RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Go, change the world

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

2021 SCHEME
(AS PER NEP-2020 GUIDELINES)

COMPUTER SCIENCE AND ENGINEERING

(ACADEMIC YEAR 2022-2023)

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

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

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
R.V. Vidyaniketan Post, Mysore Road
Bengaluru – 560 059

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

2021 SCHEME

DEPARTMENT OF
COMPUTER SCIENCE &ENGINEERING

DEPARTMENTVISION

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

DEPARTMENTMISSION

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

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

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Bachelor of Engineering in

COMPUTER SCIENCE AND ENGINEERING

III SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	21MA31A*	Linear Algebra, Integral Transforms and Number Theory (Common to CS & IS)	3	1	0	**4**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	21BT32A**	Environmental Technology	2	0	0	**2**	BT	Theory	1	**50**	****	**2**	**50**	****
3	21IS33	Data Structures and Applications (Common to CS & IS)	3	0	1	**4**	IS	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	21CS34	Foundations of Computer Systems Design	3	0	1	**4**	CS	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	21CS35	Operating Systems (Common to CS, IS & AI)	2	0	1	**3**	CS	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
6	21CS36	Discrete Mathematical Structures (Common to CS, IS & AI)	3	0	0	**3**	CS	Theory	1.5	**100**	****	**3**	**100**	****
7	21DCS37** *	Bridge Course: C Programming	2(A)	0	0	**AUDIT**	CS	Theory	1	**50**	****	**2**	****	****
8	21HS38A / 21HS38V	Kannada Course: AADALITHA KANNADA (18HS38A) / VYAVAHARIKA KANNADA (18HS38V)	1	0	0	**1**	HSS	Theory	1	**50**	****	**2**	**50**	****
9	21HSAE39 A/B/C/D/E	Ability Enhancement course	0	0	1	**1**	HSS	Lab	1	****	**50**	**2**	****	**50**
10	21CSI310	Summer Internship- I	0	0	1	**1**	CS	Internship	1	****	**50**	**2**	****	**50**
						23								

* Summer Internship-1 will be done after the II sem for 03 Weeks

*ENGINEERING MATHEMATICS - III			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Linear Algebra, Laplace Transform and Combinatorics	21MA31A	CS,IS & AI
2	Discrete and Integral Transforms	21MA31B	EC,EE,EI,TE
3	Engineering Mathematics –III	21MA31C	AS, BT,CH,CV,IM,ME
**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Environmental Technology	21BT32A	All circuit Branches
2	Biology for Engineers	21BT32B	BT & AS
3	Engineering Materials	21ME32	ME, CH & IM
*** Bridge Course: Audit course for lateral entry diploma students			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	21DMA37	AS,BT,CH,CV,EC,EE,EI, IM,ME&TE
2	Bridge Course C Programming	21DCS37	CS,IS & AI

Ability enhancement courses **		
Sl. No.	**Couese code**	**Course Title**
1	21HSAE39A	National Service Scheme (NSS)
2	21HSAE39B	National Cadet Corps (NCC)
3	21HSAE39C	Physical Education
4	21HSAE39D	Music/Dance/Theatre
5	21HSAE39E	Art work/ Painting/ Photography & Film making

Bachelor of Engineering in

COMPUTER SCIENCE AND ENGINEERING

IV SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	21MA41A*	Statistics and Probability for Data Science	2	1	0	**3**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	21BT42B**	Bioinspired Engineering	2	0	0	**2**	BT	Theory	1	**50**	****	**2**	**50**	****
3	21CS43	Design And Analysis of Algorithms (Common to CS, IS & AI)	3	0	1	**4**	CS	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	21CS44	Microcontrollers and Embedded Systems	3	0	1	**4**	CS	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	21CS45	Computer Networks (Common to CS, IS & AI)	3	0	0	**3**	CS	Theory	1.5	**100**	****	**3**	**100**	****
6	21CS4AX	Professional Core Elective – Group A	2	0	0	**2**	CS	MOOC	1	**50**	****	**2**	**50**	****
7	21CS46	Design Thinking Lab	0	0	2	**2**	CS	Lab	1	****	**50**	**2**	****	**50**
8	21DMA47***	Bridge Course: Mathematics	2 (A)	0	0	**AUDIT**	MA	Theory	1	**50**	****	**2**	**50**	****
9	21HSU48	Universal Human Values and Professional Ethics	2	0	0	**2**	HSS	Theory	1	**50**	****	**2**	**50**	****
10	21CS49	Object Oriented Programming Using JAVA (Common to CS & AI)	0	0	1	**1**	CS	Lab	1	****	**50**	**2**	****	**50**
						23								

* Summer Internship-II will be done after the IV sem for 04 Weeks

*ENGINEERING MATHEMATICS - IV			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Statistics and Probability for Data Science	21MA41A	CS, IS &AI
2	Linear Algebra, Statistics and Probability Theory	21MA41B	EC,EE,EI,TE
3	Engineering Mathematics -IV	21MA41C	AS, CH, CV, ME
**** MANDATORY COURSES**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Engineering Materials	21EC42	EC,EE,EI,TE
2	Bioinspired Engineering	21BT42B	Circuit branches (CS,IS& AI)
3	Environmental Technology	21BT42A	All Non circuit branches
***** Bridge Course: Audit course for lateral entry diploma students**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	21DMA47	CS,IS & AI
2	Bridge Course C Programming	21DCS47	AS,BT,CH,CV,EC,EE,EI,IM,ME & TE

GROUP A: PROFESSIONAL ELECTIVES (MOOC COURSES)			
Sl. No.	**Course Code**	**Course Title**	**Duration**
1.	21CS4A1	Object Oriented Analysis And Design	8 Weeks
2.	21CS4A2	Multi-core Computer Architecture – Storage and interconnects	8 Weeks
3.	21CS4A3	Introduction To Haskell Programming	8 Weeks
4.	21CS4A4	Embedded System Design With ARM	8 Weeks
5.	21CS4A5	Distributed Systems	8 Weeks

Semester: III						
LINEAR ALGEBRA, INTEGRAL TRANSFORMS AND NUMBER THEORY (Theory) (Common to CS, IS)						
Course Code	**:**	21MA31A		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L+15T		**SEE Duration**	**:**	3.00 Hours

Unit – I	**09 Hrs**
Linear Algebra – I: Vector spaces, subspaces, linear dependence and independence, basis and dimension, four fundamental subspaces. Rank and nullity theorem (without proof). Linear transformations - matrix representation, kernel and image of a linear transformation, dilation, reflection, projection and rotation matrices.	
Unit – II	**09 Hrs**
Linear Algebra - II: Inner Products, orthogonal matrices, orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization. Eigen values and Eigen vectors, diagonalization of a matrix (symmetric matrices) and singular value decomposition.	
Unit – III	**09 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. Inverse Laplace transforms - properties, evaluation using different methods, convolution theorem (without proof) and problems.	
Unit – IV	**09 Hrs**
Fourier Transform: Fourier integral theorem, complex Fourier and inverse Fourier transform, Fourier sine transform, Fourier cosine transform, properties - linearity, scaling, time-shift and modulation. Convolution theorem (without proof), problems.	
Unit – V	**09 Hrs**
Number Theory: Divisibility, the greatest common divisor, properties of prime numbers, the fundamental theorem of arithmetic, congruence, linear congruence, multiplicative inverses and cancelling, Euler's theorem, RSA Public key encryption.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the fundamental concepts of linear algebra, Laplace and inverse Laplace transforms, Fourier transforms and number theory.
CO2:	Apply the acquired knowledge of linear algebra, Laplace and inverse Laplace transforms, Fourier transforms and number theory to solve the problems of engineering applications.
CO3:	Analyze the solution of the problems using appropriate techniques of linear algebra, integral transforms and number theory to the real world problems arising in many practical situations.
CO4:	Interpret the overall knowledge of linear algebra, Laplace and inverse Laplace transforms, Fourier transforms and number theory gained to engage in life-long learning.

Reference Books	
1	Linear Algebra and its Applications, Gilbert Strang, 4th Edition, 2014, Cengage Learning India Edition, ISBN: 9788131501726, 8131501728.
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: 81-7409-195-5.
4	Linear Algebra and its Applications, David C Lay, 4th Edition, 2012, Pearson Education India, ISBN-13: 970321385178, ISBN-10: 0321385171.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
MATLAB	**20**	
Model presentation/ case study/ video preparation	**20**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**

Semester III						
ENVIRONMENTAL TECHNOLOGY						
Course Code	**:**	21BT32A		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	26 L		**SEE Duration**	**:**	90 min

Course Learning Objectives: The students will be able to	
1	Explain the various components of environment and the significance of the sustainability of healthy environment.
2	Identify the implications of different types of the wastes produced by natural and anthropogenic activity.
3	Develop critical thinking for shaping strategies (scientific,social,economic and legal) for environmental protection and conservation od biodiversity, social equity and sustainable development.
4	Design the models that help mitigate or prevent the negative impact of proposed activity on the environment in line with Sustainable Developmental Goals.

Unit I	08 hrs

Introduction: Climate action – Paris convention, Sustainable Developmental Goals in relation to environment, Components of environment, Ecosystem. Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.

Unit II	09 hrs

Pollution and its remedies: 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: Advanced water treatment techniques, water conservation methods.

Waste management: Solid waste, e-waste & biomedical waste – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes.

Waste to Energy: Different types of Energy, Conventional sources & Non-conventional sources of energy: Solar, Hydro Electric, Wind, Nuclear, Biomass & Biogas Fossil Fuels and Hydrogen.

Unit III	09 hrs

Environmental design: Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), Hydroponics, Organic Farming, Biofuels, IC engine to E mobility transition and its impacts, Carbon Credits, Carbon Foot Prints, Opportunities for Green Technology Markets, Carbon Sequestration.

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.

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:	Apply 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	**Shashi Chawla, A Textbook of Environmental Studies, McGraw Hill Education, 2017, ISBN: 1259006387.**
2	**Richard A Schneider and Jerry A Nathanson, Basic Environmental Technology, Pearson, 6th Edition, 2022. ISBN: 9789332575134,**
3	G. Tyler Miller (Author), Scott Spoolman (Author), (2020) Environmental Science – 15th edition, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044
4	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

Experiential learning topics	
Assessment of the environment of certain big campuses/areas/industries etc, a case study	
1	Development of data sheet
2	Survey and its record
3	Identifying the problems associated
4	Provide a solution for the identified problem

Experiments to be performed	
1	Data development
2	Working model (in silico or demo model)
3	Preparing a report
4	Brainstorming of the work carried out.

Experiential learning evaluation will be evaluated based on the experiments and the preparation, presentation of the topics, equal weightage is given for experiments and theory.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 5 marks adding up to 1**0 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to 2**0 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**20**	
Case Study-based Teaching-Learning	**10**	
Experiments performed	**10**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**100**

Semester: III						
DATA STRUCTURE AND APPLICATIONS (Common to CS & IS) (Theory and Lab)						
Course Code	**:**	21IS33		**CIE**	**:**	150 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	150 Marks
Total Hours	**:**	36L+30P		**SEE Duration**	**:**	3Hours + 3Hours

Unit-I	**7 Hrs**
Introduction: Introduction to Data structures, Types of Data Structures, Linear & non-linear Data Structures **Stacks:** Stack definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation **Recursion:** Introduction to Recursion, Factorial function, Binary search, Towers of Hanoi problem, Role of the stack during execution.	
Unit – II	**7 Hrs**
Queues: Representation of queue, operations, circular queues. Application of Queue: Message queue using circular queue. **Dynamic Memory allocation:** malloc(), calloc(),free(), realloc() **Linked Lists:** Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, getnode, freenode, and header node.	
Unit –III	**7 Hrs**
Circular Singly Linked List (CSLL): Definition, Various operations, Application: Queue implementation. DoublyLinked List (DLL),CircularDoublyLinked List (CDLL). Applications: Polynomial multiplication, Addition of long positive integers. **Trees:** Recursive Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST), Expression Trees (ET)	
Unit –IV	**7 Hrs**
Various Operations on BT, BST, ET: Insertion, Deletion,Display and Traversals. Applications: Tree Sort, Infix, Postfix and Prefix **Heap:** Definition, Construction, Applications of Heap: Heap Sort, Priority Queue.	
Unit –V	**8 Hrs**
Threaded Binary Tree: Types and application. Balanced tree: AVL trees, B+ tree, Splay and Tries. **Graph**: Preliminaries; Matrix and Adjacency List representation of Graphs. **Hashing:** Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the knowledge of computing to define the various data structures and its operations.
CO2:	Analyse a problem and identify the suitable data structure to develop solution
CO3:	Investigate &Design solution to a given problem using modern tools and appropriate data structures.
CO4:	Implement solutions for real-time applications
CO5:	Demonstrate Good Coding Practices engaging in lifelong learning

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

Laboratory Component

PART A

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

Practice Programs:

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

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

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

1. Application of Stack

a) Implementation of Infix to Postfix conversion
b) Implementation of Infix to Postfix conversion
c) Implementation of evaluation of postfix expression
d) Implementation of evaluation of prefix evaluation

2. Application of Queue

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

3. Application of List

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

4. Application of Heap, Tries and Hash Table

a) Implementation of Double hashing technique
b) Implementation of priority queue using Binary Heap
c) Implementation of Heap sort
d) Implementation of dictionary using Tries

5. **Application of Trees**

a) Implementation of conversion of Prefix to Postfix / Infix to Postfix /Postfix to Prefix using Expression Tree.
b) Implementation of various operations on Binary Tree like – creating a tree, displaying a tree, copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.
c) Implementation of various operations on Binary Search Tree like – Inserting a node, Deleting a node, Displaying a tree, Tree Sort
d) Implementation of B+ tree

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	*****
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	*****
Test – II		
EXPERIENTIAL LEARNING(Maximum of 40 Marks)		*****
Case Study-based Teaching-Learning	**10**	*****
Program Specific Requirement for EL Assessment	**20**	
Video based seminar (4-5 minutes per student)	**10**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
PRACTICALS	**50**	**50**
TOTAL MARKS FOR THE COURSE	**150**	**150**

Semester: III						
FOUNDATIONS OF COMPUTER SYSTEMS DESIGN (Theory and Practice)						
Course Code	:	21CS34		**CIE**	:	100+50 Marks
Credits: L:T:P	:	3:0:1		**SEE**	:	100+50 Marks
Total Hours	:	45L+30P		**SEE Duration**	:	3Hours + 3Hours

Unit-I	**8 Hrs**
Introduction-Perspectives **Business Domains & Applications:** Semiconductors as an essential component of electronic devices and its advances in **communications, computing, healthcare, military systems, transportation, clean energy**, and countless other applications. Arithmetic and Logic Design Using Combinational Circuits **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, Subtracters, Comparators, Decoders, Encoders, Multiplexers	
Unit – II	**10 Hrs**
Logic Design Using Sequential Circuits **Flip-Flops and Applications**: The Basic Bistable Elements, Latches, Timing Considerations, Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops), Edge – Triggered Flip-Flops, Characteristic 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 Counters and Self-Correcting Counters	
Unit –III	**10 Hrs**
Study and design of Synchronous Sequential Networks **Synchronous Sequential Networks**: Structure and operation of Clocked synchronous Sequential Networks, Analysis of Clocked Synchronous Sequential Networks, Modelling clocked synchronous sequential network behavior, State Table Reduction, The State Assignment, Completing the design of clocked synchronous sequential networks.	
Unit –IV	**10 Hrs**
Structure of Computers and Instruction Set Architecture **Basic Structure of Computers**: Functional Units, Basic Operational Concepts, Performance – Technology and Parallelism. **Instruction Set Architecture**: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language- Assembler Directives, Assembly and Execution of Programs. Stacks, Subroutines- Subroutine Nesting and the Processor Stack, Parameter Passing, The Stack Frame.	
Unit –V	**7 Hrs**
Memory System & Basic Processing Unit **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, Multiple-Bus Organization, Control Signals, Hardwired Control, Basic organization of a Microprogrammed Control Unit.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply design requirements for digital systems and Computer organization
CO 2	Analyse the models used for designing various combinational and sequential circuits
CO3	Design optimized modern processors and memories for given specifications
CO 4	Develop applications of synchronous sequential networks using flip flop and registers.
CO5	Investigate techniques of digital system design for building industry relevant real-world systems using electronic components and modern tools
CO6	Indulge in developing novel interdisciplinary projects with effective oral and written communication skills

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

Laboratory Component

PART A (Design & Construction of Combinational & Sequential Circuits)

1A. Realization of Excess-3 Code converter with Parallel Adder and Subtractor using 4-bit adder, using the IC – 74283.

B. Realization of Binary to Gray Code Converter using decoders, using the IC 74139.

2. Realization of Full Adder and Full Subtract or using Multiplexers, using IC 74153.

3. Design and realization One Bit and Two-Bit Magnitude Comparator using logic Gates.

4A. Realization of single digit Seven segment display using the BCD to seven segment decoders, using the IC–7447.

B. Realization of Priority Encoder using IC–74147.

5. Design and Realization of Master-Slave JK Flip Flop using only NAND Gates.

6A. Realization of Synchronous Up-Down programmable counter using IC 74192.

B. Realization of Asynchronous decade counter and its variations using IC 7490.

7A. Realization of Ring counter and Johnson counter using IC 7495.

B. Design and realization of sequence generator using IC 7495.

8. Design of Mod-N Synchronous Up counters using IC 74112.

Note: Experiments & ICs indicated can be changed based on the availability and relevance

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

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

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

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
Case Study-based Teaching-Learning (Study & Dissemination of Published articles related to state of the art work in the fields of semiconductors, computer architecture, memories etc)	**10**	
Building Prototypes: Students to design & demonstrate prototypes of Smart Systems, IoT Applications etc, which involves integration of Hardware & Software.	**20**	
Participation and winning in Hackathons / Paper Presentations /Journal Publications / Course Material Preparation-Videos/Animations/AR-VR tools	**10**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
PRACTICALS	**50***	**50***
TOTAL MARKS FOR THE COURSE	**150**	**150**

Guidelines for Conducting CIE Laboratory / Practical's:

Sl.No	Contents	Marks
1	Write-Up, Conduction of Experiment & Record Writing	30
2	Design a 4/8-bit CPU using the LOGISIM/any other simulator	10
3	Lab Exam (WriteUp-2M, Conduction-6M, Viva-2M)	10
	Total:	**50**

Guidelines for Conducting SEE Lab Exam:

Sl.No	Contents	Marks
1	Write-Up and Conduction of Part A Experiment	30
2	Demonstration of CPU design on Logisim simulator & Viva.	20
	Total:	**50**

Semester: III						
OPERATING SYSTEMS (Theory and Practice) (Common to CS, IS & AI)						
Course Code	**:**	21CS35		**CIE**	**:**	100 + 50 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 + 50 Marks
Total Hours	**:**	30L+30P		**SEE Duration**	**:**	3 + 3 Hours

Unit-I	**06 Hrs**
Introduction- Perspectives **Business domain:**Virtualisation and Cloud Computing **Application:**Traditional computing, Mobile computing, Distributed systems **Introduction** What Operating System do, Operating System structure, Operating system Operations. **System Structures** Operating system services, System Calls, Types of System calls **Process Management** Process concept, Process scheduling, Operations on processes	
Unit – II	**06 Hrs**
Multithreaded programming Overview, Multicore programming, Multithreading models, Thread libraries - pthreads **CPU scheduling and Process Synchronization** Basic concepts, scheduling criteria, scheduling algorithms-FCFS, SJF, RR, priority, Real-time CPU scheduling	
Unit –III	**06 Hrs**
Process Synchronization Background, The Critical section problem, Peterson's Solution **Process Synchronization** Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization	
Unit –IV	**06 Hrs**
Main Memory Management Background, Swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table. **Virtual memory** Background, Demand Paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing	
Unit –V	**06 Hrs**
File Systems File Naming, File Structure, File Types, File Access, File Attributes, File Operations, An example program using File-System calls, File-System Layout, Implementing Files	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply the operating systems concepts to solve problems in computing domain.
CO 2	Analyze data structures and algorithms used to implement OS concepts.
CO 3	Design solutions using modern tools to solve applicable problems in operating systems domain
CO 4	Implement process, memory, scheduling, synchronization and other operating system techniques.
CO 5	Demonstrate skills like investigation, effective communication, working in team/Individual and following ethical practices by implementing operating system concepts and applications.

Reference Books	
1.	Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin , Greg Gagne, 9th Edition, Incorporated, 2018, John Wiley & Sons, ISBN 978-1-265-5427-0
2.	Modern operating systems, Tanenbaum, Andrew, 4th Edition, Pearson Education, Inc 2009. ISBN 013359162X, 978-0133591620
3.	UNIX System Programming Using C++, Terrence Chan, 2011, Prentice Hall India, ISBN: 9788120314689 978-8120314689.
4.	Operating systems - A concept based Approach, D.M Dhamdhere, 3rd Edition, 2017, Tata McGraw-Hill, ISBN: 1259005585, 978-1259005589
5.	"xv6: a simple, Unix-like teaching operating system", https://pdos.csail.mit.edu/6.828/2014/xv6/book-rev8.pdf

EXPERIENTIAL LEARNING

1. Students need to implement Operating system with kernel concepts with the help of references like:
   - Weenix- project for people interested in writing parts of a Unix kernel.
   - GitHub - cfenollosa/os-tutorial: How to create an OS from scratch
2. Open Ended Problems are given to students to solve using various latest OS technology.

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. Apply the concepts of Process control system calls to build applications to demonstrate use of fork, execve, wait, getpid, exitsystem calls
3. Apply the pthread library to build Applications to demonstrate use ofpthread library functions to create and manage threads.
4. Apply the concepts of Process/Thread synchronization to build Applications to demonstrate process/thread synchronizationusing semaphores and mutex. Implement Dining philosophers problem, reader-writer andproducer-consumer.
5. Apply the concepts of Process/Thread synchronization for file access to build applications to demonstrate process/threadsynchronization using file locks.
6. Apply Memory management concepts towrite a program to simulate Buddy memory allocation algorithm.
7. Apply the concepts of Static and Shared libraries to write a program to create and use static and shared libraries.Demonstrate the advantage of shared libraries over static libraries in terms of memory usage.

PART B
Open Ended 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.

Some sample topics could be

- Implement a complex open-ended project with case studies on various OS like Embedded OS, Mobile OS etc.
- Implement kernel concepts in OS

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
Case Study-based Teaching-Learning	**10**	
Sector wise study & consolidation (viz., Engg. Semiconductor Design, Healthcare & Pharmaceutical, FMCG, Automobile, Aerospace and IT/ITeS)	**20**	
Video based seminar (4-5 minutes per student)	**10**	
MAXIMUM MARKS FOR THE THRORY	**100 MARKS**	**100 MARKS**
TOTAL MARKS FOR THE COURSE	**100**	**100**

Semester: III						
DISCRETE MATHEMATICAL STRUCTURES (Theory) (Common to CS, IS & AI)						
Course Code	**:**	21CS36		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L		**SEE Duration**	**:**	3Hours

Unit-I	**10 Hrs**
Introduction- Perspectives **Business Domains & Applications:** Application of discrete mathematics incoding theory, job scheduling, routing in networking, network security etc. **Fundamental Principles of Counting** The Rule of Sum and Product, Permutations, Combinations, The Binomial Theorem, Combinations with repetition **Recursive Definitions, Recurrence Relations** Recursive definition, First order linear recurrence relation- Formulation problems and examples, Second order linear homogeneous recurrence relations with constant coefficients	
Unit – II	**08 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	**9 Hrs**
Relations Properties of relations, Composition of Relations, Partial Orders, Hasse Diagrams, Equivalence Relations and Partitions. **Functions** Functions-plain, One-to-one, onto functions, Stirling numbers of the second kind, Function composition and Inverse function, Growth of function.	
Unit –IV	**9 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	**9 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:-	
CO1	Apply the concepts of discrete mathematical structures for effective computation and relating problems in the computer science domain.
CO2	Analyze the concepts of discrete mathematics to various fields of computer science.
CO3	Design solutions for complex problems using different concepts of discrete mathematical structure as a logical predictable system.
CO4	Explore/Develop new innovative ideas to solve some open problems in theoretical computer science.
CO5	Effectively communicate, work in groups in order to accomplish a task and engage in continuing professional development.

Reference Books	
1.	Ralph P. Grimaldi and B V Ramana, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, Asia, 5th Edition – 2017, ISBN 978-0321385024
2.	J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata – McGraw Hill, 1st Edition 2017, ISBN 13:978-0074631133
3.	Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata – McGraw Hill, 6th Edition, 7th edition 2017, ISBN-(13): 978-0070681880
4.	John Martin, Introduction to Languages and the Theory of Computation, 4th Edition, John C Martin, ISBN 978–0–07–319146–1

EXPERIENTIAL LEARNING

Based on the concepts learnt in this course like relations, functions- problems on graph theory such as graph coloring, scheduling problems could be given for Experiential learning.
Also using the concepts of logical reasoning and group theory some of the NLP problems could also be given for Experiential learning.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS**.	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding up to **100 marks**. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**

Semester: III						
BRIDGE COURSE: C PROGRAMMING (Theory) (Common to all Branches)						
Course Code	**:**	21DCS37		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	30L		**SEE Duration**	**:**	2 Hours

Unit-I	**08 Hrs**
Introduction-Perspectives **Business Domains:** Programming. **Applications:** Design games, GUI, DBMS, Embedded Systems, Compilers and Operating Systems. **Introduction to Computer Concepts:** Introduction to Computer Hardware, Software and its Types. **Introduction to C programming:** Programming paradigms, Basic structure of C program, Process of compiling and running a C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Pre-processor directives. **Handling Input and Output operations and operators:** Formatted input/output functions, Unformatted input/output functions with programming examples using all functions.	
Unit – II	**10 Hrs**
Operators: Introduction to operator set, Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and Decrement operators, Conditional operators, Bit-wise operators, Special operators. **Expressions:** Arithmetic expressions, evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity. **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.	
Unit –III	**12 Hrs**
Programming Constructs: Decision making and looping: The 'for','while','do-while' statements with examples, Jumps in loops**. Arrays:** Introduction to Arrays, Types of arrays, Declaration arrays, Initializing dimensional arrays (One Dimensional and Multidimensional Array) with examples. **String Operations:** Introduction, Declaration and Initializing String Variables using arrays, String operations and functions with examples. **Functions:** Need for Functions, Types of functions (User Defined and Built –In), working with functions, Definition, declaration and its scope. **Pointers:** Introduction, Benefits of using pointers, Declaration and Initialization of pointers, Obtaining a value of a variable.	

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

Reference Books	
1.	Programming in C, P. Dey, M. Ghosh, 2011, 2nd Edition, Oxford University press, ISBN (13): 9780198065289.
2.	Algorithmic Problem Solving, Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5
3.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
4.	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.
5.	Rasberry pi: https://www.raspberrypi.org/documentation/
6.	Nvidia: https://www.nvidia.com/en-us/
7.	Ardunio: https://www.arduino.cc/en/Tutorial/BuiltInExamples
8.	Scratch software: https://scratch.mit.edu/

PRACTICE PROGRAMS

Implement the following programs using cc/gcc compiler

1. Develop a C program to compute the roots of the equation $ax^2 + bx + c = 0$.
2. Develop a C program that reads N integer numbers and arrange them in ascending or descending order using selection sort and bubble sort technique.
3. Develop a C program for Matrix multiplication.
4. Develop a C program to search an element using Binary search and linear search techniques.
5. Using functions develop a C program to perform the following tasks by parameter passing to read a string from the user and print appropriate message for palindrome or not palindrome.
6. Develop a C program to compute average marks of 'n' students (Name, Roll_No, Test Marks) and search a particular record based on 'Roll_No'.
7. Develop a C program using pointers to function to find given two strings are equal or not.
8. Develop a C program using recursion, to determine GCD , LCM of two numbers and to perform binary to decimal conversion.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**100%**	**---**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to 1**0 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to 3**0 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**10**	
TOTAL MARKS FOR THE COURSE	**50**	**---**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK39/49	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	01 ಗಂಟೆ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

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

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

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

ಘಟಕ -1 ಲೇಖನಗಳು

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

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	
1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. 2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ – ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಶರೀಫ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ	
1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	
1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ 2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ (Assessment Details- both CIE and SEE) :

(methods of CIE - MCQ, Quizzes, Open book test, Seminar or micro project)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

Continuous Internal Evaluation:
Three Tests each of **20 Marks (duration 01 hour**)

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

2. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

3. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - Semester End Exam (SEE):

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

1. The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

ಪಠ್ಯಪುಸ್ತಕ :

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

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

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

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

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KBK39/49	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು (Semester End Examination Marks)	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	01 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

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

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

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

Module-1

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

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-2	
1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns** 2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals** 3. **ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case**	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
Module-3	
1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative Cases, and Numerals **4. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers** **5. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು Defective / Negative Verbs and Colour Adjectives**	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
Module-4	
1 ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು **Permission, Commands, encouraging and Urging words (Imperative words and sentences)** **2.** ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು **Accusative Cases and Potential Forms used in General Communication** **3.** "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs **6.** ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
Module-5	
1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - ifferent types of forms of Tense, Time and Verbs **2.** ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms **3. Kannada Vocabulary List :** ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - **Kannada Words in Conversation**	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು: **course Outcomes (Course Skill** Set): At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conservation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour**)

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

7. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

8. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - **Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

2. The question paper will have 50 questions. Each question is set for 01 mark.
3. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

Textbook :

ಬಳಕೆ ಕನ್ನಡ

ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Semester: III						
COURSE TITLE: NATIONAL SERVICE SCHEME (Practical)						
Course Code	:	21HSAE39A/21HSAE46A		**CIE**	:	50 Marks
Credits: L:T:P	:	0:0:1		**SEE**	:	50 Marks
Total Hours	:	L + T + 13 P		**SEE Duration**	:	2 Hours

Prerequisites:

1. Students should have service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, any time with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the timely will and wishes to achieve service-oriented targets on time.

Content	**13 Hours**

Students must take up any one activity on below mentioned topics and has to prepare contents for awareness and technical contents for implementation of the projects and has to present strategies for implementation of the same. Compulsorily must attend one camp.
CIE will be evaluated based on their presentation, approach, and implementation strategies. (Any one of the below mentioned activity)

1. Helping local schools to achieve good result and enhance their enrolment in Higher/technical/ vocational education.
2. Preparing an actionable business proposal for enhancing the village/ farmer income and approach for implementation.
3. Developing Sustainable Water management system for rural/ urban areas and implementation approaches.
4. Setting of the information imparting club for women leading to contribution in social and economic issues.
5. Spreading public awareness/ government schemes under rural outreach program. (Minimum 5 programs)
6. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, AtmanirbharBharath, Make in India, Mudra scheme, Skill development programs etc..
7. Social connect and responsibilities
8. Plantation and adoption of plants. Know your plants
9. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing
10. Waste management – Public, Private and Govt organization, 5 R's
11. Water conservation techniques – Role of different stakeholders - Implementation
12. Govt. School Rejuvenation and assistance to achieve good infrastructure.
13. Organize National integration and social harmony events/ workshops / seminars. (Minimum 2 programs)

AND <u>ONE NSS-CAMP</u>

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the importance of his/her responsibilities towards society.
CO2:	Analyze the environmental and societal problems/ issues and will be able to design solutions for the same.
CO3:	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4:	Implement government or self-driven projects effectively in the field.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
COURSE TITLE:NATIONAL CADET CORPS (Practical)						
Course Code	:	21HSAE39B/ 21HSAE46B		**CIE**	:	50 Marks
Credits: L: T:P	:	0:0:1		**SEE**	:	50 Marks
Total Hours	:	15 P		**SEE Duration**	:	2 Hrs

Unit 1	**7 Hrs**
Drill (Contact Hrs. 12). Foot Drill- Drill kiAamHidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, KhadeKhade Salute Karna	
Unit 2	**3 Hrs**
Weapon Training (WT): Introduction & Characteristics of 7.62 Self Loading rifle, Identification of rifle parts	
Unit 3	**3 Hrs**
Adventure activities: Trekking and obstacle course	
Unit 4	**2 Hrs**
Social Service and Community Development (SSCD): Students will participate in various activities throughout the semester e.g., Blood donation Camp, SwachhataAbhiyan, Constitution Day, All National Festival	

Course Outcomes: Cadets will be able to: -	
CO1	Understand that drill as the foundation for discipline and to command a group for common goal.
CO2	Understand the importance of a weapon its detailed safety precautions necessary for prevention of accidents and identifying the parts of weapon
CO3	Understand that trekking will connect human with nature and cross the obstacles to experience army way of life.
CO4	Understand the various social issues and their impact on social life, Develop the sense of self-less social service for better social & community life.

Reference Books	
1	NCC Cadet Hand Book by R K Gupta, Ramesh Publishing House, New Delhi, Book code:R- 1991, ISBN: 978-93-87918-57-3, HSN Code: 49011010
2	nccindia.ac.in

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	SEE
Drill Skill Test	**20**	*****
Weapon Training	**10**	*****
Adventure activities	**10**	Report on adventure and social service activities
Social service activities	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) (Practical)						
Course Code	**:**	21HSAE39C/ 21HSAE46C		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	0:0:1		**SEE**	**:**	50 Marks
Total Hours	**:**	30 P		**SEE Duration**	**:**	2.30 Hours

Introduction of Physical Education and Sports
General & Specific warm up exercises Conditioning exercises Any 2 Major Games Intramural Competitions

Choose any one according to serial no			
1. Kho-Kho	Giving Kho, Single chain, Pole dive, Pole turning, 3-6 Up	**6. Kabaddi**	Hand touch, Chain hold, Ankle hold, Thigh hold, Getting bonus
2. Throwball	Service, Receive, Spin pass, Simple pass, Jump throw	**7. Volleyball**	Attack, Block, Service, Upper hand pass, Lower hand pass
3. Netball	Step with ball, Shooting, Passing, Blocking	**8. Handball**	Step with ball, Shooting, Passing, Blocking, Dribbling
4. Softball	Catching, Pitching, Slugging, Base Running, Stealing	**9. Football**	Dribbling, Chest Drop, Ball Control, Thigh Drop, Shooting
5. Ball badminton	Service, Fore hand receive, Back hand receive, Spin smash, Rally	**10. Table Tennis**	Service, Fore hand receive, Back hand receive, Smash, Rally

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the basic principles and practices of Physical Education and Sports.
CO2	Instruct the Physical Activities and Sports practices for Healthy Living
CO3	To develop professionalism among students to conduct, organize & Officiate Physical Education and Sports events at schools and community level

Topics for Viva:

1. On rules and regulations pertaining to the games / sports
2. On dimensions of the court, size / weight of the ball and standards pertaining to that sports / game
3. Popular players and legends at state level / National level/ International level
4. Recent events happened and winner / runners in that particular sport / game
5. General awareness about sport / game, sports happenings in the college campus

Reference Books	
1	Muller, J. P. (2000). Health, Exercise and Fitness. Delhi: Sports.
2	Vanaik.A (2005) Play Field Manual, Friends Publication New Delhi
3	IAAF Manual
4	M.J Vishwanath, (2002) Track and Field Marking and Athletics Officiating Manual, Silver Star Publication, Shimoga
5	Steve Oldenburg (2015) Complete Conditioning for Volleyball, Human Kinestics.
Note: Skills of Sports and Games (Game Specific books) may be referred	

ASSESSMENT AND EVALUATION PATTERN CIE-50 MARKS	
Activity book- **10** marks	
QUIZZES	
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**
Quiz-II	
Test – I	Demonstration of skills is evaluated for 10 marks adding up to **20 MARKS.**
Test – II	
ASSESSMENT AND EVALUATION PATTERN SEE-50 MARKS	
Practical	**30 marks**
Viva voce	**20 marks**
Total	**50 marks**

Rubric for CIE (2022 Scheme)		
Sl. No.	**Content**	**Marks**
1	Attendance	10
2	Performing Skills (Any Two)	20
3	Court measurement (Markings)	20
	Total:	**50**

Rubric for SEE (2022 Scheme)		
Sl. No.	**Content**	**Marks**
1	Performing Skills (Any Two)	30
2	Viva	20
	Total:	**50**

Semester: III						
COURSE TITLE: MUSIC (Practical)						
Course Code	**:**	21HSAE39D1/ 21HSAE46D1		**CIE**	**:**	50 Marks
Credits: L:T:P		0:0:1		**SEE**	**:**	50 Marks
Total Hours	**:**	13P		**SEE Duration**	**:**	2 Hours

Prerequisites:

1. Students should know basics of music.
2. Students should have dedication to learn and improve on their musical skills.
3. Students should have participated in musical events and have basic knowledge on how to present their music.

Content	**13 Hours**

1. Introduction to different genres of music
2. Evolution of genres in India: Inspiration from the world
3. Ragas, time and their moods in Indian Classical Music
4. Identification of ragas and application into contemporary songs
5. Adding your touch to a composition
6. Maths and Music: A demonstration
7. Harmonies in music
8. Chords: Basics and application into any song
9. Music Production-I
10. Music Production-II

Students have to form groups of 2-4 and present a musical performance/ a musical task which shall be given by the experts. The experts shall judge the groups and award marks for the same.
CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand basics of Music and improve their skills
CO2	Appreciate the impacts on health and well being
CO3	Perform and present music in a presentable manner
CO4	Develop skills like team building and collaboration

Reference Books	
1.	Music Cognition: The Basics by Henkjan Honing
2.	Basic Rudiments Answer Book - Ultimate Music Theory: Basic Music Theory Answer Book by Glory St Germain
3.	Elements Of Hindustani Classical Music by ShrutiJauhari
4.	Music in North India: Experiencing Music, Expressing Culture (Global Music Series) by George E. Ruckert

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
COURSE TITLE: DANCE (Practical)						
Course Code	**:**	21HSAE39D2/ 21HSAE46D2		**CIE**	**:**	50 Marks
Credits: L:T:P		0:0:1		**SEE**	**:**	50 Marks
Total Hours	**:**	13P		**SEE Duration**	**:**	2 Hours

Prerequisites:
1. Students should have the will and interest to learn dancing.
2. Students should have a positive mindset.
3. Students should be willing to interact and cooperate in group activities.

Content	13 Hours

1. Introduction to Dance
2. Preparing the body for dancing by learning different ways to warm up.
3. Basics of different dance forms i.e. classical, eastern, and western.
4. Assessing the interest of students and dividing them into different styles based on interaction.
5. Advancing more into the styles of interest.
6. Understanding of music i.e. beats, rhythm, and other components.
7. Expert sessions in the respective dance forms.
8. Activities such as cypher, showcase to gauge learning.
9. Components of performance through demonstration.
10. Introduction to choreographies and routines.
11. Learning to choreograph.
12. Choreograph and perform either solo or in groups.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamentals of dancing.
CO2:	Adapt to impromptu dancing.
CO3:	Ability to pick choreography and understand musicality.
CO4:	To be able to do choreographies and perform in front of a live audience.

Reference Books	
1	Dance Composition: A practical guide to creative success in dance making by Jacqueline M. Smith-Autard

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
COURSE TITLE: LIGHTS CAMERA DRAMA (Practical)						
Course Code	:	21HSAE39D3/ 21HSAE46D3		**CIE**	:	50 Marks
Credits: L:T:P	:	0:0:1		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	2 Hours

Prerequisites:

1. Students should have creative oriented mindset and social concern.
2. Students should have dedication to work with their classmates for long hours until a collective goal is reached.
3. Students should be ready to sacrifice some of the timely will and wishes to achieve targets on time.

Content	**13 Hours**

1. **Break the ICE**
2. **Introduction to freedom** Talk to each and every single person for a period of 5 complete minutes**.** This is aimed at to make everyone in the room comfortable with each other. This helps everyone get over social anxiety, Shyness and Nervousness.
3. **Ura**
4. **Rhythm Voice Projection, Voice Modulation, Weeping & Coughing** Voice projection is the strength of speaking or singingwhereby the voiceis used powerfully and clearly. It is a technique employed to command respect and attention, as when a teachertalks to a class, or simply to be heard clearly, as used by an actor in a theatre.
5. **It's Leviosa, Not Leviosaaa!**
6. **Speech work: Diction, Intonation, Emphasis, Pauses, Pitch and Volume Tempo Dialogues delivery.** The art of dialogue delivery plays a vital role in in ensuring the efficacy of communication especially from the dramatic aspect of it, this unit discusses some tips to help the young actors improve their dialogue delivery skills:
7. **Elementary, My dear Watson.**
8. **Responsibilities of an actor tools of an actor character analysis** Observations aspects, Stage presence, concentration, conviction, confidence, energy and directionality.
9. **Show time**
10. **Pick a genre: COMEDY, THRILLER, HORROR, and TRAGEDY: Showcase a performance.** Stylized acting with reference to historical and mythological plays. **Mime**: conventional, occupational and pantomime **Mono acting:** different types of characters

Course Outcomes: After completing the course, the students will be able to	
CO1:	Develop a range of Theatrical Skills and apply them to create a performance.
CO2:	Work collaboratively to generate, develop and communicate ideas.
CO3:	Develop as creative, effective, independent and reflective students who are able to make inform ed choices in process and performance.
CO4:	Develop an awareness and understanding of the roles and processes undertaken in contemporary professional theatre practice.

CIE's will be evaluated through mono-acting or dialogue. The students need to use whatever they've learnt through the course of the drama class. Judges/Teachers can award the marks accordingly. Certificates won outside of college, can be submitted for evaluation as well.

For SEE's. Students need to form groups of 4-6. They need to pick a genre and enact a play of at least 20 mins long. The venue will be IEM auditorium. No mics should be used. They will be given 2 weeks to prepare.

Reference Books	
1	The Empty Space by Peter Brook
2	The Viewpoints Book: A Practical Guide to Viewpoints and Composition by Anne Bogart and Tina Landau

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of Script (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Interpretation of Script	**10**	
Performance based seminar (20 mins long)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
COURSE TITLE: ART (Practical)						
Course Code	:	21HSAE39E1/ 21HSAE46E1		**CIE**	:	50 Marks
Credits: L:T:P		0:0:1		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	2 Hours

Prerequisites:

Although there are no prerequisite qualifications for this subject, students must have a basic understanding of and interest in the fields of art and design in order to enroll in it.

Content	**13 Hours**

1. Use points, line and curves to create various shapes and forms
2. Use of shapes and forms to create various objects and structures
3. Recognizing distinctions in objects when viewed from various perspectives and grasping basic notions of perspective
4. Students will be introduced to the significance of color in art, as well as the principles of color theory and application.
5. Applied the concepts of unity, harmony, balance, rhythm, emphasis and proportion, abstraction and stylization to create a composition.
6. Learn how to use which materials and for what types of art and textures.
7. Use of the above concepts to create art through the medium of collage, mosaic, painting, mural, batik, tie and dye.
8. Real world application of the above concepts in the form of book cover design and illustration, cartoon, poster, advertisements, magazine, computer graphics and animation
9. Familiarization with the many art forms and techniques of expression found throughout India.

AND

ONE EDUCATIONAL VISIT TO AN ART MUSEUM / INSTITUTE / GALLERY

Students must turn in assignments for each of the above said topics on a weekly basis and have to compulsorily take part in the museum visit. CIE will be evaluated based on a still life piece, a composition using any one of the media of composition and a presentation on Indian art styles and creation of a piece pertaining to the presented art style.

Reference Books	
1.	Catching the Big Fish: Meditation, Consciousness, and Creativity by David Lynch
2.	Art & Fear: Observations on the Perils (and Rewards) of Artmaking by David Bayles & Ted Orland

Course Outcomes: After completing the course, the students will be able to	
CO1:	To use lines, shapes, and colors to depict the various sentiments and moods of life and nature.
CO2:	To use one's creativity to develop forms and color schemes, as well as the ability to portray them effectively in drawing and painting on paper.
CO3:	To develop the ability to properly use drawing and painting materials (surfaces, tools and equipment, and so on).
CO4:	To improve their observation abilities by studying everyday items as well as numerous geometrical and non- geometrical (i.e. organic) shapes found in life and nature and to hone their drawing and painting talents in response to these insights.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	SEE
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
COURSE TITLE: PHOTOGRAPHY (Practical)						
Course Code	:	21HSAE39E2/ 21HSAE46E2		**CIE**	:	50 Marks
Credits: L:T:P		0:0:1		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	2 Hours

Prerequisites:

1. Students should know basics of photography and cinematography.
2. Students should have dedication to learn and improve on their photography and film making skills.
3. Students should have participated in photography events.
4. Students should have a DSLR camera.

Content	**13 hours**

1. Introduction to photography.
2. Understanding the terminologies of DSLR.
3. Elements of photography.
4. Introduction to script writing, storyboarding.
5. Understanding the visualization and designing a set.
6. Basics of film acting
7. Video editing using software
8. Introduction to cinematography.
9. Understanding about lighting and camera angles.
10. Shooting a short film.

Students must form groups of 2-4 and present a short film which shall be given by the experts. The experts shall judge the groups and award marks for the same.
CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand basics of photography and videography and improve their skills
CO2:	Appreciate the skills acquired from photography
CO3:	Perform and present photos and films in a presentable manner
CO4:	Develop skills like team building and collaboration

Reference Books	
1.	Read This If You Want to Take Great Photographs – Henry Carroll
2.	The Digital Photography Book: Part 1 – Scott Kelby

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2)	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester III						
Course Title: SUMMER INTERNSHIP-I (Practice)						
Course Code	**:**	21CSI310		**CIE Marks**	:	50 Marks
Credits: L:T:P	**:**	0:0:1		**SEE Marks**	:	50 Marks
Total Hours	**:**	3 Weeks		**SEE Duration**	:	2 Hours

Guidelines	**3 Weeks**

1. **A minimum of 1 credit of internship after I year may be counted towards B.E. degree program.**
2. **During II semester to III semester transition, Three weeks of internship is mandatory**.
3. **Internship report and certificate need to be submitted at the end of the internship to the concerned department for the evaluation.**
4. **Internship evaluation will be done during III semester for 1 credit in two phases.**

Students can opt the internship with the below options:

A. **Within the respective department at RVCE (Inhouse) Departments** may offer internship opportunities to the students through the available tools so that the students come out with the solutions to the relevant societal problems that could be completed within THREE WEEKS.

B. At RVCE Center of Excellence/Competence

RVCE hosts around 16 CENTER OP EIXCELLENCE in various domains and around 05 CENTER OP COMPETENCE. The details of these could be obtained by visiting the website https:/ /rvce.edu.in / rvce-center-excellence. Each center would be providing the students relevant training/internship that could be completed in three weeks.

C. At Intern Shala

Intern Shala is India's no.1 internship and training platform with 40000+ paid internships in Engineering. Students can opt any internship for the duration of three weeks by enrolling on to the platform through https: / /internsha1a.com

D. At Engineering Colleges nearby their hometown

Students who are residing out of Bangalore, should take permission from the nearing Engineering College of their hometown to do the internship. The nearby college should agree to give the certificate and the letter/email stating the name of the student along with the title of the internship held with the duration of the internship in their official letter head.

E. At Industry or Research Organizations

Students can opt for interning at the industry or research organizations like BEL, DRDO, ISRO, BHEL, etc..throughpersonalcontacts. However, the institute/industry should provide the letter of acceptance through hard copy/email with clear mention of the title of the work assigned along with the duration and the name of the student.

Procedures for the Internship:

1. Request letter/Email from the office of respective departments should go to Places where internships are intended to be carried out with a clear mention of the duration of Three Weeks. Colleges/Industry/ CoEs/CoCs will confirm the training slots and the number of seats allotted for the internship via confirmation letter/ Email.
2. Students should submit a synopsis of the proposed work to be done during internship program. Internship synopsis should be assessed or evaluated by the concerned Colleges/Industry/CoEs/CoC. Students on joining internship at the concerned Colleges/Industry/ CoEs/CoCs submit the Daily log of student's dairy from the joining date.
3. Students will submit the digital poster of the training module/project after completion of internship.
4. Training certificate to be obtained from industry.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Develop communication, interpersonal, critical skills, work habits and attitudes necessary for employment.
CO2:	Assess interests, abilities in their field of study, integrate theory and practice and explore career opportunities prior to graduation.
CO3:	Explore and use state of art modern engineering tools to solve societal problems with affinity towards the environment and involve in professional ethical practice.
CO4:	Compile, document and communicate effectively on the internship activities with the engineering community.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
Phase – I	**20**	**50**
Phase- II	**30**	
TOTAL MARKS FOR THE COURSE	**50**	

Semester: IV						
STATISTICS AND PROBABILITY FOR DATA SCIENCE (Theory) (Common to ALL Programs)						
Course Code	**:**	21MA41		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	30L+15T		**SEE Duration**	**:**	3.00 Hours

Unit-I	**06 Hrs**
Statistics: Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Correlation analysis, rank correlation, linear and multivariate regression analysis – problems.	
Unit – II	**06 Hrs**
Random Variables: Random variables-discrete and continuous, probability mass function, probability density function, cumulative density function, mean and variance. Two or more random variables - Joint probability mass function, joint probability density function, conditional distribution and independence, Covariance and Correlation.	
Unit –III	**06 Hrs**
Probability Distributions: Discrete distributions - Binomial, Poisson. Continuous distributions – Exponential, Normal and Weibul.	
Unit –IV	**06 Hrs**
Sampling and Estimation: Population and sample, Simple random sampling (with replacement and without replacement). Sampling distributions of means (known), Sampling distributions of mean (unknown): t - distribution, Sampling distributions of variance (unknown): Chi - squared distribution. Estimation - Maximum Likelihood Estimation (MLE).	
Unit –V	**06 Hrs**
Inferential Statistics: Principles of Statistical Inference, Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors, level of significance, Tests involving the normal distribution, one – tailed and two – tailed tests, P – value, Special tests of significance for large and small samples (F, Chi – square, Z, t – test).	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the fundamental concepts of statistics, random variables, distributions, sampling, estimation and statistical hypothesis.
CO2:	Apply the acquired knowledge of statistics, random variables, distributions, sampling, estimation and statistical hypothesis to solve the problems of engineering applications.
CO3:	Analyze the solution of the problems using appropriate statistical and probability techniques to the real world problems arising in many practical situations.
CO4:	Interpret the overall knowledge of statistics, probability distributions and sampling theory gained to engage in life-long learning.

Reference Books	
1	Theory and Problems of Probability, Seymour Lipschutz& Marc Lars Lipson, 2nd Edition, Schaum's Outline Series, McGraw – Hill,2000, ISBN: 9780071386517.
2	Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, 7th Edition, John Wiley & Sons, 2019, ISBN: 9781119570615.
3	Probability & Statistics for Engineers & Scientists, Ronald E. Walpole & Raymond H. Myers, 9th edition, 2016, Pearson Education, ISBN-13: 9780134115856.
4	The Elements of Statistical Learning - Data Mining, Inference, and Prediction, Trevor Hastie Robert Tibshirani Jerome Friedman, 2nd Edition, 2009 (Reprint 2017), Springer, ISBN-10: 0387848576, ISBN-13: 9780387848570.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding up to 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
MATLAB	**20**	
Model presentation/ case study/ video preparation	**20**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**

Semester IV						
BIOINSPIRED ENGINEERING (Theory) (Common to AI,BT,CS&IS)						
Course Code	**:**	21BT42B		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	25L		**SEE Duration**	**:**	2.00 Hours

Unit-I	**08 Hrs**
Introduction to Bio-inspired Engineering Stem cells; types and applications. Synthetic Biology. Synthetic/ artificial life. Biological Clock, Biological and synthetic materials. Biopolymers; Bio-steel, Bio-composites, multi-functional biological materials. Inimitable properties of biomaterials: Antireflection and photo-thermal, Microfluidics in Biology.	
Unit – II	**09 Hrs**
Lesson from Nature-Bioinspired Materials and mechanism Firefly-Bioluminescence, Cockleburs –Velcro, Lotus leaf - Self-cleaning materials, Gecko - Gecko tape, Whale fins - Turbine blades, Box Fish / Bone - Bionic car, Shark skin - Friction reducing swim suits, Kingfisher beak - Bullet train, Coral - Calera cement, Forest floor / Ecosystem functioning - Flooring tiles, Morpho butterfly- Photonics and Iridescence, Namib beetle- Water collection, Termite/ ant hill-passive cooling, Birds/Insects- flights/ aerodynamics, Mosquito inspired micro needle.	
Unit –III	**09 Hrs**
Biomedical Inspiration-Concept and applications Organ system- Circulatory- artificial blood, artificial heart, pacemaker. Respiratory- artificial lungs. Excretory- Artificial kidney. Artificial Support and replacement of human organs: Artificial Skin, artificial liver and pancreas. Total joint replacements- artificial limbs. Visual prosthesis -bionic eye.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Elucidate the concepts and phenomenon of natural processes
CO2:	Apply the basic principles for design and development of bioinspired structures
CO3:	Analyse and append the concept of bio-mimetics for diverse applications
CO4:	Designing technical solutions by utilization of bio-inspiration modules.

Reference Books	
1.	Yoseph Bar-Cohen. Biomimetics: Biologically Inspired Technologies D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence", CRC Press, 2018. ISBN: 1420037714, 9781420037715.
2.	Guang Yang, Lin Xiao, and LallepakLamboni. Bioinspired Materials Science and Engineering. John Wiley, 2018. ISBN: 978-1-119-390336.
3.	M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials Cambridge University Press, 2014ISBN 978-1-107-01045.
4.	Tao Deng. Bioinspired Engineering of Thermal Materials. Wiley-VCH Press, 2018. ISBN: 978-3-527-33834-4.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZES		
Quiz-I	Each quiz is evaluated for 10 marks and the total marks obtained from two quizzes will be reduced to **10 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to **30 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**10**	
Photosynthesis and Photovoltaic cells, Bionic/Artificial leaf. 3D-Bioprinting. Biosensors: e-tongue and e-nose. Echolocation. Insect foot adaptations for adhesion. Thermal insulation and storage materials. Bees and Honeycomb Structure. Artificial Intelligence-Travelling Salesman Problem (TSP), Artificial Neural Networking and bio-robotics.	**05**	
Video based seminar (4-5 minutes per student)	**05**	
MAXIMUM MARKS FOR THE THEORY	**50 MARKS**	**50 MARKS**
TOTAL MARKS FOR THE COURSE	**50**	**50**

Semester: IV						
DESIGN AND ANALYSIS OF ALGORITHMS (Theory and Practice) (Common to CS, IS & AI)						
Course Code	:	21CS43		**CIE**	:	100+50 Marks
Credits: L:T:P	:	3:0:1		**SEE**	:	100+50 Marks
Total Hours	:	45L+30P		**SEE Duration**	:	3Hours + 3Hours

Unit-I	**8 Hrs**
Introduction- Perspectives **Business domain:** Banking, Finance services, IT, Manufacturing, e-Commerce, Online services and marketing, Logistics and Supply Chain Management, Telecommunication. **Applications:** Communication & Networking, Search engines, Machine learning, Database management, Software tools development, Data organization, GPS navigation systems **Introduction:** Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Brute Force:** Selection Sort and Bubble Sort.	
Unit – II	**10 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, Application of DFS and BFS.	
Unit –III	**10 Hrs**
Transform and Conquer: Presorting, Heapsort, Problem reduction. **Space and Time Tradeoffs:** Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	
Unit –IV	**10 Hrs**
Dynamic Programming: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, Knapsack Problem and Memory Functions. **Greedy Technique:** Prim's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.	
Unit –V	**7 Hrs**
Backtracking: N-Queen's Problem, Sum of Subset Problem. **Branch-and-Bound:** Travelling Salesperson Problem, Assignment Problem **Decision Trees:** Decision Trees for Sorting **NP and NP-Complete Problems:** Basic Concepts, Non- Deterministic Algorithms, P, NP, NP Complete, and NP-Hard classes	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Apply knowledge of computing and mathematics to algorithm analysis and design
CO2	Analyze a problem and identify the computing requirements appropriate for a solution
CO3	Apply algorithmic principles and computer science theory to the modeling for evaluation of computer-based solutions in a way that demonstrates comprehension of thetrade-offs involved in design choices.
CO4	Investigate and use optimal design techniques, development principles, skills and tools in the construction of software solutions of varying complexity.
CO5	Demonstrate critical, innovative thinking, and display competence in solving engineering problems.
CO6	Exhibit effective communication and engage in continuing professionaldevelopment through experiential learning.

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.

EXPERIENTIAL LEARNING

The students in a team of two, must solve, implement and analyze for time and space efficiency, any one engineering problem from the identified business domain and application. The team has to submit a detailed report on the work done.

Laboratory Component

PART A

Note: The following programs should be implemented in C++ language

Practice Programs:

i. Implementation and execution of simple programs to understand running time analysis of non-recursive algorithms
   - Finding maximum element in a given array.
   - Linear search,
   - Bubble sort,
   - Determine whether all the elements in a given array are distinct.
   - Given 2 NXN matrices, perform matrix multiplication using bruteforce approach.

ii. Implementation and execution of simple programs to understand running time analysis of recursive algorithms
   - Find the Factorial of a given number.
   - Print Fibonacci series
   - Given a positive decimal integer n, find the number of binary digits in n's binary representation.
   - To solve tower of Hanoi problem.
   - Recursive linear search.

Lab Programs:(At-least one application from each of the following group)

1. Apply divide and conquer strategy to solve sorting problem
   - Merge sort
   - Quicksort
2. Apply decrease and conquer strategy to solve graph problem
   - Breadth first search
   - Topological sorting using depth first search
3. Apply transform and conquer strategy
   - Heapsort
   - Checking element uniqueness after presorting
4. Apply input enhancement strategy to solve string-matching problem
   - Horspool's algorithm
   - Boyer – Moore's algorithm
5. Apply dynamic programming strategy to solve optimization problem
   - Warshall - Floyd's Algorithms,
   - Knapsack problem solution using memory function.
6. Apply greedy strategy to solve graphproblem
   - Dijkstra's algorithm
   - Prim's algorithm
7. Apply backtracking strategy to solve combinatorial problem
   - N- Queen's problem
   - Subset – sum problem
8. Apply branch and bound strategy to solve combinatorial problem
   - Travelling salesperson problem
   - Assignment problem

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) : Sorting, Searching, String matching, Graph problem, Combinatorial / Optimization problem.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
Case Study-based Teaching-Learning	**10**	
Coding challenge	**20**	
Video based seminar (4-5 minutes per student)	**10**	
MAXIMUM MARKS FOR THE THRORY	**100 MARKS**	**100 MARKS**
PRACTICALS	**50**	**50**
TOTAL MARKS FOR THE COURSE	**150**	**150**

Semester: IV						
MICROCONTROLLERS AND EMBEDDED SYSTEMS (Theory and Practice)						
Course Code	:	21CS44		**CIE**	:	100+50 Marks
Credits: L:T:P	:	3:0:1		**SEE**	:	100+50 Marks
Total Hours	:	45L+30P		**SEE Duration**	:	3Hours + 3Hours

Unit-I	**8 Hrs**
Introduction to Embedded Systems and ARM Processor/Controller **Business Domains &Applications**:Broad Overview of Applications of Microcontrollers and Embedded Systems in consumer, industrial, automotive, home appliances, medical, telecommunication, commercial, and aerospace and military applications. **Microprocessors & Microcontrollers:** Introduction to Microprocessors and Microcontrollers, Comparison of Microprocessor and Microcontrollers. Introduction to RISC and CISC architectures. **Embedded Systems**: Definition, Desirable Features & General Characteristics. Embedded Systems Vs General Computing Systems, Model of an Embedded System, Classification of Embedded Systems, Examples of Embedded Systems. **ARM Processor/Controllers:** History of the ARM Processor, The ARM Core, Comparative study of different ARM architectures and their features. ARM 7 Architecture: ISA, Operating Modes, Register Set, Mode Switching, Conditional Flags.	
Unit – II	**10 Hrs**
ARM Instruction Set & Assembly Language Programming **ARM Assembly Language**: Data Types, Data Alignment, and Assembly Language Rules, Assembler Directives. **ARM Instruction Set:** Instruction Formats, 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:** Assembly Language Programs for data transfer, expression evaluation, addition, average computation, searching and sorting.	
Unit –III	**10 Hrs**
Interfacing digital Peripherals and Application Development Using ARM Microcontroller **LPC 2148 ARM Microcontroller:** Introduction, Block Diagram of MCB 2140 compatible board, Features of the LPC 214X Family, Internal Block Diagram of LPC 2148. LPC 2148 GPIO and External I/O interfacing Using GPIO Pins. **Interfacing Parallel Digital Peripherals**: Interfacing and Programming with LEDs, Switches, Seven segment displays, LCD, Matrix Keypad, Stepper motor, DC Motor, Relay, Opto-isolators. (Programs using embedded C)	
Unit –IV	**10 Hrs**
Analog Interfacing, Programming with Timers, PWM &InterruptsUsing ARM Microcontroller **Analog Interfacing**: Analog Interfacing using ADC Channels, Interfacing with LDR and Temperature sensors. Using DAC for Waveform Generations, Programs on Embedded C. **PWM, Timers and Interrupts:**Timers – working of the Timer unit, Programming Timers and Writing Delay programs.Interrupts – Types, Nested Vectored Interrupt Controller, priorities and programming Timers with Interrupts. PWM –working of The Pulse Width Modulation Unit and Programming Using PWM Channels.(Programs using embedded C)	

Unit –V	7 Hrs

Serial Protocols and Embedded Systems design using ARM Microcontroller

Working & Programming of UART – Registers, Baud rate calculation, Interface LPC 2148 to PC and program for data transmission.

I2C, SPI: Working and Applications of serial protocols I2C and SPI Buses.

Case Studies: Case studies of Embedded systems using LPC 2148 - Data Acquisition System, Pick & Place Robot, Audio Player etc.(Programs using embedded C)

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply Embedded System fundamentals and formulate sustainable societal relevant cost-effective solutions.
CO 2	Demonstrate the development of software programs using Assembly Level Language and Embedded C, using state of the art hardware platforms, based on Microcontrollers and different sensors and peripherals.
CO3	Design smart systems using various I/O peripherals, Sensors, embedded protocols like UART,I2C,SPI using modern tools like Keil IDE software for various domains like Healthcare, automation, agriculture, smart cities and others.
CO 4	Engage in Lifelong Learning by investigating and executing real world societal problems using engineering tools – Cross compilers, debuggers and simulators, emerging processor and controller-based hardware platforms.
CO 5	Indulge in developing Novel multi-disciplinary projects using ARM microcontrollers and prototype boards, with effective oral & written communication skills and working in teams.

Reference Books

1. Embedded Systems – An integrated approach, Lyla B. Das, 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
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, ArshdeepBahga, Vijay Madisetti, 2016, Universities Press, ISBN – 978-81-7371-954-7.

EXPERIENTIAL LEARNING

Sample EL Projects / Assignments:

1. Smart Energy Monitoring & Device Automation for Houses
2. Smart Intruder detection and Alarm System using Image Processing
3. Smart Traffic Signalling System, with Cloud & Mobile Enablement
4. Smart Water Meter, with Usage Optimization with Analytics
5. Smart HMI development for Industrial Machines/Equipments

Laboratory Component

Laboratory Experiments comprises of,

Part A - Software Programs Using ARM Assembly Language and

Part B - Hardware Interfacing Programs Using RV-AllInOne-ARM Board with Embedded C (Keil IDE)

PART A:

1A) Write Assembly programs, to translate the given code in C to the ARM instruction set. Assume variables are 32bit integers represented in Registers.

Write an ARM ALP to perform addition and subtraction of two 32bit and 64bit numbers.

2A) Write an ARM ALP to find smallest and largest of N- 32-bit numbers.

3A) Write an ARM ALP to compute Average of N-32-bit numbers

4A) Write an ARM ALP to count the occurrences of given 32-bit number in a list using Linear Search algorithm

5A) Write an ARM ALP to compute number of 1's in a given 32-bit number and check the parity of the given number.

Write an ARM ALP to compute GCD of two given 32-bit numbers.

6A) Write an ARM ALP to compute the factorial of a given 32-bit number using procedures.

7A) Write an ARM ALP to sort the given list of 32-bit numbers using Bubble Sort.

PART B:

1B) Interface Logic Controller and write Embedded C programs to generate BCD up / down and Ring counters. Input is read from the DIP switch.

2B) Seven Segment Display Interface: Write a C program to display messages "FIRE" & "HELP" on 4-digit seven segment display alternately with a suitable delay.

3B) Stepper Motor Interface: Write an Embedded C program to rotate stepper motor in clockwise direction for "M" steps, anti-clock wise direction for "N" steps.

4B) DAC Interface: Write an Embedded C program to generate sine, full rectified, triangular, sawtooth and square waveforms using DAC module

5B) Matrix Keyboard Interface: Write an Embedded C program to interface 4 X 4 matrix keyboard using lookup table and display the key pressed on the Terminal.

6B) DC Motor Interface: Write an Embedded C program to generate PWM wave to control speed of DC motor. Control the duty cycle by analog input.

7B) Character LCD Interface: Write an Embedded C program to display text messages on the multiple lines of the display.

Prototype the New Idea

Then students are given specific time (a single Day) to build their idea into a prototype using the previous Lab Programs carried out. Then an academic & industry panel of judges will evaluate their works and the best three prototypes will be awarded. All the students are required to submit the report, consisting of Hardware circuits, software codes and screenshots of the prototype.

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
Case Study - based Teaching-Learning with study/dissemination of any one research journal publications / conference paper related to the subject domain	**10**	
Design, Development & Coding of Embedded Project Using ARM based Controller.	**20**	
Video based seminar on state-of-the-art technologies	**10**	
MAXIMUM MARKS FOR THE THRORY	**100 MARKS**	**100 MARKS**
PRACTICALS	**50**	**50**
TOTAL MARKS FOR THE COURSE	**150**	**150**

Semester:IV						
COMPUTER NETWORKS (Theory) (Common to CS, IS & AI)						
Course Code	**:**	21CS45		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45L		**SEE Duration**	**:**	3Hours

Unit-I	**10 Hrs**
Introduction-Perspectives **Business Domains:** Networks. **Applications:** Resource Sharing, Client Server programming, e-commerce anddigital communications. **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	**9 Hrs**
Network layer design issues: Store and Forward packet Switching, Services Provided to the Transport Layer Implementation of Connectionless Service, Implementation of ConnectionOriented 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..	
Unit –IV	**9 Hrs**
Internetworking: How networks differ, How networks can be connected Connectionless Internetworking, Tunnelling, Internetwork Routing, Fragmentation **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.	
Unit –V	**9 Hrs**
The Internet Transport Protocols: Introduction to UDP, Introduction to TCP. The TCP Service Model. **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, Telnet.	

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply the algorithms/techniques of routing and congestion control to solve problems related to Computer Networks.
CO 2	Analyse the services provided by various layers of TCP/IP model to build effective solutions.
CO 3	Design sustainable networking solutions with societal and environmental concerns by engaging in lifelong learning for emerging technology.
CO 4	Exhibit network configuration, protocol usage and performance evaluation in networks.
CO 5	Demonstratethe solutions using various algorithms/protocols available to address networking issues using modern tools by exhibiting team work and effective communication.

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.

EXPERIENTIAL LEARNING

To work on Problems similar to following aspects of Networks: Modern Networking tools usage to solve problems in Networking (Path Characterization & Bandwidth Estimation, AnalysingReal-time information about the global routing system, Measure latency and packet loss reason in wired and wireless network). Online data Privacy, Host/Network Intrusion detection, Detection of potential DDoS attacks, Network analysis to monitor Ethernet and WLAN traffic in real time, IP Spoofing, TCP Off path attacks, Privacy Preserving network log data, wireless Security).

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
QUIZZES		
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 MARKS.**	
Quiz-II		
THEORY COURSE (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to **40 MARKS**	
Test – II		
EXPERIENTIAL LEARNING	**40**	
Problem statement and modern networking tools usage.	**10**	
Design and implementation of solution.	**20**	
Demonstration and report.	**10**	
MAXIMUM MARKS FOR THE THEORY	**100 MARKS**	**100 MARKS**
TOTAL MARKS FOR THE COURSE	**100**	**100**

Semester: IV						
OBJECT ORIENTED ANALYSIS AND DESIGN (Elective – A: PROFESSIONAL ELECTIVES, MOOC COURSE)						
Course Code	:	21CS4A1		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28L		**SEE Duration**	:	Online Exam

Unit-I	**10 Hrs**
Introduction- Perspectives Challenges in software engineering, Complexity of software, Structure and attributes of a complex system etc. **Fundamental Principles of Object Model:** Object oriented analysis and design, Bringing Order to Chaos-Algorithm decomposition and object oriented decomposition, Design. **Evolution of Object Model:** Programming Languages and Paradigms, Foundations of the Object Model - Oriented Analysis (OOA), Object Oriented Design (OOD), and Object Oriented Programming (OOP). **Elements of Object Model** - Abstraction, Encapsulation, Modularity, Hierarchy, Typing, Concurrency and Persistence.	
Unit – II	**09 Hrs**
Classes and Object: The Nature of an Object-State, Behaviour and Identity, Relationships among objects, The Nature of a Class-Relationships among states. How to build Quality Classes. **Tutorials:** LMS **Identification of Classes and Object:** Identify Classes, Objects and Relationships in LMS. Overview of UML, Software Development Life Cycle (SDLC) Phases and UML Diagrams, Use – Case Diagrams- Part-I, Part-II, Part-III.	
Unit –III	**09 Hrs**
Class diagrams: Part-I, Part-II, Part-III. **Sequence Diagrams:**Part-I, Part-II. Communication Diagram, Activity Diagram- Part-I, Part-II, Part-III. Interaction Overview Diagram. **State Machine Diagrams:**Part-I, Part-II, Part-III. **Various UML Diagrams and Closing Comments**	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Explore the fundamentals concepts of Object Oriented Analysis and Design
CO2	Analyze the problem through Object Oriented principles.
CO3	Apply the structural and behavioural relationships between Classes and Objects
CO4	Design an efficient solution by applying UML diagramsfor open real world problems.

Reference Books	
1.	Grady Booch, Robert A Maksimchuk, Michael W Engle, Bobbi J Young, Jim Conallen, KelliaHoustan, "Object Oriented Analysis and Design with Applications", Addison Wesley, 3rd Edition, 2013, ISBN 978-81-317-2287-93.
2.	Brahma DathanandSarnathRamnath, "Object-Oriented Analysis, Design and Implementation", Springer Nature Switzerland, 2nd Edition, 2015, ISBN: 978-3-319-24278-1, 978-3-319-24280-4.
3.	Ali Bahrami, "Object Oriented Systems Development using the Unified Modelling Language", McGraw Hill, Second Reprint 2008, ISBN: 978-0-07-026512-7.
4.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modelling Language User Guide, Addison Wesley Professional, 2nd Edition, 2005, ISBN: 0-321-26797-4.

Semester: IV						
MULTI-CORE COMPUTER ARCHITECTURE – STORAGE AND INTERCONNECTS (Elective – A: PROFESSIONAL ELECTIVES, MOOC COURSE)						
Course Code	:	21CS4A2		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28L		**SEE Duration**	:	Online Exam

Unit-I	**10 Hrs**
Fundamentals of instruction pipeline Instruction execution fundamentals, Memory addressing, MIPS instruction set, RISC vs CISC architecture, performance measures, Speedup and Amdahl's Law, Pipeline hazards **Cache Memory Design** Optimizations of cache performance, Introduction to memory hierarchy, Design of memory hierarchy	
Unit – II	**08 Hrs**
Virtual Memory and virtual Machines Advanced cache optimizations, Compiler optimizations, Hardware pre-fetching, virtual memory concepts, paging and segmentation **DRAM** Introduction to DRAM organisation, DIMM, channels, Device control Logic, Memory controllers, DRAM scheduling	
Unit –III	**9 Hrs**
Tiled Chip Multicore Processors Introduction to TCMP, Multicore processors, Traditional bus-based communication, network on chip-based mechanisms (NOC) **NOC Router** Introduction to Network topologies, Architecture, design, routing algorithms and flow control techniques, Advances in NOC	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Explore the concepts of computer architecture with an emphasis on system design
CO2	Analyse the performances of multicore processors
CO3	Analyse the events happening at the hardware level
CO4	Explore the future directions in computer architecture research

Reference Books	
1.	John L Hennessy, David A Patterson; "Computer Architecture: A Quantitative Approach", Elsevier, 6th Edition; 2017, eBook ISBN: 9780128119068, Paperback ISBN: 9780128119051
2.	Dezso Sima, Terence fountain, peter kacsuck "Advanced Computer architectures- A design space approach " Pearson
3.	Michael Flynn "computer architecture- pipelined and parallel processor design" Narosa Publishing house

Semester: IV						
INTRODUCTION TO HASKELL PROGRAMMING (Elective – A: PROFESSIONAL ELECTIVES, MOOC COURSE)						
Course Code	:	21CS4A3		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28L		**SEE Duration**	:	Online Exam

Unit-I	**10 Hrs**
Introduction to Haskell and the ghci interpreter, Defining functions: guards, pattern matching and recursion, Lists, strings and tuples.	
Unit – II	**08 Hrs**
Types and polymorphim, Higher order functions on lists: map, filter, list comprehension Computation as rewriting, lazy evaluation and infinite data structures.	
Unit –III	**9 Hrs**
Conditional polymorphism and type classes, User defined data types: lists, queues, trees, Input/output and the ghc compiler, Arrays.	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Apply the Haskell programming skills to solve real-time problems.
CO2	Analyze the concepts of Haskell programming and constructs.
CO3	Design solutions for complex problems using different concepts of Haskel programming
CO4	Explore/Develop new innovative ideas to solve the societal problems using Haskell programming concepts
CO5	Effectively communicate, work in groups in order to accomplish a task and engage in continuing professional development.

Reference Books	
1.	Algorithm Design with Haskell, Jeremy Gibbons , Richard Bird, Cambridge University Press, ISBN-10-1108491618, ISBN-13: 978-1108491617, 9 July 2020.
2.	Alejandro Serrano Mena, Practical Haskell: A Real World Guide to Programmin, Apress; 2nd ed. edition (28 April 2019), ISBN-10 : 1484244796, ISBN-13 : 978-1484244791.
3.	John Whitington, Haskell from the Very Beginning, Coherent Press (September 30, 2019), ISBN-10 : 095767113X, ISBN-13 : 978-0957671133.
4.	Graham Hutton, Programming in Haskell 2nd Edition, Cambridge University Press; 2nd edition (September 1, 2016), ISBN-10 : 1316626229, ISBN-13 : 978-1316626221.

Semester: IV						
EMBEDDED SYSTEM DESIGN WITH ARM (Elective – A: PROFESSIONAL ELECTIVES, MOOC COURSE)						
Course Code	:	21CS4A4		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28L		**SEE Duration**	:	Online Exam

Unit-I	**10 Hrs**
Introduction- Perspectives Introduction to embedded systems and microcontroller Instruction set architecture of ARM microcontroller, and assembly language programming	
Unit – II	**08 Hrs**
D/A and A/D converter, sensors, actuators and their interfacing Microcontroller development boards and embedded programming platforms	
Unit –III	**9 Hrs**
Hands-on and demonstration I: Temperature sensing unit, Light sensing unit, Sound sensing unit Hands-on and demonstration II: Feedback control system, relay control unit, driving electrical appliances like motors, bulb, pump, etc. Hands-on and demonstration III: Object tracking using GPS and GSM Hands-on and demonstration IV: Introduction to Internet of Things, smart home concepts, motion sensing using accelerometer, control of appliances over SMS	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Apply the basic concepts of embedded system design, with particular emphasis on hands-on and demonstration sessions on system design using ARM microcontrollers
CO2	Analyzethe various interfacing issues with sensors and actuators.
CO3	Design systems using state-of-the-art microcontroller boards and programming environments.
CO4	Explore/Develop new innovative ideas byunderstanding the developmental aspects of Internet of Things (IoT) based designs
CO5	Effectively communicate, work in groups in order to accomplish a task and engage in continuing professional development.

Reference Books	
1.	F. Vahid and T. Givargis, “Embedded System Design: A Unified Hardware/Software Introduction”, Wiley India Pvt. Ltd., 2002.
2.	A.N. Sloss, D. Symes and C. Wright, “ARM System Developer’s Guide: Design and Optimizing System Software”, Morgan Kaufman Publishers, 2004.
3.	W. Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufman Publishers, 2008.
4.	Internet of Things – A Hands on approach, Arshdeep Bahga, Vijay Madisetti, 2016, Universities Press, ISBN – 978-81-7371-954-7.

Semester: IV						
DISTRIBUTED SYSTEMS (Elective – A: PROFESSIONAL ELECTIVES, MOOC COURSE)						
Course Code	:	21CS4A5		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28L		**SEE Duration**	:	Online Exam

Unit-I	**10 Hrs**
Introduction to DS, Message Passing, Leader Election, Distributed Models, Causality and Logical Time Logical Time, Global State & Snapshot and Distributed Mutual Exclusion-Non-Token and Quorum based approaches Distributed Mutual Exclusion-Token based approaches, Consensus & Agreement, Check pointing & Rollback Recovery	
Unit – II	**08 Hrs**
Deadlock Detection, DSM and Distributed MST Termination Detection, Message Ordering & Group Communication, Fault Tolerance and Self-Stabilization	
Unit –III	**9 Hrs**
Distributed Randomized Algorithms, DHT and P2P Computing Case Studies: GFS, HDFS, Map Reduce and Spark Case Studies: Sensor Networks, Authentication & Security in DS	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Apply the concepts of Distributed Systems for related problems in the Computer Science domain.
CO2	Analyze the concepts of Distributed Systems to various fields of Computer Science.
CO3	Design solutions for complex problems using different concepts of Distributed Systems
CO4	Develop new innovative ideas to solve some open real-world problems in Computer Science.

Reference Books	
1.	Ajay D. Kshemkalyani , Mukesh Singhal , Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press; South Asian edition - 2010, ISBN-10: 1107648904, ISBN-13: 978-1107648906
2.	Jennifer Welch HagitAttiya, Distributed Computing: Fundamentals, Simulations and Advanced Topics, Wiley publisher; 2nd edition – 2006, ISBN-10 : 8126509163, ISBN-13 : 978-8126509164
3.	Lynch Nancy A, Distributed Algorithms, Morgan Kaufmann publisher, 2000, ISBN-10 : 9814033340, ISBN-13 : 978-9814033343

Semester: IV						
DESIGN THINKING LAB (Practice)						
Course Code	:	21CS46		**CIE**	:	50 Marks
Credits: L:T:P	:	0:0:2		**SEE**	:	50 Marks
Total Hours	:	56P		**SEE Duration**	:	2 Hours

Guidelines for Design Thinking Lab:

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

The Design Thinking lab tasks would involve:

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

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

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

Scheme of Evaluation for CIE Marks:

Evaluation will be carried out in three phases:

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

Scheme of Evaluation for SEE Marks:

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

Semester: IV						
BRIDGE COURSE: MATHEMATICS (Common to CS, IS & AI)						
Course Code	**:**	21DMA47		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	2:0:0				
Audit Course						

Unit-I	**05 Hrs**
Differential Calculus: 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:	Illustrate the fundamental concepts of partial differentiation, double integrals, vector differentiation, solutions of higher order linear differential equations and numerical methods.
CO2:	Derive the solution by applying the acquired knowledge of total derivatives of implicit functions, Jacobians, homogeneous linear differential equations, velocity and acceleration vectors to the problems of engineering applications.
CO3:	Evaluate the solution of the problems using appropriate techniques of differential and integral calculus, vector differentiation, differential equations and numerical methods to the real-world problems arising in many practical situations.
CO4:	Compile the overall knowledge of differential and integral calculus, vector differentiation, differential equations and numerical methods gained to engage in life – long learning.

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	Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016. John Wiley & Sons, 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: IV						
UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS (Theory & Practical)						
Course Code	:	21HSU48		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28L+0T+14P		**SEE Duration**	:	2.00 Hours

Unit-I	**05 Hrs**
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.	
Unit – II	**06 Hrs**
Understanding Harmony in the Human Being - Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease	
Unit –III	**06 Hrs**
Understanding Harmony in the Family and Society- Harmony in Human Human Relationship: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives	
Unit –IV	**05 Hrs**
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	

Unit –V	06 Hrs
Implications of the above Holistic Understanding of Harmony on Professional Ethics, Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.	

Course Outcomes: After completion of the course the students will be able to	
CO1	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions,
CO2	While keeping human relationships and human nature in mind. They would have better critical ability.
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

Reference Books	
1	JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews.

ASSESSMENT AND EVALUATION PATTERN

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation. Example: Assessment by faculty mentor: 10 marks Self-assessment: 10 marks Assessment by peers: 10 marks Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination: 50 marks. The overall pass percentage is 40%. In case the student fails, he/she must repeat the course

Semester: IV						
OBJECT ORIENTED PROGRAMMING USING JAVA (Practice) (Common to CS& AI)						
Course Code	**:**	21CS49		**CIE Lab**	**:**	50 Marks
Credits: L:T:P	**:**	0:0:1		**SEE Lab**	**:**	50 Marks
Total Hours	**:**	30P		**SEE Duration**	**:**	2Hours

Laboratory Component

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.

Object Model -Explore the OO concepts behind Object Modeling.

In completing this exercise, the students will be able to:

- Identify entities, attributes, methods in an application domain
- Identify relationships among these entities.
- Design a Class Diagram for the given application.

	PART-A
	Write Java Program to demonstrate the following Object Oriented (OO) concepts and Java features:
1.	**Data abstraction/Encapsulation** -- Classes, Objects and Methods • Create user defined classes and objects. • Define class members and their properties. • Define Methods, constructors, demonstrate method / constructor overloading. • Make necessary changes to the classes by making all the instance variables private and adding getter and setter methods for the instance variables.
2.	**Inheritance and Polymorphism.** • The use of inheritance and its types. • Overriding and constructor chaining.
3.	**Package and Interfaces** • Creation of simple package. • Accessing a package/ use of different Access Specifiers • Implementing interfaces

4.	**Exception handling** -using try, catch, throw, throws and finally block • Handling predefined exceptions. • Handling user defined exceptions
5.	**Multithreading** Create multiple threads: a) Using Thread class. b) Using Runnable interface
6.	**Collections**framework and perform different operations: • Add elements of List to ArrayList • Copy ArrayList to Array • Reverse ArrayList content • Get Sub list from an ArrayList. • To sort a given ArrayList • Clone an ArrayList to another ArrayList
	PART – B Design and develop an application to demonstrate the appropriate OOconcepts and Java GUI programming: **Develop standalone Java application** with neat UI using Swings framework todemonstrate the important features of Object-Oriented approach (Abstraction/Encapsulation/Data Hiding, Inheritance and Polymorphism) and also the important features of Java such as Inheritance, Interfaces, Packages,Exception Handling, Multithreaded Programming and Collection Framework

Course Outcomes: After completing the course, the students will be able to:-	
CO 1	Apply the knowledge of object-oriented concepts with Java programming skills to solve given problems.
CO 2	Design Classes and establish relationship among Classes for various applications from problem definition.
CO 3	Analyze and develop Object-oriented applications with Java features such as Inheritance, Interfaces, Packages, Exception Handling, Multithreaded Programming, GUI Programming, using modern programming tools.
CO 4	Exhibit team work and effective oral/written communication skills in order to accomplish a common goalof solving complex problems with the engineering community and society at large, and engage in continuing professional development.

Reference Books	
1.	Object-Oriented Analysis And Design With applications, Grady Booch , Robert A Maksimchuk, Michael W Eagle, Bobbi J Young, 3rd Edition , 2009, Pearson education, ISBN-13: 978-81-317-2287-9, ISBN: 81-317-2287-2
2.	Java: The Complete Reference -Herbert Schildt , 11th Edition , 2020, McGraw Hill Education Publications, ISBN: 978-9390491629
3.	Intro to Java Programming (Comprehensive Version), Y Daniel Liang, 10thEdition, 2018, Pearson education, ISBN 13: 978-9353065782