d) will be equal to n.

iii) Write a Java program to form a staircase shape of n coins where every k-th row must have exactly k coins.

Example 1:
n = 3
The coins can form the following rows:
$
$ $
We will return 2 rows.
Example 2:
n = 4
The coins can form the following rows:
$
$ $
$

iv) Write a Java program to rearrange all the elements of an given array of integers so that all the odd numbers come before all the even numbers.

v) Write a Java program that accepts three integers from the user and return true if two or more of them (integers) have the same rightmost digit. The integers are non-negative.

vi) Given is a 2-dimensional integer array [0..m-1, 0..n-1], each row and column of which is in ascending order (see example) , write a Java program to find the row, column position of a specified number (row, column position) in a given 2-dimensional array.

PART-A

Classes and objects.

1 . Create a Java class called Complex with the following details as member variables within it. (i) Real (ii) Imaginary

Develop a Java program to perform addition and subtraction of two complex numbers by using the method add() and subtract( ) respectively, by passing object as parameter and display result using method display(). Initialize the real and imaginary values of the complex number using parameterized constructor. Also demonstrate overloading constructors and methods.

Design an Address class with member variables Street num, city, state and country and

2. appropriate constructor. Design a Student class with constructor (Student (String USN, String Name, Address addr)), College class with constructor (College (String Name, Address addr)) and Employee class with constructor (Employee (String EmpID, String Name, Address addr)). Write a Java program to create 'n' Student objects, College Objects and Employee objects and print the student, college and employee addresses respectively and demonstrate passing of object as a parameter to the constructor.

Inheritance and Polymorphism.

3. Design a base class Circle with member variables (radius and color) of type double, methods (getRadius(), getArea()) and constructors (Circle(radius), Circle(radius, color)). Derive subclass called Cylinder from the superclass Circle with member variable (height) of type double, public methods (getHeight(), getVolume(), getArea()) and its constructors(Cylinder(height, radius), Cylinder(height, radius,color)). Create the two instances of cylinder and print similar cylinders if the area, volume and color of cylinders are same. Demonstrate the code reuse and polymorphism properties of Object oriented programming by inheriting the constructors and methods of the base class.

Package and Interfaces

4. Create a class Thirdsem. Put this class into a package called CSE. Define a method Welcomemsg which prints a line "Welcome to CSE dept- 3rd sem young budding Engineers".
Create a class Csedept. Put this class into a package called RVCE.
Inherit the class Thirdsem in CSE package to Csedept class in RVCE package and call Welcomemsg method to display welcome message and also verify Public method Overriding, Private method overriding and default method overriding from different packages in java with the same program

5. Create two classes called Lion and Snake that implements all the methods defined in an interface Animal. Declare eat() method in Animal interface and display eating habits of that particular animal .Create an interface called Tired Animal. In Tired Animal interface add method definition to an existing interface by extending Animal interface to verify Extending Interface concept in java.
Note: Lion and Snake implement the required eat( ) method and has some of its own methods and instance variables

Exception handling

Design and implement a Java program for the following requirements:

6. a) An Exception class called **Demonetization Exception** which returns the statement that says "Deposit of Old currency of (Rs_) crosses Rs. 5,000 and cannot be Deposited".
   b) A class called 'Account' that creates account with 500 Rs minimum balance with following methods.
      i. deposit(amount, currencyType) method to deposit amount. This class should handle "Demonetization Exception" and print the message defined in this Exception class. If a currency type is "OLD" and the amount is greater than 5,000 then throw the Demonetization Exception, otherwise update the balance.
      ii. currBalance() method that displays balance amount in the account.
      iii. withdraw(amount) method to withdraw amount and update the balance. Use proper control structure to check Balance should not go less than 500.
   c) A 'Customer' class that creates Account object and call the methods deposit(), withdraw() and currBalance() based on the user choice.

Multithreading

7. Design and develop a Java program for the fruit market problem. The farmer will be able to produce different types of fruits (apple, orange, grape, and watermelon), and put them in the market to sell. The market has limited capacity and farmers have to stand in a queue if the capacity is exceeded to sell their fruits. Consumers can come to the market any time and purchase their desired fruits; and if the fruits they want to buy runs out, they are willing to wait until the supply of that kind is ready. Examine and formulate an approach to address this problem and implement the same using Java constructs for programming.

Lambda Expressions

8. Write the following methods that return a lambda expression performing a specified action:
(i) PerformOperation isOdd(): The lambda expression must return true if a number is odd or false if it is even.
(ii) PerformOperation isPrime(): The lambda expression must return true if a number is prime or false if it is composite.
(iii) PerformOperation isPalindrome(): The lambda expression must return true if a number is a palindrome or false if it is not.
Write a JAVA program using above lambda expressions to take 2 integers as input where the first integer specifies the condition to check for (case 1 for Odd/Even, case 2 for Prime/Composite, or case 3 for Palindrome). The second integer denotes the number to be checked.

9. Collections

Write a Java program to create a new array list, add some colors (string) and perform the following operations:

(i) Add elements of List to ArrayList
(ii) Copy ArrayList to Array
(iii) Reverse ArrayList content
(iv) Get Sub list from an ArrayList.
(v) To sort a given ArrayList
(vi) Clone an ArrayList to another ArrayList

10. String Handling

i) Write a Java program to find the penultimate (next to last) word of a sentence.

ii) Write program to replace a string "python" with "java" and "java" with "python" in a given string.

iii) Write a program that splits a string into a number of substrings with the help of string split() method and then prints the substrings.

PART – B

Student will design, develop and implement an application using the appropriate OOP concepts using Java:

Develop standalone Java application with neat UI using JavaFX framework to demonstrate the important features of Object Oriented approach (Abstraction/Encapsulation/Data Hiding, Inheritance and Polymorphism) and also the important features of Java such as Interfaces, Packages, Inheritance, Exception Handling, Multithreaded Programming, Collection Framework, Lambda Expressions, Regular Expressions

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Explore the fundamentals of Object-oriented concepts and apply features of object-oriented programming of Java to solve real world problems.
CO 2:	Design Classes and establish relationship among Classes for various applications from problem definition.
CO 3:	Analyze and implement reliable object-oriented applications using Java features such as Exception Handling, Multithreaded Programming, Lambda Expressions, Collection framework, Strings, JavaFX GUI Programming.
CO 4:	Design and develop real world applications using Object Oriented concepts and Java programming

Reference Books:	
1.	Object-Oriented Analysis And Design With applications, Grady Booch , Robert A Maksimchuk, Michael W Eagle, Bobbi J Young, 3rd Edition , 2013, Pearson education, ISBN :978-81-317-2287-9.
2.	The Complete Reference - Java , Herbert Schildt , 10th Edition , 2017, McGraw Hill Education Publications, ISBN-10: 9789387432291, ISBN-13: 978-9387432291
3.	Introduction to Java Programming, Y Daniel Liang, 10th Edition , 2014, Comprehensive Version Pearson education, ISBN 10: 0-13-376131-2, ISBN 13: 978-0-13-376131-3
4.	Core Java – Vol 1, Cay S.Horstmann, 10th Edition, 2016, Pearson Education, ISBN-10: 9332582718, ISBN-13: 978-9332582712

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The Average Marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a Test (T) is conducted for 10 marks. The students are encouraged to implement additional Innovative Experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks
SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**2**	**2**	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**-**	**1**
CO3	**1**	**3**	**2**	**2**	**3**	**-**	**-**	**1**	**2**	**2**	**-**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**1**	**1**	**1**	**3**	**2**	**1**	**2**

High-3: Medium-2: Low-1

Semester: IV						
COMPUTER NETWORKS (Theory)						
Course Code	**:**	18CS46		**CIE Marks**	**:**	**100**
Credits: L:T:P	:	3:0:0		**SEE Marks**	**:**	**100**
Total Hours	:	39L		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives: The students will be able to

1.	Understand the functionalities of various elements of the network.
2.	Understand the design aspects in computer networks.
3.	Gain the knowledge of routing, internetworking and congestion control.
4.	Explore networks layer, transport layer and application layer protocols.

Unit – I	**8 Hrs**
Introduction: Networks, Network types. **Network Models:** TCP / IP protocol suite, Addressing, The OSI Model. **Transmission Modes:** Parallel Transmission and Serial Transmission. **Link Layer:** Data Link Control (DLC): DLC Services, Data Link Layer Protocols, High Level Data Link Control (HDLC), Point-to-Point Protocol (PPP): Framing, Transition phases. **Media Access Control (MAC):** Random Access: CSMA/CD, CSMA/CA.	
Unit – II	**8 Hrs**
Network layer design issues: Store and Forward packet Switching, Services Provided to the Transport Layer Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual Circuit and Datagram Subnets; **Routing algorithms:** Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing Broadcast Routing, and Multicast Routing.	
Unit – III	**8 Hrs**
Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control; Quality Of Service: Requirements, Techniques for Achieving Good Quality of Service Integrated Services Differentiated Services. **Internetworking:** How networks differ, How networks can be connected Connectionless Internetworking, Tunnelling Internetwork Routing, Fragmentation.	
Unit – IV	**8 Hrs**
The Network Layer in the Internet: The IP Protocol, IP Addresses, Internet Control Protocols, OSPF- Interior Gateway Routing Protocol, BGP- Exterior Gateway Routing Protocol, IPv6. **The Transport Service:** Services provided to the Upper Layers. **The Internet Transport Protocols:** Introduction to UDP, RPC, RTCP, Introduction to TCP. The TCP Service Model.	
Unit – V	**7 Hrs**
The TCP Protocol: TCP protocol, TCP Segment Header, TCP Connection Establishment, TCP Connection Release. TCP Transmission Policy, TCP Congestion Control, TCP Timer Management. **Application Layer:** World Wide web and HTTP, FTP, Electronic Mail, Telnet.	

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Explain the principles of computer network and layered model of networking.
CO 2:	Apply the algorithms/techniques of routing, congestion and Quality of Service to solve problems related to Computer Networks.
CO 3:	Analyse the services provided by various layers of TCP/IP model.
CO 4:	Evaluate and compare various algorithms/protocols available to address networking issues.

Reference Books:	
1.	Data Communications and Networking, Behrouz A Forouzan, 5th Edition, 2013, Tata McGraw-Hill, ISBN – 9781259064753.
2.	Computer Networks, Andrew S Tanenbaum, 5th Edition, 2014, Pearson Education; ISBN – 978-81-7758-165-2.
3.	Computer Networking, A Top-Down Approach, James Kurose and Keith Ross, 6th Edition, 2013, ISBN-13: 978-0-13-285620-1.
4.	Data and Computer Communications, William Stallings, 8th Edition, 2009, Pearson Education, ISBN-13: 978-0131392052.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of Quizzes (Q), Tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for the course contains two parts, Part A and Part B. Part A consists of objective type questions for 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**1**	**2**	**-**	**2**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**-**
CO3	**2**	**2**	**-**	**3**	**3**	**1**	**1**	**-**	**1**	**-**	**-**	**2**
CO4	**2**	**2**	**-**	**3**	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**2**

High-3: Medium-2: Low-1

Semester: IV						
Design Thinking Lab						
Course Code	**:**	**18CS47**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Hours	**:**	**26P**		**SEE Duration**	**:**	**02 Hours**
Course Learning Objectives: To enable the students to:						
1	***Knowledge Application:*** Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to provide solutions of societal concern					
2	***Communication:*** Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.					
3	***Collaboration:*** Acquire collaborative skills through working in a team to achieve common goals.					
4	***Independent Learning:*** Learn on their own, reflect on their learning and take appropriate action to improve it.					

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	
CO 1:	Interpreting and implementing the empathy, ideate and design should be implemented by applying the concepts learnt.
CO 2:	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.
CO 3:	Appling project life cycle effectively to develop an efficient prototype.
CO 4:	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	05M
5.	Report	05M
	Total	**50M**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO4	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**M**	**L**	**M**	**L**	**L**

Semester: III/IV						
MATHEMATICS **Bridge Course** **(Common to all branches)**						
Course Code	**:**	18DMA48		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	**50 Marks**
Audit Course				**SEE Duration**	**:**	**2.00 Hours**

Course Learning Objectives: The students will be able to

1	Understand the concept of functions of several variables, types of derivatives involved with these functions and its applications, approximate a function of single variable in terms of infinite series.
2	Acquire concepts of vector functions, scalar fields and differential calculus of vector functions in Cartesian coordinates.
3	Explore the possibility of finding approximate solutions using numerical methods in the absence of analytical solutions of various systems of equations.
4	Recognize linear differential equations, apply analytical techniques to compute solutions.
5	Gain knowledge of multiple integrals and their applications.
6	Use mathematical IT tools to analyze and visualize the above concepts.

Unit-I	**05 Hrs**
Differential Calculus: Taylor and Maclaurin series for function of single variable. Partial derivatives – Introduction, simple problems. Total derivative, composite functions. Jacobians – simple problems.	
Unit – II	**05 Hrs**
Vector Differentiation: Introduction, simple problems in terms of velocity and acceleration. Concepts of gradient, divergence – solenoidal vector function, curl – irrotational vector function and Laplacian, simple problems.	
Unit –III	**06 Hrs**
Differential Equations: Higher order linear differential equations with constant coefficients, solution of homogeneous equations - Complementary functions. Non homogeneous equations –Inverse differential operator method of finding particular integral based on input function (force function).	
Unit –IV	**05 Hrs**
Numerical Methods: Solution of algebraic and transcendental equations – Intermediate value property, Newton-Raphson method. Solution of first order ordinary differential equations – Taylor series and 4^{th} order Runge-Kutta methods. Numerical integration – Simpson's $1/3^{rd}$, $3/8^{th}$ and Weddle's rules. (All methods without proof)**.**	
Unit –V	**05 Hrs**
Multiple Integrals: Evaluation of double integrals, change of order of integration. Evaluation of triple integrals. Applications – Area, volume and mass – simple problems.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the concept of partial differentiation, double integrals, vector differentiation, solutions of higher order linear differential equations and requirement of numerical methods.
CO2:	Solve problems on total derivatives of implicit functions, Jacobians, homogeneous linear differential equations, velocity and acceleration vectors.
CO3:	Apply acquired knowledge to find infinite series expansion of functions, solution of non-homogeneous linear differential equations and numerical solution of equations.
CO4:	Evaluate triple integrals, area, volume and mass, different operations using del operator on scalar and vector point functions, numerical solution of differential equations and numerical integration.

Reference Books	
1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2015, ISBN: 978-81-933284-9-1.
2	Higher Engineering Mathematics, B.V. Ramana, 11th Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3	N.P. Bali & Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, 7th Edition, 2010, ISBN: 978-81-31808320.
4	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016, ISBN: 978-0470458365.

Continuous Internal Evaluation (CIE); Theory (50 Marks)
CIE is executed by way of Quizzes (Q) and Tests (T**)**. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. The two tests are conducted for 30 marks each and the sum of the marks scored from two tests is reduced to 30. **Total CIE is 20(Q) +30(T)=50 Marks.**

Semester End Evaluation (SEE); Theory (50 Marks)
SEE for 50 marks is executed by means of an examination. The Question paper for the course consists of five main questions, one from each unit for 10 marks adding up to 50 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: III and IV						
PROFESSIONAL PRACTICE – I COMMUNICATION SKILLS (Common to all Programmes)						
Course Code	**:**	**18HS49**		**CIE**	**:**	**50**
Credits: L:T:P	**:**	0:0:1		**SEE**	**:**	**50**
Total Hours	**:**	18 hrs /Semester		**SEE Duration**	**:**	**2 Hours**

Course Learning Objectives: The students will be able to

1	Understand their own communication style, the essentials of good communication and develop their confidence to communicate effectively.
2	Manage stress by applying stress management skills.
3	Ability to give contribution to the planning and coordinate Team work.
4	Ability to make problem solving decisions related to ethics.

III Semester	**6 Hrs**
Communication Skills: Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening. **Communication with Confidence & Clarity**- Interaction with people, the need the uses and the methods, Getting phonetically correct, using politically correct language, Debate & Extempore.	
	6 Hrs
Assertive Communication- Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive. **Presentation Skills-** Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, How to make effective presentations, body language & Dress code in presentation, media of presentation.	
	6 Hrs
Team Work- Team Work and its important elements Clarifying the advantages and challenges of team work Understanding bargains in team building Defining behaviour to sync with team work Stages of Team Building Features of successful teams.	
IV Semester	**6 Hrs**
Body Language & Proxemics - Rapport Building - Gestures, postures, facial expression and body movements in different situations, Importance of Proxemics, Right personal space to maintain with different people.	
	6Hrs
Motivation and Stress Management: Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques**.** Individual Counseling & Guidance, Career Orientation. Balancing Personal & Professional Life-	
	6 Hrs
Professional Practice - Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behaviour at different Hierarchical Levels. Positive Attitude, Self Analysis and Self-Management. **Professional Ethics** - values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects. Balancing Personal & Professional Life	

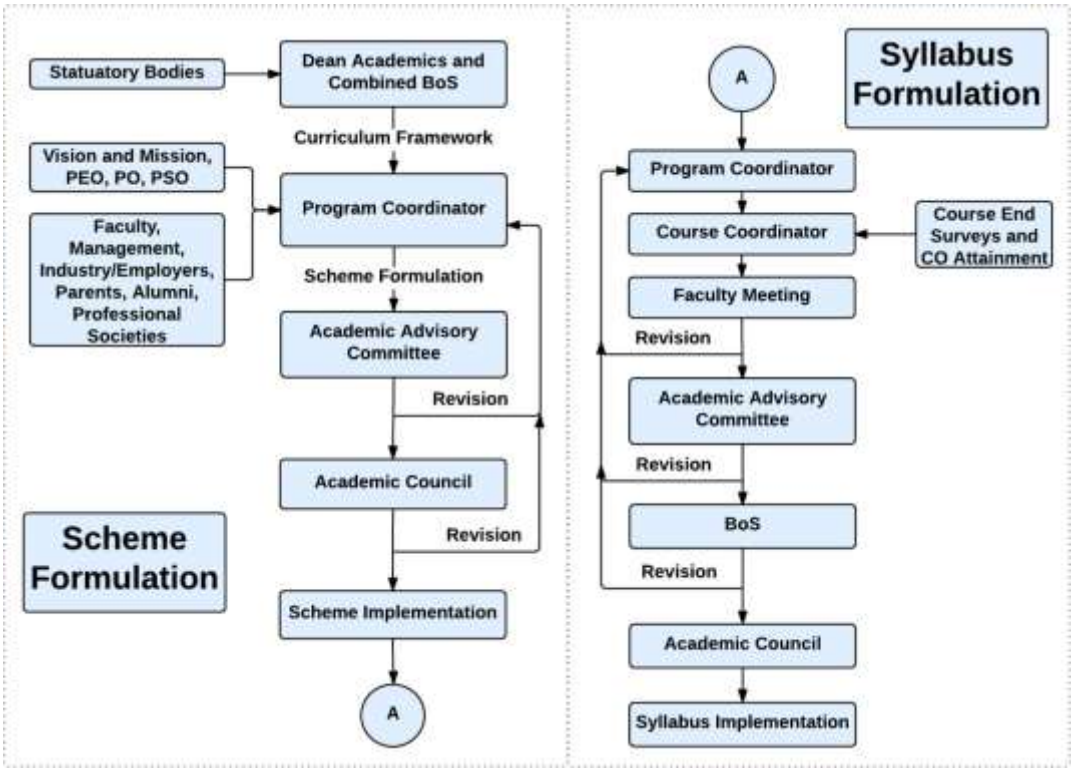
Course Outcomes: After completing the course, the students will be able to	
CO1:	Inculcate skills for life, such as problem solving, decision making, stress management
CO2:	Develop leadership and interpersonal working skills and professional ethics.
CO3:	Apply verbal communication skills with appropriate body language.
CO4:	Develop their potential and become self-confident to acquire a high degree of self

Reference Books	
1.	The 7 Habits of Highly Effective People, Stephen R Covey, Free Press, 2004 Edition, ISBN: 0743272455
2.	How to win friends and influence people, Dale Carnegie, General Press, 1st Edition, 2016, ISBN: 9789380914787
3.	Crucial Conversation: Tools for Talking When Stakes are High, Kerry Patterson, Joseph Grenny, Ron Mcmillan, McGraw-Hill Publication, 2012 Edition, ISBN: 9780071772204
4.	Aptimithra: Best Aptitude Book, Ethnus,Tata McGraw Hill, 2014 Edition, ISBN: 9781259058738

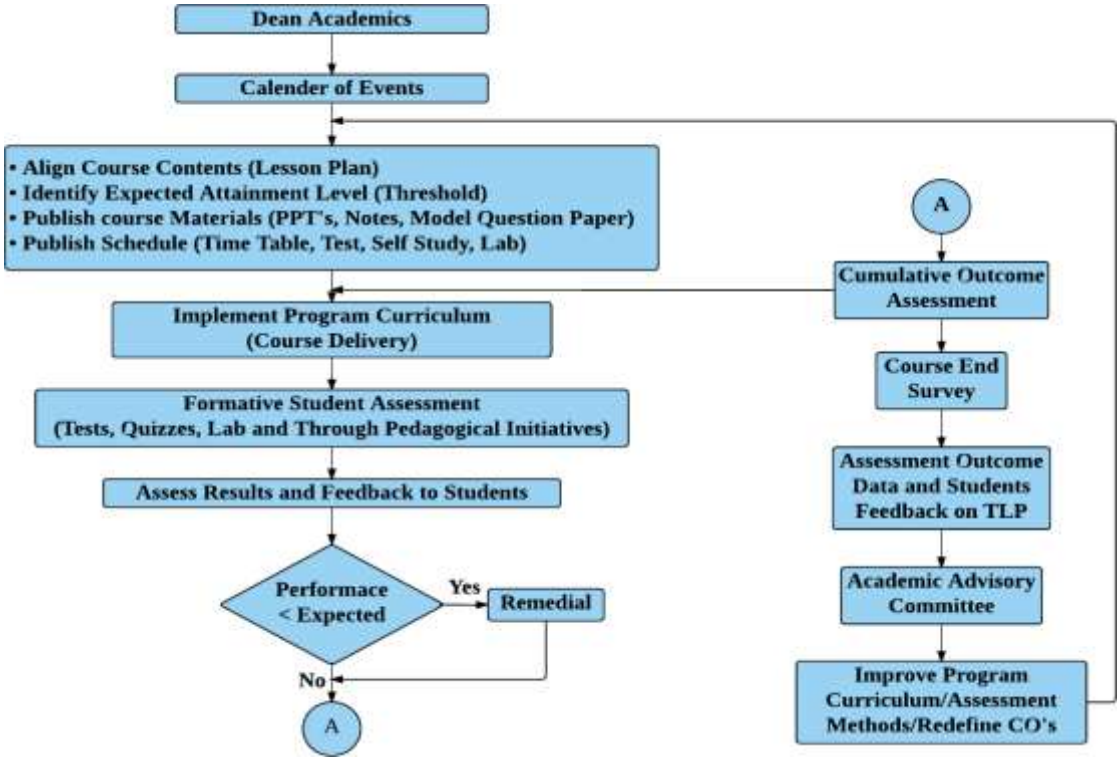
Scheme of Continuous Internal Examination and Semester End Examination

Phase	Activity	Weightage
Phase I III Sem	CIE will be conducted during the 3rd semester and evaluated for 50 marks. The test will have two components. The Quiz is evaluated for 15 marks and second component consisting of questions requiring descriptive answers is evaluated for 35 marks. The test & quiz will assess the skills acquired through the training module. SEE is based on the test conducted at the end of the 3rd semester The test will have two components a Quiz evaluated for 15 marks and second component consisting of questions requiring descriptive answers is evaluated for 35 marks.	50%
Phase II IV Sem	During the 4th semester a test will be conducted and evaluated for 50 marks. The test will have two components a Short Quiz and Questions requiring descriptive answers. The test & quiz will assess the skills acquired through the training module. SEE is based on the test conducted at the end of the 4th semester The test will have two components. The Quiz evaluated for 15 marks and second component consisting of questions requiring descriptive answers is evaluated for 35 marks	50%
Phase III At the end of IV Sem	At the end of the IV Sem Marks of CIE (3rd Sem and 4th Sem) is consolidated for 50 marks (Average of Test1 and Test 2 (CIE 1+CIE2)/2. At the end of the IV Sem Marks of SEE (3rd Sem and 4th Sem) is consolidated for 50 marks (Average of CIE 1 and CIE 2 (CIE 1+CIE2)/2.	

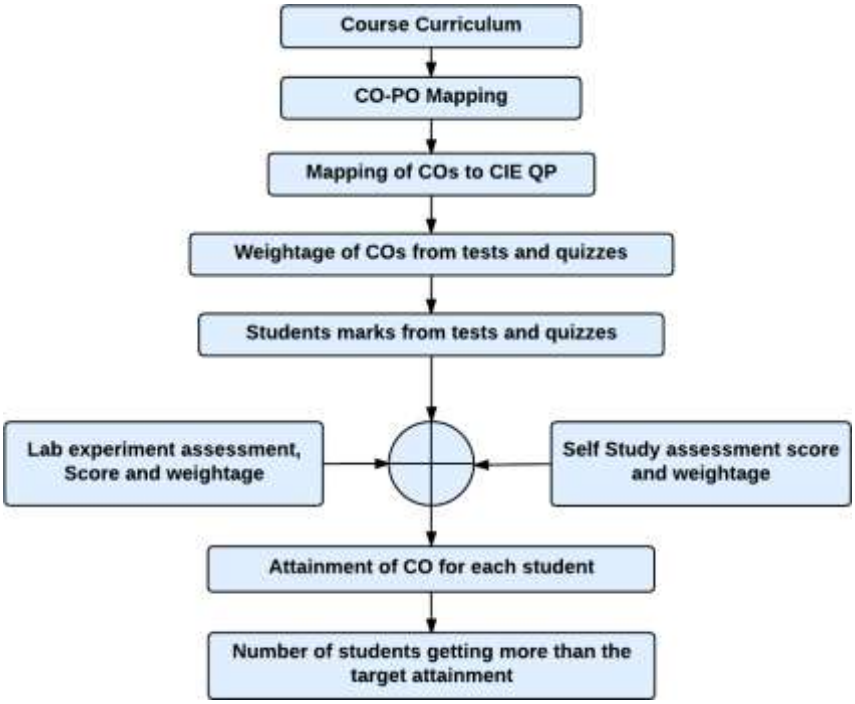
Curriculum Design Process



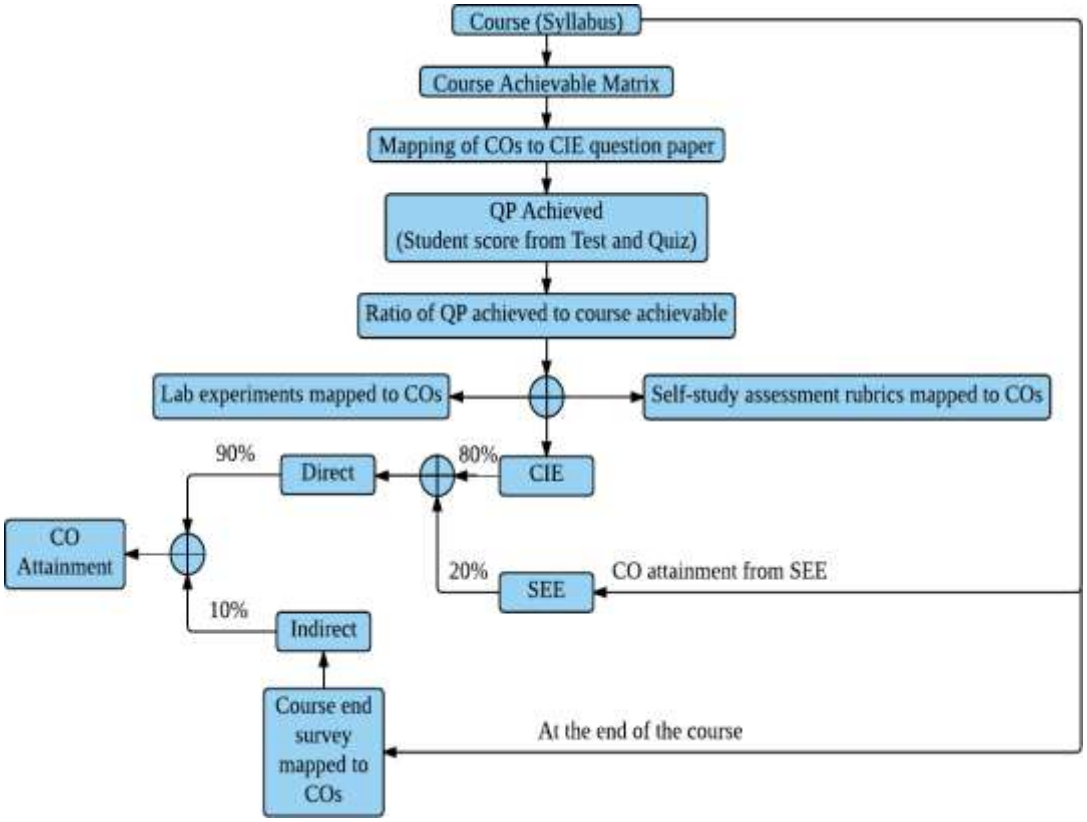
Academic Planning And Implementation



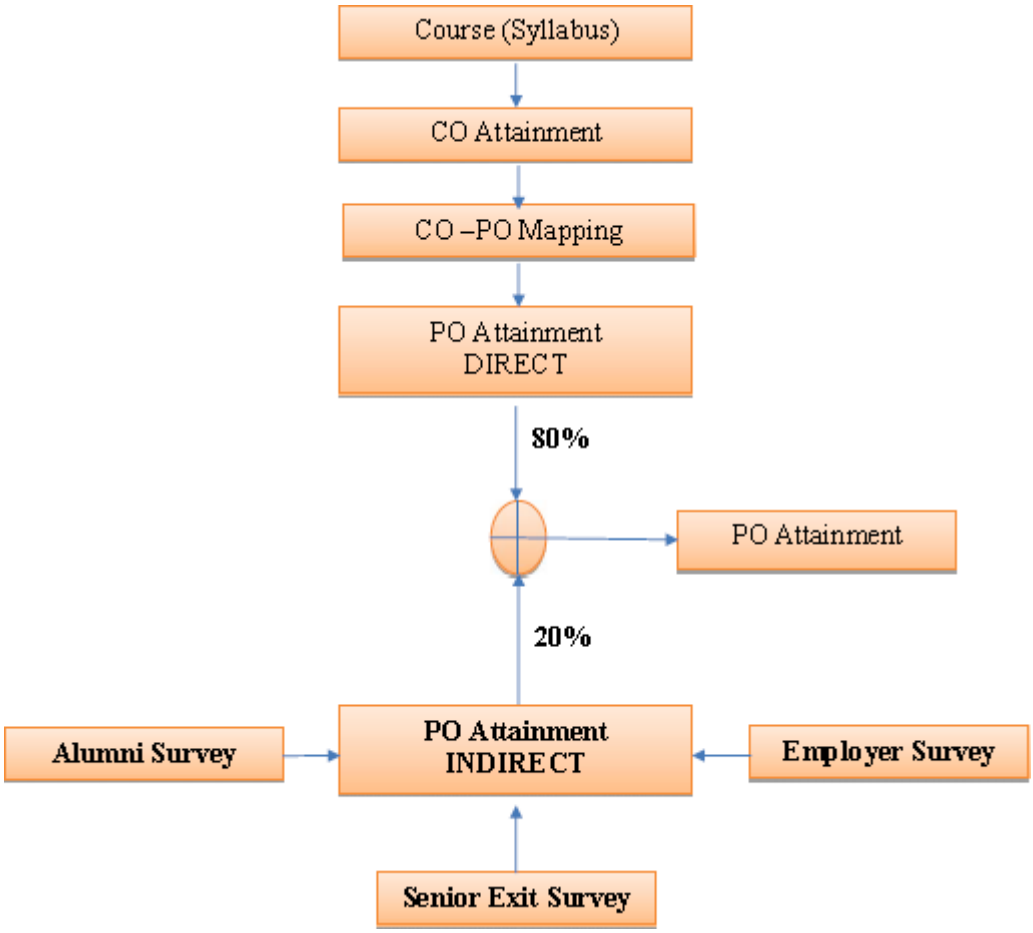
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



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.

Innovative Clubs of RVCE

1	**Ashwa Racing**	Ashwa Mobility Foundation (AMF) is a student R&D platform that designs and fabricates Formula theme race cars and future mobility solutions to tackle urban transportation problems.
2	**Astra Robitcs**	Team involved in the design, fabrication and building application specific robots.
3	**Coding Club**	To facilitate students the skills, confidence, and opportunity to change their world using coding and help them become successful in GSoC, ACM-ICPC, and other recognized coding competitions.
4	**Entrepreneurship Development Cell**	E-Cell is a student run body that aims to promote entrepreneurship by conducting workshops, speaker sessions and discussions on business and its aspects. We possess a mentor board to help startups grow.
5	**Frequency Club**	Team aims at contributing in both software and hardware domains mainly focusing on Artificial Intelligence, Machine Learning and it's advances.
6	**Garuda**	Design and development of supermileage urban concept electric car. Indigenous development of E-mobility products.
7	**Jatayu**	Build a low cost Unmanned Aerial Vehicle capable of Autonomous Navigation, Obstacle Avoidance, Object Detection, Localization, Classification and Air Drop of a package of optimum weight.
8	**Solar Car**	Build a roadworthy solar electric vehicle in order to build a green and sustainable environment.
9	**Team Antariksh**	Team Antariksh is a Space Technology Student Club whose goal is to understand, disseminate and apply the engineering skills for innovation in the field of Space technology. designing Nano-Satellite payload for ISRO PS4 Orbital platform, RVSAT-1 along with developing experimental rockets of various altitude.
10	**Team Chimera**	Building a Formula Electric Car through Research and Development in E-Mobility. Electrifying Formula Racing.
11	**Helios Racing**	Team involved in design, manufacturing and testing of All-Terrain Vehicles and other supportive tasks for the functioning of the team. Participating in BAJA competitions organized by SAE in India and the USA.
12	**Team Hydra**	Developing autonomous underwater vehicles and use it for various real world applications such as water purification, solid waste detection and disposal etc.
13	**Team Krushi**	Develop low cost equipments, which help farmers in cultivating and harvesting the crops. Use new technology applications to reduce the labour time hand cost for farmers. Aims at developing implants for Tractors.
14	**Team vyoma**	Design, fabrication and testing of radio controlled aircrafts and research on various types of unmanned aerial vehicles.
15	**Team Dhruva**	Organizing activities like quizzes based on astronomy.Stargazing and telescope handling sessions.Construction of a standard observatory. working on small projects with organizations like ICTS, IIA, ARIES etc.
16	**Ham club**	To popularize Amateur Radio as a hobby among students, alongside exploring technical innovations in the communications domain. Intended to provide human capital for service to the nation at times of natural calamities.

NCC

एकता और अनुशासन

NSS

राष्ट्रीय सेवा योजना
NATIONAL SERVICE SCHEME

"Not me but you"
" Education through
Community Service &
Community Service through education"

Cultural Activity Teams

1. **AALAP (Music club)**
2. **DEBSOC (Debating society)**
3. **CARV (Dramatics club)**
4. **FOOTPRINTS (Dance club)**
5. **QUIZCORP (Quizzing society)**
6. **ROTARACT (Social welfare club)**
7. **RAAG (Youth club)**
8. **EVOKE (Fashion team)**
9. **f/6.3 (Photography club)**
10. **CARV ACCESS (Film-making club)**

VISION

Leadership in Technical Education, Interdisciplinary Research & Innovation, with a Focus on sustainable and Inclusive Technologies.

MISSION

- To deliver outcome based Quality Education, emphasizing on experiential learning with state of the art infrastructure.
- To create a conducive environment for interdisciplinary research and innovation.
- To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
- To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
- To focus on technologies that are sustainable and inclusive, benefitting all sections of the society.

RV COLLEGE OF ENGINEERING

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