SYLLABUS (3rd & 4th Semester)

3rd SEMESTER

	Applied Mathematics –III for				
	Computer Science and				
Course Title	Engineering Stream	Semester	III 50 50 50 100 ration 3 Hours		
	(AIML, ISE, CSE,				
	CSE-IOT)				
Course Code	MC201	CIE	50		
Total No. of Contact Hours	50	SEE	50		
No. of Contact Hours/week	3:2:0:2	Total	100		
Credits	4	Exam. Duration	3 Hours		
Teaching Department	MATHEMATICS				

Course objective is to:

- Have a foundation in the fundamentals of logic, enabling them to apply logical reasoning effectively in their academic and professional pursuits.
- Develop skills in data analysis, problem-solving, and communication, preparing them to apply statistical techniques effectively in various fields such as science and engineering.
- To facilitate students with the knowledge and skills needed to effectively use regression analysis as a tool for understanding data relationships, making predictions, and drawing meaningful conclusions from

data.

Module 1	RBT Levels	10 Hours	
	L1,L2,L3	10 110013	
Mathematical logic: Fundamentals of Logic: Basic connectives and truth tables, Logical equivalence implication – Rules of Inference. Quantifiers, Validity of Quantifiers.	– The laws of Lo	gic, Logical	
Module-2	RBT Levels L1,L2,L3	10 Hours	
Probability Distributions : Review of basic probability theory. Random variables (discrete and continuous functions. Mathematical expectation, mean and variance. Binomial, Poiss distributions.), probability mas on, Exponential	s and density and normal	
Module-3	RBT Levels L1,L2,L3	10 Hours	
Joint probability distribution:			
Joint Probability distribution for two discrete random variables, expectation, cov	ariance and corre	lation. Markov	
Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrice	es, Regular stocha	stic matrices,	
Markov chains, Higher transition probabilities, Stationary distribution of Regular	and absorbing st	ates	
Module-4	RBT Levels L1,L2,L3	10 Hours	
Statistical Methods:			
Correlation and Regression-Karl Pearson's coefficient of correlation and rank co Fitting: Curve fitting by the method of least squares-fitting the curves of $y = ax^b$ and $y = ax^2 + bx + c$.	rrelation-problen the form-	ns, Curve y = ax + b,	
Module-5	RBT Levels L1,L2,L3	10 Hours	

Statistical Inference :

Introduction, sampling distribution, standard error, Type-I and Type-II errors. Testing of hypothesis, levels of significance, confidence limits, sampling of attributes, test of significance for large samples for mean and proportions. Students 't' distribution, Chi-square distribution as a test of goodness of fit.

Suggested L Textbooks:	earning Resources:
1	Ralph P. Grimaldi, B V Ramana: "Discrete and Combinatorial Mathematics ", 5th Edition, Pearson Education, 2004.
2	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
3	Kenneth H. Rosen: "Discrete Mathematics and its Applications", 6th Edition, McGraw Hill, 2007.
Reference Bo	oks:
1	Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Concept- based approach", Universities Press, 2016
2	D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications, Latest Edition, Thomson, 2004.
3	Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education. 2004.
4	Thomas Koshy – Elementary Number Theory with Applications, Academic Press, 2nd edition, 2008.
Web links and	d Video Lectures (e-Resources):
M1: <u>https://yc</u>	outu.be/xlUFkMKSB3Y?list=PL0862D1A947252D20
M2: <u>https://yo</u>	outu.be/_BIKq9Xo_5A
M3: <u>https://yo</u>	outu.be/Q9HNSfF7Hq4?list=PL3RvMHSY8k8lyQsWfHsFELUjfglQB0Ovn M4:
https://youtu.	be/BA1iyzRFGzo?list=PLT3bOBUU3L9h4StzmTBjUnzosZYpCKcKZ
M5: <u>https://yo</u>	outu.be/OQV8WmUdeIo?list=PLLqEsfz6HOamSu7v9zBZ1IkVcCl2atzWL
A	

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

Quiz, Group Discussions, Seminar, In class assignments,

Course outcomes:												
CO1	Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.											
CO2	Explain the basic concepts of probability, random variables, probability distribution											
CO3	Apply suitable probability distribution models for the given scenario											
CO4	Make u	use of t	he ana	lysis to	o fit a s	uitable	mathe	ematica	al mod	el for st	atistical	data.
CO5	Compu	te the	confid	ence ir	terval	s for th	e meai	n of the	e popu	lation		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		2								2
CO2	2	2		2								2
CO3	2 2 2 2 2 2 2											
CO4	2 2 2 2 2 2										2	
CO5	2	2		2								2

Course Title	Digital Design and	Semester	
	Computer		
	Organization		
Course Code	CS202	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:2:0:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE		

Course objective is to:

- 1. To understand the basics of Digital System Design.
- 2. To learn about Combinational and Sequential circuit design.
- 3. To understand the Basic Structure of Computer and machine instructions.
- 4. To understand basics of Memory System, Processing unit and Pipeline concept.
- 5. Identify the applicability of the embedded system for real time use cases.

PREREQUISITES	: None	
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Module-1: Overview and Introduction of Digital System Design	RBT Levels:L1,	8 Hours
	L2,L3	

Digital System Design: Need for Digital Systems, Summary on Simplification of the Digital design, Analog vs Digital Signals. Basic Theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard form, Digital logic gates, The Map Method, Product of sum simplification, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, EX- OR function, Hardware Description Language.

Text Book 1: 2.4, 2.5, 2.6, 2.8, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, 3.9

Module-2: Combinational and Sequential logic	RBT Levels:L1,L2,L3	8 Hours
		1

Combinational Logic: Introduction, Combinational Circuits, Binary Adder- Subtractor, Decoders, Encoders, Multiplexers.

Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters.

Text Book 1: 4.1, 4.2, 4.5, 4.9, 4.10, 4.11, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4, 6.5.

Module-3: Basic Structure of Computers and MachineInstructions, Programs	RBT Levels:L1,L2	8 Hours									
Basic Structure of Computers: Functional Units, Basic Operational	Concepts, Bus structure,										
Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance											
Measurement.	Measurement.										
Machine Instructions and Programs: Numbers Arithmetic operati	ons and characters, Mem	nory									
Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Interrupts.											
Textbook 2:1.2,1.3,1.4,1.6, 2.1,2.2,4.1,4.2											
Module-4: The Memory System, Basic Processing Unit and Pipelining	RBT Levels:L1,L2, L3	8 Hours									

The Memory System: Some Basic concepts, Internal Organization of memory chips, Structure of large memory, Read only memories, Speed, Size, Cost, Cache memories, Mapping functions, Replacement algorithms, Examples of mapping technique.

Basic Processing Unit: Some fundamental concepts, Execution of Complete instruction.Pipelining: Basic Concepts, Data Hazards, and Instruction Hazards.

Text Book 2: 5.1, 5.2.1, 5.2.5, 5.3, 5.4, 5.5, 5.5.1, 5.5.2, 5.5.3, 7.1, 7.2, 8.1, 8.2, 8.3 Module-5: Embedded system Architectures and Case study RBT Levels:L1, L2, L3

Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, Typical embedded system, Core of the embedded system, General purpose and domain specific processors, Sensors and actuators, Communication interface, Embedded firmware.

8 Hours

Summary on all modules.

Case Study on Automatic Chocolate Vending Machine (ACVM).

Text Book 3:1.2 to 1.6, 2.1, 2.1.1, 2.3, 2.4, 2.5

Follow on Courses: Microcontrollers, ARM, Embedded System, RISC-V, Compiler Design, and IOT.

Topics for Advanced Learners:

1. RISC-V

Resources for Advanced Learners:

https://riscv.org/certifications-and-courses/

Sugg	Suggested Learning Resources:								
Text	books:								
1.	M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog HDL, 5 th Edition, Pearson Education.								
2.	Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.								
3	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2 nd Edition.								
Refer	ence Books:								
1.	Fundamentals of Logic Design, Charles H. Roth, 4th Edition, PWS Publishing Company.								
2.	Computer Organization and Design: The Hardware/Software Interface Hardcover, <u>David A.</u> <u>Patterson</u> , <u>John L. Hennessy</u> , 6 TH Edition, MK Publications								
Web l	links and Video Lectures (e-Resources):								
https:	://onlinecourses.nptel.ac.in/noc21_ee39/preview_								
https:	://archive.nptel.ac.in/courses/106/105/106105163/								
Activi	ity-Based Learning (Suggested Activities in Class)/ Practical Based learning								
1. 2.	Flipped Class Room Presentation								

Course o	Course outcomes:									
CO1	Ability to simplify Digital Design using various techniques.									
CO2	Ability to build Combinational and Sequential circuits.									
CO3	Understanding of Basic Structure of Computer and machine instructions.									
CO4	Understanding of basic operational concept of computer and pipelining.									
CO5	Understanding the basics of Embedded Systems with sample applications.									

CO-PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	З	3	2	-	2	3	-	-	2	2	2	-
CO2	3	3	3	3	3	2	-	2	2	-	-	2	2	2	-
CO3	3	3	3	3	3	2	-	2	3	-	-	2	2	2	-
CO4	3	3	3	3	3	2	-	2	2	-	-	2	2	2	-
CO5	3	3	3	3	3	2	-	2	3	-	-	2	2	2	-

Digital Design and Computer Organization Laboratory							
Course Code	CS203	Semester	III				
L:T:P:S	0:0:2:1	CIE Marks	50				
Hrs. / Week	2	SEE Marks	50				
Credits	1	Total Marks	100				
Exam Hours	03	•					

Cours	Course objectives : At the end of the course, the student will be able to:				
1.	To Simplify the Digital System Design.				
2	Flip - Flops and their operations.				
3.	Counters and registers using flip-flops.				
4.	Synchronous and Asynchronous sequential circuits.				
5.	Develop VHDL code for combinational and sequential circuits.				

Pgm. No.	List of Experiments / Programs		COs
	Prerequisite Experiments / Programs / Demo		
	NIL		
	PART-A		
1	Title: Design a Digital System that Connects any one input to output based on selection inputs.		CO1,CO2
	Problem Description : A Digital system which consists of 8 input lines and at any given time only one input will be connected to output based on select lines.		
	Method: The technique utilized here is to simplify the given expression using multiplexer and connect one among multiple input to output signal based on selected inputs.		
	Theory Reference: Module 1		
2	Title: Simplify the digital design that accepts two/three binary inputs and produces two binary outputs.	2	CO1,CO2
	Problem Description: The technique involves simplifying the digital design to accept two/three binary inputs A&B and return two outputs Sum S and Carry C.		
	Method: In this experiment, the truth table of 2-bit and 3-bit adder is converted to logical expression and implementing the simplified expression to verify the truth table.		
	Theory Reference: Module 1		

3	Title: Design a circuit to store one bit of information using universal gates.	2	CO1,CO2
	Problem Description: Realize the working of flip-flops using universal gates.		
	Method: In this experiment flip-flops can be built using universal gates in the feed-back path and to demonstrate it can be used as storage elements.		
	Theory Reference: Module 2		
4	Title: Synchronous counter.	2	CO1,CO2
	Problem Description: Given 'n' count, counter is designed to count up from 0 to n up counting.		
	Method: In this experiment Counter is designed using appropriate technique which counts from 0 to n digit.		
	Theory Reference: Module 2		
5	Title: Design asynchronous counter.	2	CO1,CO2
	Problem Description Design a counter for the sequence: 0-1-2- 3-4-5-6-7-8-9 and display them on 7-segment LED display.		
	Method: In this experiment Counter is designed using appropriate		
	technique which count up from 0 to n (n<=9) and demonstrate on 7-segment display.		
	Theory Reference: Module 2		
6	Title: Design a code converter circuit.	2	CO1,CO2
	Problem Description: In this experiment code conversion is done		
	from Binary to Gray and appropriate technique is used to simplify the logic circuit demonstrate the conversion.		
	Method: Given Binary code is converted to Gray code and		
	obtained logic equation is simplified and realized in the hardware.		
	Theory Reference: Module 2		
	PART-B		

7	Title: Simulate a Full Adder in VHDL.	2	CO1,CO2
	Problem Description: Develop a program in VHDL to perform full adder operation.		
	Method: Design full adder and check the truth table and waveforms generated.		

Theory Reference: Module 2	

8	Title: Simulate a 8:1 MUX in VHDL	2	CO1,CO2
	Problem Description: Develop a program in VHDL to perform		
	8:1 multiplexer operation.		
	Method: Design 8:1 Multiplexer and check the truth table and		
	waveforms generated.		
	Theory Reference: Module 2		
9	Title: Simulate a Flip-Flops in VHDL.	2	CO1,CO2
	Problem Description: Develop a program in VHDL to check the		
	working of flip-flops (JK/D/T)		
	Method: Design Flip-Flops (JK/D/T) and check the operations		
	and waveforms generated.		
	Theory Reference: Module 2		
10	Title: Simulate a 4-bit binary counter VHDL program.	2	CO1,CO2
	Problem Description: Develop a program in VHDL to check 4-		
	bit binary counter.		
	Method: Design a 4-bit binary counter and check all		
	combinations generated.		
	Theory Reference: Module 2		
11	Title: Design of a 4-bit Ripple Carry Adder.	2	CO1,CO2
	Problem Description: Develop a program in VHDL to perform		
	4-bit Ripple Carry Adder.		
	Method: Design 4-bit Ripple Carry Adder by examining		
	the rippling of carry behaviour.		
	Theory Reference: Module 2		

12	Title: Design of a 4-bit ALU.	2	CO1,CO2
	 Problem Description: Develop a program in VHDL to perform 4-bit ALU. Method: Design a 4-bit ALU counter and check all combinations generated. Theory Reference: Module 2 		

PART-C

Beyond Syllabus Virtual Lab Content Logical Alarm

Sugges Textbo	sted Learning Resources: poks:							
1	M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog HDL, 5 th Edition, Pearson Education.							
2	Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, 5th Edition, Tata							
	McGraw Hill.							
3	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2 nd Edition.							
Referen	nce Books:							
1	Fundamentals of Logic Design, Charles H. Roth, 4th Edition, PWS Publishing Company.							
2	Computer Organization and Design: The Hardware/Software Interface Hardcover,							
-	David A.							
	Patterson, John L. Hennessy, 6 TH Edition, MK Publications.							
Web lin	ks and Video Lectures (e-Resources):							
https://	https://onlinecourses.nptel.ac.in/noc21_ee39/preview							
https://	archive.nptel.ac.in/courses/106/105/106105163/							

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

Course ou	Course outcomes:						
CO1	Ability to realize Digital System Design and demonstrate using hardware components.						
CO2	Ability to demonstrate working of flip-flops and counters.						
CO3	Ability to demonstrate working of sequential circuits.						
CO4	Proficiency in writing simple programs using VHDL						

CO-PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	2	3	-	-	2	2	2	-
CO2	3	3	3	2	2	2	-	2	2	-	-	2	2	2	-
CO3	3	3	3	2	2	2	-	2	3	-	-	2	2	2	-
CO4	3	3	3	2	2	2	-	2	2	-	-	2	2	2	-
CO5	3	3	3	2	2	2	-	2	3	-	-	2	2	2	-

Course Title	Data Structures and Applications		111
Course Code	CS204	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	3:2:0:2	Total	100
Credits	4	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE		

Course objective is to:

- 1. To explain fundamentals of Data structures and their applications.
- 2. To illustrate the representation of various data structures.
- 3. To learn implementation of all the operations on data structures.

4. To understand the intricacies of various Data Structures thus mapping them to problem solving.

PREREQUISITES : This course requires that the students are familiar with programming language such as C and Python.

Modul	e-1: Overv	view
mouun		

RBT Levels:L1, L2, L3 10 Hours

Data Types to Data Structures: Data Structures, Classifications: Primitive & Non-Primitive (**Stack, Queue, Linked List, Graph, Trees, Hash Table**). Data structure Operations. Review of pointers, Dynamic Memory Allocation Functions with Programming Examples (**Dynamic 1D array, 2D array**), review of structures, polynomial, Sparse Matrices, string pattern matching (nfind, KMP)

Text Book 1: 1.2,2.1-2.4,2.5.1-2.5.3,2.7.3

		1
Module-2: Stacks and Queues	RBT Levels:L1, L2, L3	10 Hours

Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. Multiple stacks, Tower of Hanoi. **Queues:** Definition, Array Representation, Queue Operations, Priority Queues, Circular Queues, Circular queues using Dynamic arrays

Text book 1:3.1,3.2,3.3,3.4,3.6,3.7, 9.1-9.2

Module-3: Linked List: its types and operations	RBT Levels:L1, L2, L3	10 Hours
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Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion, Doubly Linked lists Circular linked lists and header linked operations: Traversing, Searching, Insertion, and Deletion, polynomial using header linked list.

Text book 1:4.1,4.2,4.3,4.4,4.5,4.8

RBT Levels:L1, L2, L3 10 Hours

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals – In-order, post-order, pre-order; Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching. AVL Trees and Red Black Trees construction, Selection Trees, Forest.

Text book 1:5.1-5.3,5.7-5.9,10.2,10.3

		40.11
Module-5: Graphs, Hashing and Case Studies	RBT Levels:L1, L2, L3	10 Hours

Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations,

Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing

Summarization of all modules. Case Studies:

a. **Design a music playlist system:** The functionality of a playlist needs to be implemented, i.e., adding a song to the playlist, playing the next song, playing the previous song, switching to a song, display of songs based on its genre type etc.

a. **Efficiently manage table reservations for a restaurant**: Managing table reservations for a restaurant efficiently involves handling various aspects such as availability of tables, booking requests, and ensuring a smooth flow of operations.

Text book1: 6.1,6.2,8.1,8.2,8.3

Follow on Courses: Design & Analysis of Algorithms, Operating Systems

Resources for Advanced Learners:

Data Structures and Algorithms Made Easy – Data Structures & Algorithmic Puzzles Author: Narasimha Karumanchi (MTech. IIT Bombay, Founder- CareerMonk.com) 5th Edition

Sugg	ested Learning Resources:						
Text	books:						
1.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2 nd Ed, Universities						
	Press, 2014.						
2.	Yedidyah te, Moshe J. Augenstein and Aaron M. Tenenbaum, Data Structures using C and						
	C++, 2nd edition 2023.						
Refer	ence Books:						
1	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2 nd Ed, Cengage						
1.	Learning,2014.						
2	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data						
2.	Structures with Applications,2 nd Ed, McGraw Hill, 2013						
3.	Robert Kruse, Data Structures and Program Design in C, 2 nd Ed, PHI, 1996.						
Webl	inks and Video Lectures (e-Resources):						
1. http	p://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html						
2. htt	ps://nptel.ac.in/courses/106/105/106105171/						
3. http	p://www.nptelvideos.in/2012/11/data-structures-and-algorithms.htm						

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

- 1. Real world problem solving using group discussion.
- 2. Back/Forward stacks on browsers.
- 3. Undo/Redo stacks in Excel or Word.

Course	outcomes:
CO1	Ability to explain different data structures and their applications.
CO2	Ability to apply Stacks and Queue data structures to solve the given problems.
CO3	Ability to use the concept of linked list in problem solving.
CO4	Ability to explain the advanced Data Structures concepts such as Hashing Techniques and
004	augmentednbinary search trees.
CO5	Ability to develop solutions using trees and graphs to model the real-world problem.

CO-P	O Ma	pping	5												
CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PO															
CO1	3	2	3	2	2	-	-	-	1	1	-	-	3	3	2
CO2	З	2	3	2	2	-	-	-	1	1	-	-	3	З	2
CO3	3	2	3	2	2	-	-	-	1	1	-	-	3	3	2
CO4	З	2	3	2	2	-	-	-	1	1	-	-	3	З	2
CO5	3	2	3	2	2	-	-	-	1	1	-	-	3	3	2

	Da	ata Structures Laboratory	
Course Code	CS205	Semester	111
L:T:P:S	0:0:2:1	CIE Marks	50
Hrs. / Week	2	SEE Marks	50
Credits	1	Total Marks	100
Exam Hours	03		·

Cours	e objectives : This laboratory course enables students to
1.	Get practical experience in design, develop, implement Linear data structures and their applications.
2	Get practical experience to design, develop and implement Non-Linear data structures and their applications.

Pgm. No.	List of Experiments / Programs	Hour	COs
		S	
	Prerequisite Experiments / Programs / Demo		
This course	requires that the students are familiar with programming language	such as	
C(23POP103	9/203).		
	PART-A		
1	Title: Write a program in C to create a data structure which can	2	CO2,CO3
	handle varying number of entries and sort it.,		
	Problem Description: Need to create a data structure which makes		
	use of memory dynamically. The sorting can be done using any		
	technique.		
	Method: The method utilized here is the use of dynamic memory		
	allocation functions and define a function to perform selection		
	sort.		
	Theory Reference: Module 1		
2	Title: Design, develop, and implement a data structure of integers	2	CO2,CO3
	that follows the LIFO principle and demonstrates its operations.		
	Problem Description: The program creates the data structure and		
	performs operations like inserting an element, deleting an		
	element, and displaying the status of the data structure.		

	Method: In this program, create the data structure and support the program with appropriate functions for each of the above operations.		
	Demonstrate Overflow and Underflow situations and support the		
	When everflow eccure increase the size of the datactructure by array		
	doubling tochniquo		
	doubling technique.		
	Theory Reference: Module 1		
3	Title: Design, Develop and Implement a Program in C for converting an	2	CO2,CO3
	Infix Expression to Postfix Expression and Evaluate the converted		
	postfix expression.		
	Problem Description: The problem involves implementing a function		
	that convert the Infix Expression to Postfix Expression anda function		
	that evaluates the converted expression and prints the result. Program		
	should support for both parenthesized and free parenthesized		
	expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and		
	alphanumeric operands.		
	Method: In this program, Infix expression is given as an input andthe		
	function for converting infix to postfix expression. After obtaining the		
	postfix expression for each alphanumeric operand's values are given at		
	the runtime and display the resultant value. Choose the best data		
	structure for these operations.		
4	Title: Design develop and implement an efficient use of memorydata	2	02.003
•	structure of Integers that follows the FIFO principle and demonstrates	-	002,000
	its operations.		
	Bucklass Description. The supersus exected the data structure and		
	Problem Description: The program creates the data structure and		
	performs operations like inserting an element, deleting an		
	element, and displaying the status of the data structure.		
	Method: In this program, create the data structure and support the		
	program with appropriate functions for each of the above operations.		
	Demonstrate Overflow and Underflow situations and support the		
	program with appropriate functions for each of the above operations.		
	Theory Reference: Module 2		
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for	2	CO2,CO3
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for handling change of branch.	2	CO2,CO3
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for handling change of branch.	2	CO2,CO3
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for handling change of branch. Problem Description: After 1 St year, students can apply forchange of	2	CO2,CO3
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for handling change of branch. Problem Description: After 1 st year, students can apply forchange of branch and are generally selected based on their CGPA. Assume that	2	CO2,CO3
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for handling change of branch. Problem Description: After 1 st year, students can apply forchange of branch and are generally selected based on their CGPA. Assume that among the selected students, some may change their mind. Some	2	CO2,CO3
5	Theory Reference: Module 2 Title: Design, Develop and Implement a menu driven Program in C for handling change of branch. Problem Description: After 1 st year, students can apply forchange of branch and are generally selected based on their CGPA. Assume that among the selected students, some may change their mind. Some existing students also may choose to leave and join another	2	CO2,CO3

	student data with regular and change of branch students, Limit your program to only your department.		
	Method: Make use of arrays or linked lists.		
	Theory Reference: Module 2		
	PART-B		4
6	Title: Design, Develop and Implement a menu driven Programin C for traversing a tree and search a given item.	2	CO1,CO2,CO3
	Problem Description: Create a hierarchical data structure and perform efficient insertion and search. Given a set of data items, Create a hierarchical data structure of N nodes, with certain		
	order. Implement all Traversal of the created data structure and output the nodes visited. Iii) Perform efficient Search for an element (KEY) in the created		
	data structure and report the appropriate message.		
	Method: Make use of binary search tree. You can use recursion or iterative techniques.		
	Theory Reference: Module 3, Binary Search Tree.		
7	Title: Develop a C program to implement height balanced tree Problem Description: Given an imbalanced tree, restructure it as a balanced tree.	2	CO1,CO2,CO3
	Method: Make use of AVI tree.		
	Ensure that the program performs proper rotations such as Left- Left, LR, RR and RL to create a height balanced binary search tree and display the tree created as a output .		
	Theory Reference: Module 4		
8	Title: Design, Develop and Implement a Program in C to createN router connections and display the routers by removal of which will disconnect the network completely.	2	CO1,CO2,CO3
	Problem Description: create a data structure to represent the routers and its connections between the routers and display the router numbers on removal which it disconnects the network		
	completely.		
	Method: choose the best data structure to represent the routers and a function to find the articulation point.		
	Theory Reference: Module 5		
9	Title: Design and develop a Program in C that uses Hash function H: $K \rightarrow J$ as $H(K) = K$ mod m and implement hashing	2	CO1,CO2,CO3

technique to map a given key K to the address space L. Resolve the collision (if any).		
Problem Description: Given a set K of Keys (4-digit) which uniquely determines the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers.		
Method: Ensure that the program generates the 4-digit key randomly and generates the L using hash function, demonstrates if there is a collision and its resolution by using linear probing.		
Theory Reference: Module 5		
 Title: Design and develop a Program in C to implement Merkle Tree typically used in Blockchain. 	2	CO1,CO2,CO3
Problem Description: Generate a Merkle tree to store a given		
block of transactions in a tamper-proof manner.		
Method: In a Merkle Tree, each leaf node is labelled with the		
hash value of a data block and each non-leaf node is labelled		
with the hash value of its child nodes labels. Ensure that the		
program should uses SHA-256 hash function to hash		
transaction data continuously till the Merkle root is obtained.		
Theory Reference: Module 5		
PART-C		
Beyond Syllabus Virtual Lab		
Content <u>https://ds1-</u>		
lith.viabs.ac.in/exp/linked-		
ist/doubly-linked- ist/dllevercise.html		

Sug Tex	gested Learning Resources: tbooks:
1	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities
	Press, 2014.
2	Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
Refe	rence Books:
1	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2 nd Ed, Cengage
	Learning,2014.
2	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with
2	Applications,2 nd Ed, McGraw Hill, 2013
3	Robert Kruse, Data Structures and Program Design in C, 2 nd Ed, PHI, 1996.
Web	links and Video Lectures (e-Resources):
1. ht	tp://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2. ht	tps://nptel.ac.in/courses/106/105/106105171/
3. ht	tp://www.nptelvideos.in/2012/11/data-structures-and-algorithms.htm

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning1.Real world problem solving using group discussion.

- **2.** Back/Forward stacks on browsers.
- **3.** Undo/Redo stacks in Excel or

Course	outcomes:
CO1	Ability to analyze and compare various linear and non-linear data structures
CO2	Ability to Code, debug and demonstrate the working nature of different types of data structures and their applications.
CO3	Ability to choose the appropriate data structure for solving real world problems

CO-P	C-PO Mapping														
CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
PO															3
CO1	3	3	2	2	3	-	-	-	-	-	-	1	3	3	2
CO2	3	3	2	2	3	-	-	-	-	-	-	1	3	3	2
CO3	3	3	2	2	3	-	-	-	-	-	-	1	3	3	2

Course Title	Object Oriented Programming with Java	Semester	111		
Course Code	CS206	CIE	50		
Total No. of Contact Hours	40	SEE	50		
No. of Contact Hours/week	2:0:2:1.5	Total	100		
Credits	3	Exam. Duration	3 Hours		
Teaching Dept	CSE/ISE				

PREREQUISITES: This course requires that the students are familiar with programming language such as C(23POP103/203) and python(23PLB105/205).

Course objective is to:

- 1. To understand Object Oriented Programming Features of JAVA.
- 2. To learn the concept classes and their interrelationships and how to explode them application development.
- 3. To develop programs which enable concurrent and parallel processing.
- 4. To understand and implement error processing in java.
- 5. To learn how to develop a java application using a standard framework.

Object oriented Programming: Need for OOP paradigm, summary of OOP concepts. **Java Basics:** Java buzzwords, data types, variables, scope and lifetime of variables, arrays, expressions, control statements (for each), type conversion and casting, simple java program.

Text Book:1, Chapters 2,3

Мос	lule	e-2: (Classes	s, Object	ts an	d Me	tho	ds			RB	T Leve	els: L1, L2	8 Hours	
		-											-		

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection.

Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes.

Text book: 1, Chapters 6,7

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Module-3: Inherit	ance and Interfaces	RBT Levels: L1, L2	8 Hours

Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance.

Interfaces: Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.

Text book:1, Chapter 8, 9.4-9.6, 9.7

Module-4: Exception handling and Multithreading RBT Levels: L1, L2 8 Hours

Exception handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built- in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.

Multithreading: Thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication. Enumerations, autoboxing.

Text book: 1, Chapter 10, 11.1,11.3, 11,6, 11.7-11.8,12.1, 12.3

Module-5: Swings, Exploring Swing and Case Studies	RBT Levels: L1, L2, L3	8 Hours
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Introducing Swing: The Origins of Swing, Swing Is Built on the AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application. **Exploring Swing:** JLabel and Imagelcon, JTextField, The Swing Buttons, JTabbedPane, JScrollPane, JList, JComboBox, Trees, JTable. **Case Studies: Hangman Game, Tic Tac Toe Game.**

Summarization of all modules.

Text book: 1, Chapter 32, 33

Follow on Courses: Advanced Java Programming, Object-Oriented Analysis and Design

Resources for Advanced Learners

1. <u>Advanced Java Tutorial | Mastery in Java Programming - GeeksforGeeks</u>

Practice Component of IPCC

L:T:P (0:0:2)

Programming Experiments (Suggested and are not limited to)

Program 1:

Title: Write a program in java to pass argument and count how many parameters are passed.

Problem Description: The program counts the number of parameters passed at the command prompt and displays them along with their occurrence.

Method: The method utilized here is to access the command line arguments using the args array in the main method. The length of this array is then used to determine the number of parameters passed.

Theory Reference: Module 1

Program 2:

Title: Write a java program to create and display the student details.

Problem Description: The problem involves creating a Java class named Student, which contains variables for USN, Name, Branch, and Phone. The task further requires writing a Java program to instantiate 'n' Student objects and printing their details with appropriate headings.

Method: In this program, the 'Student' class encapsulates the details of a student, and the main program creates an array of Student objects, initializes each object with sample data, and then prints out the details of each student.

Theory Reference: Module 2

Program 3:

Title: Write a java program to implement staff hierarchy.

Problem Description: The problem involves designing a superclass named Staff with attributes such as: Staffld, Name, Phone, and Salary. Additionally, three subclasses: Teaching, Technical, and Contract-are to be created with specific attributes for each category. The task requires writing a Java program to read and display at least three staff objects from all three categories.

Method: In this example, the Staff superclass encapsulates common attributes shared by all staff members, while the Teaching, Technical, and Contract subclasses define specific attributes for each category of staff. The main program creates and displays at least three staff objects from each category.

Theory Reference: Module 3

Program 4:

Title: Write a java program to implement Box class application to depict constructor overloading.

Problem Description: Given three classes called A, B, and C, C can be a subclass of B, which is a subclass of A. When this type of situation occurs, each subclass inherits all of the traits found in all of its super classes. methods with different parameters.

Method: In this program, C inherits all aspects of B and A. To see how a multilevel hierarchy can be useful, consider the following program. In it, the subclass BoxWeight is used as a superclass to create the subclass called Shipment. Shipment inherits all of the traits of BoxWeight and Box, and adds a field called cost, which holds the cost of shipping such a parcel.

Theory Reference: Module 3

Program 5:

Title: Write a java program to solve Tower of Hanoi Problem using Stack.

Problem Description: Move all the disks stacked on the first tower over to the last tower using a helper tower in the middle. While moving the disks, certain rules must be followed. Only one disk can be moved. A larger disk cannot be placed on a smaller disk.

Method: In this program, Solving the Tower of Hanoi problem using a stack is an elegant and efficient approach. The Tower of Hanoi problem involves three rods and a number of disks of different sizes that can slide onto any rod. The puzzle starts with the disks in a neat stack in ascending order of size on one rod, with the smallest disk at the top, and the objective is to move the entire stack to another.

Theory Reference: Module 3

Program 6:

Title: "Write a Java Program to calculate area and perimeter of variety of shapes (circle and triangle)"

Problem Description: Develop a JAVA program to create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.

Method: Ensure that the program is well-structured, follows object-oriented principles, and provides clear and concise output demonstrating the functionality of each class and method.

Theory Reference: Module 3 Page no:157

Program 7:

Title: "Java Program: Resizable Interface for Object Resizing with Rectangle Implementation".

Problem Description: Develop a JAVA program to create an interface Resizable with methods resizeWidth(int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods.

Method: Ensure that the program follows proper object-oriented principles, such as encapsulation and abstraction, and provides clear and concise output demonstrating the resizing functionality.

Theory Reference: Module 3

Program 8:

Title: "Java Program: Custom Exception Handling for DivisionByZero and Arithmetic Exceptions".

Problem Description: Develop a Java program that demonstrates the handling of custom exceptions, specifically for DivisionByZero and Arithmetic exceptions. You are required to utilize try-catch blocks along with throw statements to handle these exceptions gracefully.

Method: Ensure that the program demonstrates the proper usage of try-catch blocks, throw statements, and custom exception handling for DivisionByZero and Arithmetic exceptions.

Theory Reference: Module 4

Program 9:

Title: "Write a Java program to generate random numbers using multiple threads.

Problem Description: Develop a Java program that implements a multi-threaded application with three threads. Each thread has a specific task as described as follows: First Thread (Random Number Generator): This thread generates a random integer every 1 second. Second Thread (Square Computation): This thread receives the random integer generated by the first thread and computes its square. After computing the square, it prints the result. Third Thread (Cube Computation): This thread integer generated by the first thread and computes theread receives the random integer generated by the first thread (Cube Computation): This thread receives the random integer generated by the first thread (Cube Computation): This thread receives the random integer generated by the first thread and computes the random integer generated by the first thread and computes its cube. After computing the cube, it prints the result.

Method: Program should demonstrate the multi-threading capabilities of Java and showcase the asynchronous computation of squares and cubes. Additionally, it should handle synchronization and data sharing effectively to prevent race conditions and ensure thread safety.

Theory Reference: Module 4

Program 10:

Title: "Java Swing Program: Creating Buttons with JFrame Inheritance".

Problem Description: Develop a Java program using Swing to create a button and add it to a JFrame object inside the main method. Additionally, you should inherit the JFrame class without explicitly creating an instance of the JFrame class.

Method: Program should demonstrate the creation of a Swing button and its addition to a JFrame object, while also showcasing inheritance of the JFrame class.

Theory Reference: Module 5

Open ended experiments leading to guided projects:

Mobile App Development

Suggested Learning Resources: Textbooks:

Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, 1. McGraw-Hill, ISBN: 9781260463422.

Reference Books:

Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill 1. Education,

ISBN:9789353162337.

Fourth Edition, Bruce Eckel, Prentice Hall, 2006 Thinking in Java, by 2. (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

Web links and Video Lectures (e-Resources):

- 1. Learn Java - A Beginners Guide for 2024 - GeeksforGeeks
- 2. Java Tutorial: https://www.javatpoint.com/java-tutorial
- 3. https://www.youtube.com/watch?v=GoXwIVyNvX0
- 4. https://www.youtube.com/watch?v=bm0OyhwFDuY&list=PLsyeobzWxl7pe_liTfNyr55kwJP WbgxB5

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

- 1. Demonstration of online IDEs like geeksforgeeks, jdoodle or any other Tools.
- 2. **Mini Project**

Course o	Course outcomes:									
CO1	Ability to demonstrate proficiency in writing simple programs involving branching and									
01	looping structures and design class involving data members and methods for the given									
	scenario.									
CO2	Ability to apply the concepts of inheritance and interface in solving real world problems.									
CO2	Ability to use the concept of multithreading and exception handling in solving complex									
05	problem.									
CO4	Ability to use the concept of swings in solving the real-world problems.									
	Appring									

CO BO Manning

CO-P															
CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PO															
CO1	3	2	3	1	1	-	-	-	2	-	-	-	3	3	3
CO2	3	2	3	1	1	-	-	-	2	-	-	-	3	3	3
CO3	3	2	3	1	1	-	-	-	2	-	-	-	3	3	3
CO4	3	2	3	1	1	-	-	-	2	-	-	-	3	3	3

Course Title	Operating Systems	Semester	111
Course Code	CS221	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:1:1:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE		

PREREQUISITES: C Programming Course.

Course objective is to:

- 1. To introduce the concepts, roles, and functions of traditional and modern operating systems.
- 2. To explain the concept of process and its management which includes process scheduling.
- 3. To understand the problems related to concurrency, different synchronization mechanisms and deadlock handling.
- 4. To Illustrate the various memory management and file management techniques.
- 5. To understand different APIs/Commands related to processor, memory, storage, and file system management.

Module-1: Overview and structure of Operating System RBT Levels:L1,L2	2 8 Hours
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Overview Operating Systems: Definition - Operating System, computing environment and nature of computations, classes of operating systems, Efficiency, system performance and user services, Batch processing systems, multiprogramming systems, time sharing systems, real time OS, distributed OS, Modern OS.

Structure of Operating Systems: operation of an OS, structure of an OS, layered design of OS, Virtual machine OS.

Text book 1: Chapter 3.1 to 3.9, 4.1 to 4.4

Module-2: Process, Threads and Process Synchronization	RBT Levels:L1,L2,L3	8 Hours

Process and Threads: Processes and programs, Implementing process, case study: Threads, processes in UNIX.

Process Synchronization: Race conditions, Critical section, control synchronization and invisible operations, synchronization approaches, structure of concurrent systems, classic approach synchronization problems, semaphores, monitors, case study: process synchronization in UNIX.

Textbook 1: Chapter 5.1 to 5.3, 5.4.1, 6.1 to 6.7, 6.9, 6.10, 6.11.2.

Module-3: Scheduling and Deadlocks	RBT Levels:L1,L2,L3	8 Hours
Schoduling: Schoduling Terminology and concents, non pro-	omptive and are emptive	cchoduling

Scheduling: Scheduling Terminology and concepts, non-pre-emptive and pre-emptive scheduling policies, scheduling in practice, Case study: scheduling in UNIX.

Deadlocks: what is deadlock? Deadlocks in resource allocation, Handling Deadlocks, Deadlock Detection and Resolution, Deadlock prevention, deadlock avoidance, case study: Deadlock handling in UNIX.

Textbook 1: Chapter 7.1 to 7.4, 7.6.1, 8.1 to 8.6, 8.8.1.

Module-4: Memory Management and Virtual memory	RBT Levels:L1,L2,L3	8 Hours
Module-4. Memory Management and Virtual memory	RDT LEVEIS:LI,LZ,LS	OHOUIS

Memory Management: Managing the memory hierarchy, static and dynamic allocation, execution of program, memory allocation to process, contiguous and non-contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual memory: Basics, demand paging, the virtual memory manager, page replacement policies, Case study: UNIX virtual memory

Textbook 1: Chapter 11.1 to 11.4, 11.6 to 11.10

Module-5: File Systems and Mass Storage Structures	RBT Levels:L1,L2,L3	8 Hours
would e-5. The systems and wass storage structures	RBT Levels:L1,L2,L3	8 Hours

File Systems: overview of File Processing. Files and file operation, fundamental file organization and access methods, directories, case study: Unix File system.

Mass Storage Structures: Overview; Disk Structure, Scheduling, Management.

Textbook 1: Chapter 13.1 to 13.4, 13.14.1 Textbook 2: chapter 12.1,12.2,12.4,12.5.

Follow-on Courses: System Software Compiler Design, Embedded Systems and Cloud Computing.

Resources for Advanced Learners

An Introduction to Operating Systems Concepts and Practice, PCP Bhatt, 2013 https://www.amazon.in/INTRODUCTION-OPERATING-SYSTEMS-CONCEPTS-PRACTICEdp-9387472876/dp/9387472876/ref=dp_ob_title_bk

Practice Component of IPCC

L:T:P (0:0:2)

Programming Experiments (Suggested and are not limited to)

Program 1:

Title: Demonstrate operating systems Installation and Basic Unix/Linux commands like ... pwd, cd, Is Is-I, rm, mv, cp, chmod, mkdir rmdir, find, file, cat, wc, sort, grep etc...

Problem Description: To learn the OS installation Process and the purpose of basic Commands in Unix/Linux.

Method: Follow the procedure for installation, open terminal and execute basic commands by understanding the purpose of each command.

Theory Reference: Module 1

Program 2:

Title: Write a C/C++/Python code to implement process creation.

Problem Description: The students can create child process and recognize the Id's of both parent and child process.

Method: Follow the method to create a child process by a parent process in an operating system using a fork () system call. A child process may also be known as a subprocess or a subtask. A child process is created as a copy of its parent process. The child process inherits most of its attributes.

Theory Reference: Module 1

Program 3:

Title: Write a C/C++/Python code to implementing the Process system calls for inter process communication.

Problem Description: To learn how OS System calls allow programs to create and terminate processes, as well as manage inter-process communication.

Method: Follow the procedure for using various types of system calls in operating systems, including process control system calls, file management system calls, device management system calls, information maintenance system calls, and communication system calls.

Theory Reference: Module 1

Program 4:

Title: Write a C/C++/Python code to Implementing I/O system calls to demonstrate file operations.

Problem Description: To learn the OS I/O system calls open , close , read , and write are commonly used in programming to interact with files and perform input/output operations.

Method: Follow the procedure

- 1. open(name, mode) Used to open a file name in the mode (read or write) specified.0 isfor opening in read mode, 1 for writing and 2 for both.
 - 2. close(fd) Close an opened file.
 - 3. read(fd, buffer, n_to_read) Read data from a file.
 - 4. write(fd, buffer, n_to_write) write data from to a file.

Theory Reference: Module 1

Program 5:

Title: Write a C/C++/Python code to Implementing IPC using message queues using socket program.

Problem Description: To learn IPC where an application sends a message to an operating system process. The operating system sends the message to a designated IPC mechanism, which handles the message and sends a response back to the application. IPC mechanisms can be found in the kernel or the user.

Method: Follow the procedure to create IPC using Unix domain socket through UDS or IPC socket (inter-process communication socket) is a data communications endpoint for exchanging data between processes executing on the same host operating system.

Theory Reference: Module 2

Program 6:

Title: Write a C/C++/Python code to implement Bankers Algorithm for Deadlock avoidance in resources allocation process.

Problem Description: To learn how to prevent the situation where two or more processes are unable to proceed because each is waiting for one of the others to release a resource.

Method: Follow the procedure for deadlock avoidance by eliminating any of the four necessary conditions, which are mutual exclusion, hold and wait, no preemption, and circular wait.

Theory Reference: Module 3

Program 7:

Title: Write a C/C++/Python code for FCFS and SJF Scheduling to allocate the jobs to CPU for processing jobs.

Problem Description: To learn the activity of the process manager that handles the removal of the running process from the CPU and the selection of another process based on a particular strategy. Process scheduling is an essential part of a Multiprogramming operating system.

Method: Follow the procedure for scheduling the process into ready, waiting, and operating states via process scheduling algorithm FCFS (allocates the process that arrived first to the CPU) and SJF(allocates the process that has the shortest burst time to the CPU).

Theory Reference: Module 2

Program 8:

Title: Write a C/C++/Python code to implement round robin scheduling algorithm to allocate the computing resource uniformly to all the jobs running on the system without delay.

Problem Description: To learn the activity of the process manager that handles the removal of the running process from the CPU and the selection of another process that is allocated to CPU based on a particular strategy. Process scheduling is an essential part of a Multiprogramming operating system.

Method: Follow the procedure for scheduling the process into ready, waiting, and operating states via process scheduling algorithm Round Robin (allocates the process in a circular fashion on regular time interval to the CPU).

Theory Reference: Module 2

Program 9:

Title: Write a C/C++/Python code to implement FIFO Page Replacement Algorithm to efficiently use the frames.

Problem Description: To learn page replacement the process in which a page from the main memory is replaced with a page from the secondary memory.

Method: Follow the procedure for page replacement using FIFO Page Replacement Algorithm(replaces the page that has come first.

Theory Reference: Module 4

Program 10:

Title: Write a C/C++/Python code to implement LRU and LFU Page Replacement Algorithm to load the pages to frames efficiently.

Problem Description: To learn page replacement the process in which a page from the main memory is replaced with a page from the secondary memory.

Method: Follow the procedure for page replacement using LRU (replace the page that has not been used recently) and LFU(replace the page that will not be used in the near future) Page Replacement Algorithm.

Theory Reference: Module 4

Program 11:

Title: Write a C/C++/Python code to implement first fit, best fit and worst fit algorithms for efficient memory management.

Problem Description: To learn memory management the process of controlling and coordinating a computer's main memory. It ensures that blocks of memory space are properly managed and allocated so the operating system (OS)

Method: Follow the procedure for searching through the list of free blocks of memory, starting from the beginning of the list and implement First Fit(searches for the first free partition that is large enough to accommodate the process) and Best Fit(searches through the list of free blocks of memory to find the block that is closest in size to the memory request from the process) algorithm.

Theory Reference: Module 4

Open ended experiments leading to guided projects:

1. Develop a lightweight Operating System

Suggested Learning Resources:

Textbooks:

1.	Dhananjay M Dhamdhere, Operating systems: a Concept- Based Approach, McGraw hill, 3rd Edition 2012.						
2.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 9th Edition, 2012, ISBN 9781118063330.						
3.	Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH, 2017.						
Referer	ice Books:						
1.	Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition						
2.	William Stallings, "Operating Systems: Internals and Design Principles", Eighth Edition, Prentice Hall, 2015.						
3.	Unix Shell Programming, Yashwant Kanetkar.						
4.	Introduction to UNIX by M G Venkatesh Murthy.						
5.	Practical Linux System Administration. by Kenneth Hess.						
6.	5. Beginning Linux System Administration. by Sander van Vugt.						
Web lin	ks and Video Lectures (e-Resources):						
https:/	//www.w3schools.in/operating-system/linux-operating-						
<u>system</u>	1						
<u>https:</u>	//www.tutorialspoint.com/unix/unix-getting-started.htm						
https:	//www.javatpoint.com/unix-operating-system						
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning							
1.Setting up a VMware Workstation2.Installing							
a VMw	a VMware Guest OS						
3.Runr	3.Running LINUX Operating System						

Course	Course outcomes:				
CO1	Identify the roles and functions of traditional and modern operating systems.				
CO2	Analyse the various techniques for process management and process scheduling				
CO3	Evaluate the problems related to concurrency, different synchronization mechanisms and deadlock handling.				
CO4	Apply various technique for memory management				
CO5	Explain file and secondary storage management strategies				

CO-PO Mapping															
CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PO															
CO1	3	2	3	-	-	-	-	-	-	-	-	2	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	-	2	3	2	2
CO3	3	2	3	-	2	-	-	-	-	-	-	2	3	2	2
CO4	3	2	3	1	2	-	-	-	1	1	-	2	3	2	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	3	2	2

Course Title	Unix Programming	Semester	5
Course Code	CS222	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:1:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	CSE / ISE		

Course objective is to:

- To help the students to understand effective use of Unix concepts, commands and terminology.
- Identify, access, and evaluate UNIX file system
- Explain the fundamental design of the unix operating system
- Familiarize with the systems calls provided in the unix environment
- Design and build an application/service over the unix operating system

PREREQUISITES: A basic knowledge of computers, programming language like C, operating system.

Module-1 Introduction, Unix Files	RBT Level – 1, 2	8 Hours
	1	1

Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, Is, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the uper user: su command. **Unix files:** Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.

Text Book1: Chapter-1, 2, 3, 4, 5

Module-2 Attributes, Commands, Shell ProgrammingRBT Level – 1, 2, 38 HoursFile attributes and permissions: The Is command with options. Changing file permissions: the relative
and absolute permissions changing methods. Recursively changing file permissions. Directory
permissions.Directory

The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection.

Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.

Shell programming: Ordinary and environment variables. The. profile. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples.

Text Book1: Chapter-6,8,13,14

Module-3 Unix Standardization, File I/O, Directories, Unix	RRT Lovel - 1 2 3	8 Hours	
Process		0110013	

Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation.

File I/O: Introduction, File Description, open, create, read, write, close, fcntl functions.

Files and Dictionaries: mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files.

The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions. **Text Book 2:** 2.3.4.7.

Module-4 Process Control, IPC	RBT Level – 1, 2, 3	8 Hours

Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions.

Overview of IPC: Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.

Shared Memory, Client-Server Properties, Passing File Descriptors, An Open Server-Version 1. **Text Book2:** Chapter 8, 15,17

Module-5 Signals and Daemon Process	RBT Level – 1, 2, 3	8 Hours
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Signals and Daemon Processes: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers.

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

Text Book 2: Chapter 10, 13

Follow on Courses: Operating Systems, Computer Systems, Computer Networks.

Resources for Advanced Learners:

https://www.youtube.com/watch?v=ffYUfAqEamY https://www.youtube.com/watch?v=Q05NZiYFcD

gested Learning Resources: tbooks:								
Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill								
W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005								
rence Books:								
Unix System Programming Using C++ - Terrence Chan, PHI, 1999.								
M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.								
Richard Blum, Christine Brenham: Linux Command Line and Shell Scripting Bible, 2ndEdition, Wiley, 2014.								
Web links and Video Lectures (e-Resources):								
https://www.youtube.com/watch?v=8GdT53KDlyY								
https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo								

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

- 1) Programming assignment -1 (Shell level) 10 marks
- 2) Programming assignment -2 (API level) 15 marks.

Course	Course outcomes: Ability to							
CO1	Demonstrate the basics of Unix concepts and commands							
CO2	Demonstrate the UNIX file system.							
CO3	Apply commands to reflect changes in file system.							
CO4	Demonstrate IPC and process management.							
CO5	Develop an application/service over a Unix system							

	CO-PO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	2	1	-	-	1	-	1	-	-	3	-	-
CO2	3	2	1	1	1	-	-	1	1	1	-	1	3	-	-
CO3	3	3	2	2	1	-	-	1	1	1	-	1	3	-	-
CO4	3	3	2	2	1	-	-	1	1	1	-	1	3	-	-
CO5	3	3	3	3	3			1	1	1	-	-	3	-	-

Course Title	Biology for Engineers	Semester	III
Course Code	BG207	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/Week	2:0:0:1	Total	100
Credits	2	Exam. Duration	3 Hours
Teaching Dept.	Basic Sciences		

Course objective is to enable students:

- Acquire an understanding on basic modern biological concepts with an emphasis on how bioprocesses are analogous to engineering field, as a multidisciplinary field.
- Understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions that are arrived citing body functional examples.
- Explain aspects that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

Module-1	RBT Level L1, L2	6 Hours							
Biomimetics:									
Biology for Engineers, Body Fluid: Blood – Mechanics of heart, Blood pressure, Life molecules: Water,									
Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes- engineering analogies.									
Module-2	RBT Level L1, L2	6 Hours							
Bioenergy:									
Unit of life: Human and Plant cell, Metabolism: Enzymes as B	io-catalysts and physiologica	al entities,							
Anabolism – Bioenergy from Sun-Photosynthesis, catabolism									
Module-3	RBT Level L1, L2	6 Hours							
Biomechanics (Human body Movement Mechanics)									
Normal Human Movement: Force-vector of body; Movement	t Angles; Muscle contraction	-relaxation;							
Posture – Static & Dynamic; Ideal and abnormal posture, Prac	ctical: Stepping- Lifting- Sit-S	Stand.							
Modulo 4	PBT Lovel 11 12	6 Hours							
Module-4	RBT Level LI, LZ	OHOUIS							
Bioelectronics									
Brain & Computer: Senso-neural networks, Biosensors and	I IoT as applied to biology,	Bionic Eye:							
Mechanism of Vision, Electronic Nose: Bio-olfactory mechanis	sms (Science of smell), Impu	lses: Cardiac							
and Nerve, Biological Clock and Circadian rhythm/									
Module-5	RBT Level L1, L2,L3	6 Hours							
Biopharma:									
Metabolic syndromes, Cancer and its diagnostics, Lab on a ch	ip, Drug Discovery								
25									
55									

Suggested L	earning Resources:							
Textbooks:								
1	Campbell, N.A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S.A.; Minorsky, P.V.; Jackson, R. B. Pearson. "Biology: A global approach", , Global Edition, 10/E, 2014							
2	David Nelson, Michael Cox. "Lehniger Principles of Biochemistry". W H Freeman & Company, Seventh Edition, 2017.							
Reference Bo	poks:							
1	Janine M Benvus. "Biomimicry: Innovation inspired by Nature". William Morrow Paperbacks, 2002.							
Activity-Base	d Learning (Suggested Activities in Class)/ Practical Based learning							
Real	world problem solving and puzzles using group discussion.							
Demo	Demonstration of solution to a problem though experiential learning.							
Demo	Demonstration using real objects taking students on educational tour.							

Course At the	e outcomes: completion of the course. The student shall be able to
	Apply and utilize essential knowledge of the biological mechanisms of living organisms from
CO1	the perspective of engineers and find solutions to solve bio-engineering problems
	with
	appropriate tools.
	Distinguish and make use of optimal designs in engineering that are bio-mechanical in nature
CO2	and build and use by observing and understanding bio-physiological processes involved in
	sensing, locomotion, and knowledge application of range of bio-chemicals.
<u> </u>	Demonstrate that bio-chemical, bio-sensory, bioprocesses could be path-finders to
COS	optimise
	similarities for functional aspects of electronic, computer, mechanical, electrical machines.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1				1					1
CO2	3	1	1				1					1
CO3	3	1	1				1					1
Course Title	NSS – Phase 1	Semester	Ш									
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Course Code	NS208	CIE	50									
Total No. of Contact Hours	25	SEE	0									
No. of Contact Hours/week	0:2:0	Total	50									
Credits	0	Exam. Duration										
Teaching Dept	Any Department											

Course objective is to: National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work

2. Identify the needs and problems of the community and involve them in problem-solving

3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems

4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

Module:1	RBT Level/s :L1, L2	4 Hours

Youth population in India and its characteristics:

Introduction to India: Physical, Socio-Economic and Demographic Background, Study on Indian Population Composition (Age composition), Youth composition, Youth policy, Importance of Youth Policy, Youth population in India, NSS as a Youth Organization.

Module:2	RBT Level/s :L1, L2	3 Hours
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Fundamentals of NSS:

Introduction to NSS, Origin of NSS, Aims and Objectives of NSS, NSS Motto, NSS Emblem, NSS Badge, NSS Day.

Module:3	RBT Level/s	3 Hours
	:L1, L2	

NSS Songs:

NSS Anthem (Hindi & Kannada), National Integration song, Rastriya sevayojane Madiharu. Uteh samajkeliye Uteh Uteh. Navellaru Ondagi Balona Banni. Hum Sab Mil ka rDeshka Apani.

Module:4	RBT Level/s	15
	:L1, L2	Hours

Activity Based Programmes:

A. Campus Activities:

Shramadhan – Plantation, Cleaning, Watering, Weeding, Any other activities.

Awareness Programmes – Seminar, Workshops, celebration of National and International days, Personality Development Programmes, Group Activities, etc

B : Off Campus Activities:

Rally, Jatha, Visit to Adopted villages, Swatchatha Programme, Visit and Conserving Ancient monuments and heritage site, Socio Economic Survey of village/slum, Nature Camp, Environmental Education

Course outcomes:

At the completion of the course. The student shall be able to

CO1	Describe the concept of	Youth and co	ompare the international	definitions of the term Youth.
001				

CO2Students will be able to appreciate our demographic advantage and its role in nation building.CO3Know the growth and evolution of NSS and its role in Nation building through community service

CO4 Visualize the signs, symbols, logo of NSS and understand their broader meaning.

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

Course Title	Physical Education (PE) (Sports and Athletics) – Phase 1	Semester	111
Course Code	PE208	CIE	50
Total No. of Contact Hours	25	SEE	0
No. of Contact Hours/Week	0:2:0	Total	50
Credits	0	Exam. Duration	
Teaching Dept	Sports		

Course objective:

Physical education aims to develop all aspects of the human personality through physical and sports activities. Being a subject of science, it has its own value in society and human life. Physical Education is a form of one of the most effective means of education imparted through exercises, fun activities and sports. It is an integral part of the education system. It caters to the need for development of the students on physical, mental and social aspects.

Module – 1	RBT Level/s :L1, L2	5 Hours								
Orientation:										
Introduction of Physical Education and sports, Importance of Physical fit	ness and healthy	/ life style								
A. Lifestyle										
B. Fitness										
C. Food & Nutrition										
D. Health & Wellness										
E. Pre-Fitness test										
Module – 2	RBT Level/s :L1, L2	15 Hours								
General Fitness & Components of Fitness:										
A. Warming up (Free Hand exercises)										
B. Strength – Push-up / Pull-ups										
C. Speed – 30 Mtr Dash										
D. Agility – Shuttle Run										
E. Flexibility – Sit and Reach										
F. Cardiovascular Endurance – Harvard step Test.										
Module - 3	RBT Level/s :L1, L2	10 Hours								
Recreational Activities:										

- A. Postural deformities.
- B. Stress management.
- C. Aerobics.
- D. Traditional Games.

Course outcomes:								
At the o	completion of the course. The student shall be able to							
CO1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness							
39								

CO2	Familiarization of health-related Exercises, Sports for overall growth anddevelopment
CO3	Create a foundation for the professionals in Physical Education and Sports
CO4	Participate in the competition at regional/state / national / internationallevels
CO5	Create consciousness among the students on Health, Fitness and Wellness indeveloping and maintaining a healthy lifestyle.

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

Course Title	Yoga for a Better Life - Phase 1	Semester	111
Course Code	YG208	CIE	50
Total No. of Contact Hours	25	SEE	0
No. of Contact Hours/week	0:2:0	Total	50
Credits	0	Exam. Duration	
Teaching Dept			

Course objectives:

1) To enable the student to have good health.

2) To practice mental hygiene.

- 3) To possess emotional stability.
- 4) To integrate moral values.

5) To attain higher level of consciousness.

Semester III	RBT Level/s :L1, L2	25 Hours

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health Rules to be followed during yogic practices by practitioner Yoga its misconceptions, Difference between yogic and non yogic practices.

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting

- 1. Padmasana
- 2. Vajrasana

b. Standing

- 1. Vrikshana
- 2. Trikonasana

c. Prone line

- 1. Bhujangasana
- 2. Shalabhasana

d. Supine line

- 1. Utthitadvipadasana
- 2. Ardhahalasana

Suggested Learning Resources:

Textbooks:

- 1. Yogapravesha in Kannada by Ajitkumar
- 2. Light on Yoga by BKS Iyengar
- 3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
- 4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
- 5. Yoga for Children step by step by Yamini Muthanna

Web links and Video Lectures (e-Resources): Refer links

- <u>https://youtu.be/KB-TYlgd1wE</u>
- https://youtu.be/aa-TG0Wg1Ls

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as;

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

• Physical

- 1. Improved body flexibility and balance
- 2. Improved cardiovascular endurance (stronger heart)
- 3. Improved digestion
- 4. Improved abdominal strength
- 5. Enhanced overall muscular strength
- 6. Relaxation of muscular strains
- 7. Weight control
- 8. Increased energy levels
- 9. Enhanced immune system
- Mental
 - 1. Relief of stress resulting from the control of emotions
 - 2. Prevention and relief from stress-related disorders
 - 3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
 - 1. Life with meaning, purpose, and direction
 - 2. Inner peace and tranquility
 - 3. Contentment

Course outcomes: At the completion of the course. The student shall be able to								
CO1	Understand the meaning, aim and objectives of Yoga.							
CO2	Perform Suryanamaskar and able to Teach its benefits.							
CO3	Understand and teach different types of Pranayama, Asanas by name, its importance, methods and benefits.							
CO4	Instruct Kapalabhati and its need and importance.							

CO5 Coach different types of Kriyas , method to follow and usefulness.

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

	Additional				
Course Title	Mathematics (Common for all				
	branches)				
Course Code	DM209	CIE	50		
Total No. of Contact Hours	30	SEE	50		
No. of Contact Hours/week	2:0:0	Total	100		
Credits	0	3 Hours			
Teaching Dept	MATHEMATICS				

Course objective is to:

- Develop the knowledge of numerical methods and apply them to solve transcendental and differential equations.
- Study the fundamental concepts of vector calculus viz. Gradient, curl and divergence
- Familiarize the importance of Integral calculus and Linear Algebra.

Solution of algebraic and transcendental equations –Newton-Raphson methods. Finite differences, Interpolation and extrapolation using Newton's forward and backward difference formulae, Newton's divided difference Numerical integration: Trapezoidal rule, Simpson's (1/3)rd and (3/8)th rules, Weddle's rule.

Numerical Solution of Ordinary Differential Equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order

Module-2: Ordinary Differential	Equations	RBT Levels L1, L2,L3	6 Hours					
Introduction to first order ordinary differential equations portaining to the applications for Computer								

Introduction to first-order ordinary differential equations pertaining to the applications for Computer
Science & Engineering. Linear and Bernoulli's differential equations. Exact and reducible to exact
differential equations - Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right) = \frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$.

Higher -order linear ordinary differential equations with constant coefficients - Inverse differential operator,

Module-3: Integral Calculus	RBT Levels L1, L2,L3	6 Hours						
Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration								
Modulo 4: Vector Calculus	RBT Levels	Glioura						
Woulle-4. Vector Calculus	L1, L2,L3	OHOUIS						
Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrational vector fields.								
Madula F. Lincar Alashra	RBT Levels	6 Hours						
Wodule-5: Linear Algebra	L1, L2,L3	OHOUIS						

Row reduction and echelon forms- Consistency of System of Equations. Solution sets of linear equations by Gauss Seidel, Gauss Jordan,. Eigenvalues and eigenvectors Rayleigh's power method.

Suggested L	earning Resources:
Textbooks:	
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2.	Erwin Kreyszig - Advanced Engineering Mathematics, Wiley publication, 10th edition, 2015
3	David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018
Reference Bo	poks:
1.	Srimanta Pal & Subodh C Bhunia - Engineering Mathematics, Oxford University Press, 3rd Reprint, 2016.
2.	James Stewart: "Calculus" Cengage Publications, 7thEd., 2019.
3.	Gilbert Strang, Linear Algebra and its Applications, 5th Edition (2016).
4.	N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022. 4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics"
Web links an	d Video Lectures (e-Resources):
https://yout	ı.be/Y7VWyyZ6B0g?si=rhxgG4vvrs3VS7mw
https://yout	ı.be/zT83sJ5IrEE?si=Crb9_clWw4tTJxmj
https://yout	ı.be/9_m36W3cK74?si=h-bd19yVCgLF3VvW
https://yout	u.be/2DX8Vp1Q2-0?si=rQ76vQyXPATricZz
https://yout	u.be/AuUi_bUeTS4

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning: Course Seminars, Quiz, In class assignments.

Course	outcomes: At the end of the course students will be able to
CO1	Apply numerical methods to find the solution of algebraic and transcendental equations.
CO2	Apply numerical methods to find the solution of ordinary differential equations.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Use fundamentals of vectors to find gradient, curl and divergence.
CO5	Test the consistency and solve the system of liner equations .

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

Course Title	UNIX Shell programming and GIT	Semester	
Course Code	CS209	CIE	50
Total No. of Contact Hours	30	Exam. Duration	2 Hours
No. of Contact Hours/week	0:2:0:1	Teaching Dept	CSE
Credits	0		

Course objective is to:

- 1. Help the students to understand the effective use of Shell scripting, commands and terminology.
- 2. Understand UNIX command syntax and semantics.
- 3. Identify, access, and evaluate UNIX file system.
- 4. Read and understand specifications, scripts and programs.
- 5. Familiarize students with basic command of Git
- 6. Understand how to collaborate and work with Remote Repositories

PREREQUISITES : This course requires that the students are familiar with Commands and programming language such as C programming.

Module-1: Introduction to Shell	RBT Levels: L1, L2,L3	6 Hours		
What is shell scripting? Importance of shell scripting, Different types of shells, creating shell script,				
making shell scripting executable, Shell input & output, Pipes and Filters, echo, print, read				
Module-2: System and File Management	RBT Levels: L1, L3	6 Hours		

Stages of a Process, Types of Process Management, Commands Used to Manage Processes like 'ps','top','kill','nice'.'renice','pkill', 'jobs', 'fg',' bg', Job scheduling commands like 'cron', 'at', 'batch'. Different types of Files, working with files, working with Directories, basic File Attributes displaying, searching, comparing, accessing long files and Zip files.

Module-3: User Management	RBT Levels: L1,L3	6 Hours		
Creating Users & Groups, Managing Users and Groups, Create Group, , Create a Account, Modify Account , Delete a Account	e a Group, Modify a Group,	, Delete a		
Module-4: Introduction to Git	RBT Levels:L1,L2,L3	6 Hours		
Setting Up and Basic Commands				

Initialize a new Git repository in a directory. Create a new file and add it to the staging areaand commit the changes with an appropriate commit message.

Creating and Managing Branches

Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master." Write the commands to stash your changes, switch branches, and then apply the stashed changes.

Collaboration and Remote Repositories

Clone a remote Git repository to your local machine. Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch. Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.

Module-5: Git workflows	RBT Levels:L3,L4	6 Hours
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Git Tags and Releases

Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.

Analysing and Changing Git History

Given a commit ID, how would you use Git to view the details of that specific commit,

including the author, date, and commit message? Write the command to list all commits made by the author "John Doe" between "2023-01-01" and "2023-12-31." Write the command to display the last

five commits in the repository's history.

Sugge	Suggested Learning Resources:						
Refere	ence Books:						
1.	Unix Shell Programming, Prof: Yogesh HK						
2.	Unix Shell Programming, Yashwant Kanetkar						
3.	Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022,						
4.	Publisher(s): O'Reilly Media, Inc.						
5.	Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, https://git						

Web links and Video Lectures (e-Resources):

1. Shell Scripting Tutorial

2. Getting Started with Git

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

1. Create Git Project: Personal Portfolio Website

Objective: Create a Git repository for a personal portfolio website. The repository will include a simple HTML file and showcase basic Git operations such as initialization, staging, committing, branching, and merging.

Course	outcomes:
CO1	Ability to understand scripts and programs. Know the basics of Unix concepts and commands.
CO2	Ability to evaluate the UNIX file system and apply Changes in file system.
CO3	Ability to analyze authorizations for different users
CO4	Ability to use the basics commands related to git repository., Create and manage the branches, Apply commands related to Collaboration and Remote Repositories
CO5	Use the commands related to Git Tags, Releases and advanced git operations. Analyse and change the git history.

CO-PC) Maj	pping													
CO/P	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO	PSO
0	1													2	3
CO1	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO2	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO3	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO4	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3

4th SEMESTER

Course Title	Applied Mathematics-IV for Computer Scienceand Engineering Stream(AIML, ISE, CSE, CSE-IOT)		IV
Course Code	MC251	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:2:0:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	Mathematics	•	•

Course objective is to understand:

- The concepts of functions and groups
- The basic concepts of graphs and their properties, and operations of graphs
- Hamiltonian and Euler graphs, trees and matrix representation of the graph.

Module-1	RBT Levels L1,L2,L3	8 Hours

Relations and Functions:

Cartesian Products and Relations, Properties of Relations, Functions – Plain and One-to-One, Onto Functions. Function Composition, and Inverse Functions., Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

Madula 2	RBT Levels			
Widdule-2	L1,L2,L3	δΠOURS		
Group Theory:				
Klein 4-group, Additive group of Integers modulo n, Multiplicative group	of Integers mod	ulo-p and		
permutation groups, Properties of groups, Subgroups, cyclic groups, Cose	ets, Lagrange's T	heorem.		
Modulo 3	RBT Levels			
	L1,L2,L3	8 110013		
Graph Theory :				
Directed graphs, Definition – Application of graphs – finite, infinite and bip	artite graphs – Ir	ncident and		
Degree – Isolated vertex, Pendant vertex and Null graph.				
Paths and circuits- Isomorphism, sub-graphs, walks, paths and circuits, connected graphs,				
disconnected graphs and components.				
Module-4	RBT Levels	8 Hours		
	L1,L2,L3	onours		
Hamilton Cycle and Euler's circuit :				

Eulerian and Hamiltonian Graphs-Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem.

Module-5		RBT Levels L1,L2,L3	8 Hours
Trees:			
Rooted Trees	, Binary trees, counting Trees and Spanning trees. Penda	nt vertices in a tre	ee.
Connectivity	Graphs: Vertex connectivity, Edge connectivity, cut set a	nd cut vertices, Fi	undamental
circuits.			
Suggested Textbooks:	earning Resources:		
1	Narsingh Deo, Graph theory with the applications to ena Dovers Publications, 2016.	gineering & Comp	uter Scienco
2	J.A. Bondy and U.S.R. Murty. Graph theory with Applic 2008.	ations, Springer,	1st edition,
3	Ralph P. Grimaldi-Discrete and Combinatorial Mat Publishing company, 2006.	thematics, Addis	ion Wesley
Reference Bo	poks:		
1	R. Diestel, Graph Theory, free online edition theory.com/basic.html.	ition, 2016: c	liestel-graph
2	Kenneth H. Rosen and Kamala Krithivasn- Discrete Mathema graw Hill publication, 2021.	itics and Its Applica	tions, Mc
3	Robin J. Wilson, Introduction to Graph Theory, Longma	an Group Ltd.,201	.0
Web links an M1: https:// M2: https:// M3: https:// M4: https:// M5: https:// Activity-Base Quiz, Group	d Video Lectures (e-Resources): <u>youtu.be/-peAUmrm4RM</u> <u>youtu.be/utBfKsYUwe8</u> <u>youtu.be/tORLeHHtazM</u> <u>youtu.be/V8F8Wenuo?list=PLhSp9OSVmeyLB62fT9N</u> <u>youtu.be/qNqrHO3woyE</u> ed Learning (Suggested Activities in Class)/ Practical Base Discussions, Seminar, In class assignments	<u>/NbjRkDEzJzzp</u> ed learning	

Course	outcomes: At the end of the course students will be able to
CO1	Apply the basic concepts of relations, functions and partially ordered sets for computer representations
CO2	Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering.
CO3	Apply concepts of trees and graph connectivity to solve real world problems.
CO4	Solve the problems involving characterization and operations on graphs.
CO5	Apply concepts of trees and graph connectivity to solve real world problems.

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

Course Title	Design and Analysis of Algorithms	Semester	IV
Course Code	CS252	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:2:0:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE		

Course objective is to:

- 1. Enable students to learn the methods for analysing algorithms and evaluating their performance.
- 2. Enable students to demonstrate the efficiency of algorithms.
- 3. Prepare students to solve problems using various algorithm design methods
- 4. Appreciate the concepts of P and NP complexity classes.

PREREQUISITES : This course requires that the students are familiar with programming language and Data Structures and Applications. Graph Theory is desirable

Module-1: Introduction and Overview	RBT Levels: L1,L2,L3	8 Hours

Introduction and Examples: What is an Algorithm? Algorithm Specification, Examples from real life: Air Travel, Xerox Shop, Document Similarity and types of algorithms.

Motivation for Performance Analysis using Examples: Bubble Sort, Selection Sort, Insertion Sort, String Pattern Matching. Contrast performance analysis versus actual runs.

Performance Analysis Framework: Space complexity, Time complexity. **Asymptotic Notations:** Big-Oh notation (*O*), Omega notation (Ω), Theta not - recursive and recursive Algorithms with Examples. ation (\Box), Mathematical analysis of non

Text Book 1: Chapter 1.1,2.1-2.4,3.1,3.2 Digital Resource: D1

Module-2: Decrease and Conquer, Divide and Conquer,	PPT Loveley 11 12 12	
Greedy Method	KDT LEVEIS: L1,L2,L5	OHOUIS

Decrease and Conquer Approach: Insertion sort, Topological Sort.

Divide and Conquer: General method, Recurrence equation for divide and conquer, Finding the maximum and minimum. Merge sort, Quick sort

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines,

Text book 1: Chapter 4.1,4.2,5.1,5.2,6.4 Text book 2:4.1,4.3,4.5

Module-3: Greedy Method, Transform and Conquer, Dynamic Programming	RBT Levels:L1,L2,L3	8 Hours

Minimum cost spanning trees: Prim"s Algorithm, Kruskal"s Algorithm, union find method

Single source shortest paths: Dijkstra's Algorithm. **Optimal Tree problem:** Huffman Trees and Codes. **Transform and Conquer Approach:** Heaps and Heap Sort.

Dynamic Programming: General method with Examples, **Transitive Closure:** Warshall's Algorithm, **All Pairs Shortest Paths:** Floyd's Algorithm

	DOOK 1: 9.1,9.2,9.3,9.4,8.1,8.4				
Mod	lule-4: Dynamic Programming, Backtracking	RBT Levels:L1,L2,L3	8 Hours		
Dyn a prob subs	amic Programming (cont): Multistage Graphs, Travelling Sa blem, Bellman-Ford Algorithm, Backtracking: General metho sets problem, Hamiltonian cycles.	ales Person problem, Kna od, N-Queens problem, S	ipsack Sum of		
Text	book 1: 8.2,12.1 text book 2: 5.2, 5.4, 5.9				
Mod Case	dule-5: Space and Time Trade-offs, Branch and Bound and e Studies	RBT Levels:L1,L2,L3	8 Hours		
Coι Kna	unting Sort Branch and Bound: Assignment Problem, T apsack	ravelling Salesperson p	roblem, 0/1		
NP-C	Complete and NP-Hard Problems concept.				
Case calcu cons Sum	e Studies: Efficient Route calculation application in GPS navigulates the optimal route from the user's current location siders factors such as distance, estimated travel time, traffination of all modules.	gation system: The navig to the destination. This ic conditions.	ation syster is calculatio		
Taxt back 1: 7.1. 12.2. 12.2					
IEXL					
Follo	ow on Courses: Advanced Algorithms, Machine Learning				
Follo	ow on Courses: Advanced Algorithms, Machine Learning ources for Advanced Learners:				
Follc Resc	bw on Courses: Advanced Algorithms, Machine Learning burces for Advanced Learners: Data Structures and Algorithms Made Easy – Data Structu Narasimha Karumanchi (M.Tech IIT Bombay, Founder- Ca	res & Algorithmic Puzzle reerMonk.com) 5 th Edit	s Author: ion		
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1. Design and Analysis of Algorithms course by Madhavan Mukund

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

- 1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,
- 2. Demonstration of solution to a problem through programming.

Course	outcomes:
CO1	Apply asymptotic notational method to analyse the performance of the algorithms in terms of
	time complexity
CO2	Demonstrate divide & conquer approaches and decrease & conquer approaches to solve
	computational problems
CO3	Use transform & conquer and dynamic programming methodologies to solve the given real world computational problems
CO4	Explain various classes (P, NP and NP Complete) of problems and demonstrate backtracking, branch & bound and approximation methods.
CO5	Apply appropriate algorithm design strategies to a given case study/use case.

CO-PC) Map	ping													
CO/	PO1	PO	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
РО		2													
CO1	3	3	3	3	-	-	-	-	1	1	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	1	1	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	1	1	-	-	3	-	-
CO4	3	3	3	3	-	-	-	-	1	1	-	-	3	-	-
CO5	3	3	3	3	-	-	-	-	1	1	-	-	3	-	-

Design & Analysis of Algorithms Laboratory						
Course Code	CS253	Semester	IV			
L:T:P:S	0:0:2:1	CIE Marks	50			
Hrs. / Week	2	SEE Marks	50			
Credits	1	Total Marks	100			
Exam Hours	03	·	·			

Course	Course objectives : This laboratory course enables students to				
1.	Train students to design and implement various algorithms in JAVA/C/C++				
2.	Assist students to employ various design strategies for problem solving.				
3.	Enable students to measure and compare the performance of different algorithms.				

Pgm. No.	List of Experiments / Programs	Hours	COs					
	Prerequisite Experiments / Programs / Dem	0						
This cou	his course requires that the students are familiar with programming language and Data Structures &							
Applicati	ons. Graph Theory is desirable.							
	PART-A							
1	Title: Program that uses simple technique to a) search a key b) to sort n elements	2	CO1,CO3					
	Problem Description: Run the program for varied values of n>5000 and record the time taken to search/sort. Plot a graph of the time taken v/s n. The elements can be read from a file or can be generated using the random number generator.							
	Method: A Brute Force- Non recursive algorithm implementation. Sequential Search and Selection Sort.							
	Theory Reference: Module 1							
2	Title: Sorting elements based on their value.	2	CO1,CO3					
	Problem Description: Run the program for varied values of n to demonstrate the behaviour of the algorithm in the Worst, Bestand Average Cases. Record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be							
	read from a file or can be generated using the random number generator for large values of n.							
	Method: A Divide & Conquer approach partitioning the dataset on a pivot- Recursive algorithm implementation.							
	Theory Reference: Module 2							

	Title: Sorting elements in a list by breaking them into sub-lists.		
3	Problem Description: Run the program for varied values of n to demonstrate the behaviour of the algorithm in the Worst, Bestand Average Cases. Record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator for large values of n.	2	CO1,CO3
	Method: A Divide & Conquer- Recursive algorithm implementation- Merge Sort		
	Theory Reference: Module 2		
4	Title: Urban planning of water supply networks	2	CO2,CO3
	Problem Description: Design an optimized water distribution network that minimizes the total cost of the infrastructure while ensuring reliable water supply to all areas in the given region.		
	Method: Represent the problem in the form of a graph. Use the greedy Technique for a spanning tree which has a total minimum weight.		
	Theory Reference: Module 3		
5	Title: Optimal Road Network	2	CO2,CO3
	Problem Description: A local government wants to improve the road network between towns to enhance connectivity and reduce travel costs. The region consists of five towns that need to be connected by the most efficient road network possible, minimizing the total length of the roads while ensuring that each town is accessible from any other town.		
	Method: A greedy Technique for a spanning tree which has atotal minimum weight. Use Union-Find Data Structure to detect cycles during the execution of the algorithm.		
	Theory Reference: Module 3		
			I

	PART-B		
6	Title: Optimal Road Routes	2	CO2,CO3
	Problem Description: You are the chief planner for a		
	transportation department in a country with several cities. The		
	cities are connected by a network of roads, each with a specific		
	travel time (in hours). Your task is to determine the shortest trave		
	time from a designated source city to all other cities.		
	Method: Represent the problem in the form of a graph using		
	adjacency matrix or adjacency list. Using the Single Source		
	Shortest Path Algorithm find the shortest path from the source		
	city to all other cities.		
	Theory Reference: Module 3		
7	Title: Metropolitan Subway System Optimization	2	CO2,CO3
	Problem Description: A metropolitan city is planning to optimize		
	its subway system to ensure efficient travel for its commuters.		
	The subway system consists of various stations connected by		
	subway lines, and each line has a different travel time. The city's		
	transportation authority wants to find the shortest travel time		
	between all pairs of stations.		
	Method: Use Dynamic programming technique to find the		
	shortest travel time between all pairs of stations using the Floyd-		
	Warshall algorithm		
	Theory Reference: Module 3		
8	Title: Optimal Product Selection for a Limited Shelf Space	2	CO2,CO3
	Problem Description: You are a store manager responsible for		
	stocking products on the shelves. The store has limited shelf		
	space, and you want to maximize the total profit by selecting		
	the most valuable products to display. Each product has a		
	specific weight and profit associated with it.		
	Method: Solve the 0/1 Knapsack Problem using dynamic		
	programming or other optimization techniques. The key idea is to		
	build a table that stores the maximum value achievable for		
	different weights and items.		
	Theory Reference: Module 4		

0			
9	Title: Event Budget Allocation	2	CO2,CO3
	Problem Description: An event planner is organizing a conference and		
	has a fixed budget to allocate across various categories such as venue,		
	catering, speakers, and marketing. Theplanner needs to ensure that the		
	total expenditure does notexceed the budget while maximizing the		
	guality of the event. Setof Expenses (with costs): Venue rental-\$5000,		
	Catering-		
	\$2000, Keynote Speaker-\$3000, Marketing-\$1500, Audio/Visual		
	Equipment-\$1000. Given Fixed budget-\$8000		
	Method: Use backtracking technique to solve the problem.		
	Theory Reference: Module 4		
10	Title: Delivery Route Optimization.	2	CO2,CO3
	Problem Description: Imagine a delivery company that operates in a city		
	with five key delivery locations. The company needs to design a route		
	for their delivery vehicle that visits each location exactly once and		
	returns to the starting point without retracing its steps.		
	Method: Given a graph representing the locations as vertices and the		
	roads between them as edges, determine whether a Hamiltonian Circuit		
	exists. If it does, find the circuit.		
	Theory Reference: Module 4		
	Theory Reference: Module 4		
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Beyon 1. 2. 3. Sugge Textl 1 2 Web li 1. http 2. http 3. http 4. http 5. http Activit	PART-C N-Queens problem Topological Sorting Heap Sort ested Learning Resources: books: Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd 2009.Pearson. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Universities Press inks and Video Lectures (e-Resources): o://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html os://nptel.ac.in/courses/106/101/106101060/ o://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html o://cse01-iiith.vlabs.ac.in/ o://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToc ty-Based Learning (Suggested Activities in Class)/ Practical Based learning	Editio	on, on, 2014, rithms
Beyon 1. 2. 3. Sugge Textl 1 2 Web li 1. http 2. http 3. http 4. http 5. http Activit 1.	PART-C d Syllabus Virtual Lab Content N-Queens problem Topological Sorting Heap Sort ested Learning Resources: books: Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd 2009.Pearson. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Universities Press inks and Video Lectures (e-Resources): c://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html os://nptel.ac.in/courses/106/101/106101060/ o://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html o://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroTot ty-Based Learning (Suggested Activities in Class)/ Practical Based learning Real world problem solving and puzzles using group discussion. E.g., Fake col	Editio Editio	on, on, 2014, rithms ntification,
Beyon 1. 2. 3. Sugge Textl 1 2 Web li 1. http 2. http 3. http 4. http 5. http 4. http 1. Peasar	PART-C d Syllabus Virtual Lab Content N-Queens problem Topological Sorting Heap Sort ested Learning Resources: books: Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd 2009.Pearson. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Universities Press inks and Video Lectures (e-Resources): o://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html os://nptel.ac.in/courses/106/101/106101060/ o://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html o://cse01-iiith.vlabs.ac.in/ o://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroTot ty-Based Learning (Suggested Activities in Class)/ Practical Based learning Real world problem solving and puzzles using group discussion. E.g., Fake cont nt, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,	Editio Editio	on, on, 2014, rithms ntification,

Course o	putcomes:
CO1	Choose appropriate algorithm design techniques like divide and conquer, Decrease and conquer, Transform and conquer to develop solutions to the computational and complex problems.
CO2	Develop programs to solve computational problems using greedy method, Dynamic programming, Backtracking algorithm design strategies.
CO3	Compare algorithm design strategies by developing equivalent programs and observing running times for empirical analysis.

CO-PC) Марр	ing													
CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
0															3
CO1	3	3	3	3	3	-	-	-	-	-	-	1	3	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	1	3	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	1	3	-	-

Course Title	Microprocessor & Microcontrollers	Semester	IV
Course Code	CS254	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	3: 0: 2:2	Total	100
Credits	4	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE	·	

PREREQUISITES: Digital Design and Computer Organization, C Programming.

Course objective is to:

- Enable students to understand the fundamentals of 8086 Microprocessors.
- Assist students to familiarize themselves with 8086 Microprocessor programming.
- Help students to understand the fundamentals of ARM Microcontroller.
- Train students to develop Assembly Level Programming using various instruction sets to program the Microcontrollers.
- Prepare students to learn New Architecture and engage in a Case study.

Module-1: Overview and Architecture of 8086	RBT Levels:L1, L2	10 Hours					
Microprocessor vs Microcontroller, Applications of Microcontrollers, contemporary study on different microprocessors and microcontrollers (8051, PIC, ARM), Introduction of 8086: Register Organization of 8086,8086 microprocessor architecture, Machine language Instruction format, Addressing modes of 8086.							
Text Book 1: 1.1,1.2,2.1,2.2							
Module-2: Instruction Set of 8086	RBT Levels:L1, L2, L3	10 Hours					
Instruction set of 8086, Assembler directives and operators, A Coding the Program, Assembly language example program Text Book 1: 2.3,2.4,3.1,3.2,3.4	few Machine Level Program	n, Machine					
Module-3: Introduction to ARM	RBT Levels:L1, L2, L3	10 Hours					
The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions Textbook 2: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5							
Module-4: ARM Instruction Set	RBT Levels:L1, L2, L3	10 Hours					
Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instructions, Program Status Register Instructions, Loading Constants.							
Textbook 2: Chapter 3 - 3.1 to 3.6							

Module-5: Emerging Architecture: RISC-V	RBT Levels:L1, L2	10 Hours
Introduction, Assembly Language, Programming, Machitype instructions), Evolution of the RISC-V.	ine Language (R-type, I-type, S/B	type, U/J-
Case Study: Ibex core for real time applications.		
Textbook 3: Chapter 6 – 6.1 to 6.4 and 6.7		
Follow-on Courses: Embedded Systems, Internet of Th	nings, Advanced Computer Archi	tecture.
Topics for Advanced Learners:		
Advanced RISC-V		
Embedded System Design		
Resources for Advanced Learners:		
David A. Patterson & John L. Hennessy, Computer Orga	nization and Design RISC-V Edition	on.
https://www.youtube.com/watch?v=GySwSvU3Ak4		
https://elearn.nptel.ac.in/shop/nptel/introduction-to-er	mbedded-system-	

Textbooks:

1	Advanced Microprocessors and Peripherals, K M Bhurchandi, A K Ray, 3rd Edition Carl
±.	Hamacher, Tata McGraw Hill.
2	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier,
2.	Morgan Kaufman publishers, 2008.
3.	Sarah L. Harris, David Harris, Digital Design and Computer Architecture RISC-V Edition.
Referer	nce Books:
1.	The Intel Microprocessors, Barry B. Brey,8 th Edition, Prentice Hall
2.	The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005.
2.	
3.	David A. Patterson & John L. Hennessy, Computer Organization and Design RISC-V Edition.
Web lin	iks and Video Lectures (e-Resources):
https://	archive.nptel.ac.in/courses/106/105/1061051
<u>93/ http</u>	os://riscv.org/
https://	onlinecourses.nptel.ac.in/noc23_cs113/previ
<u>ew</u>	
Activity	r-Based Learning (Suggested Activities in Class)/ Practical Based learning
4. F	lipped class room

5. Presentation

Course	outcomes:
CO1	To understand 8086 Microprocessor Architectural features.

CO2	To use 8086 Microprocessor Instruction set.
CO3	To understand ARM Architectural features.
CO4	To use ARM Instruction Set.
CO5	To understand RISC-V Architecture and apply Instruction Set.

r															
CO-PC) Мар	ping													
CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
0															
CO1	2	3	3	-	2	2	-	-	-	-	-	2	3	3	-
CO2	2	3	3	-	2	2	-	-	-	-	-	2	3	3	-
CO3	2	3	3	-	2	2	-	-	-	-	-	2	3	3	-
CO4	1	3	3	-	2	2	-	-	-	-	-	2	3	3	-
CO5	1	3	3	-	2	2	-	-	-	-	-	2	3	3	-

Microprocessor and Microcontroller Laboratory							
Course Code	CS255	Semester	IV				
L:T:P:S	0:0:2:1	CIE Marks	50				
Hrs. / Week	2	SEE Marks	50				
Credits	1	Total Marks	100				
Exam Hours	03	·					

Cour	Course objectives: This laboratory course enables						
1.	To introduce students with the architecture and instruction set of x86 microprocessors and ARM microcontrollers.						
2.	To familiarize the students with the programming of x86 microprocessors and ARM microcontrollers.						
3.	To learn interfacing of microcontrollers.						

Pgm.	List of Experiments / Programs	Hours/Week	COs							
No.		Hoursy week								
	PART-A									
Write	Assembly Language program using x86 instructions for the following ar	nd execute the s	same.							
1	Read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriated messages. Also display the length of the stored strings.	2	CO1							
2	Simulate a Decimal Up-counter to display 00-99.	2	CO1							
3	Compute nCr using recursive procedure. Assume that 'n' and 'r' are non- negative integers	2	CO1							
4	Sort a given set of 'n' numbers in ascending and descending orders using the Bubble Sort algorithm.	2	CO1							
5	Read the current time from the system and display it in the standard format on the screen.	2	CO1							
	PART-B									
Conduc Embed	Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler.									
6	i) Interface a Stepper motor and rotate it in clockwise and anti- clockwise direction.ii) Interface and Control a DC Motor.	2	CO2,CO3							
7	Display "Hello World" message using Internal UART.	2	CO2, CO3							

8	Display the 4 digit counter sequence 000, 001,FFF on a 7- segment LED interface, with an appropriate delay in between .	2	CO2, CO3
9	Determine Digital output for a given Analog input using Internal ADC of ARM controller.	2	CO2, C 3
10	Interface a 4x4 keyboard and display the key code on an LCD.	2	CO2,CO3

Conduct of Practical Examination:

Experiment distribution : Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

Mark distribution: Part A = 40% Marks, Part B = 60 % Marks

Course outcomes:

CO1: Understand and apply the fundamentals of assembly level programming of x86 microprocessors.

CO2: Develop embedded C programs for ARM microcontrollers.

CO3: Understand the interfacing of ARM microcontrollers in real world applications.

CO-PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2		-	-	2	-	2	-	-	2	2	2
CO2	1	2	2	2	-	-	-	2	-	2	-	-	1	1	1
CO3	1	2	2	2	-	-	-	2	-	2			2	2	2

	Web		
Course Title	Programming	Semester	IV
Course Code	CS256	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:0:2:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE		

Course objective is to:

- 1. Enable the students to design layouts of web pages.
- 2. Enable students to Client and Server-Side Programming
- 3. Enable students to understand Data-base Connectivity aspects in web applications.
- 4. Enable students to add dynamic content to web pages.
- 5. Enable students to develop end-to-end web applications.

PREREQUISITES : Basic Programming Skills

Module-1: Introduction and Overview

RBT Levels:L1,L2,L3 8 Hours

Web Basics and Overview: Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Toolbox.

Introduction to HTML: What is HTML and Where did it come from? ,HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, frames

HTML5 Semantic Structure Elements: Header and Footer, Heading Groups, Navigation, Articles and Sections, figure and Figure captions, Aside.

Textbook: T1

Experiential Learning: (Experiments which can be conducted on the concepts of contents)

- 1. Write an HTML program for the demonstration of Lists. a. Unordered List b. Ordered List c. Definition List d. Nested List.
- Write an HTML program for demonstrating Hyperlinks. a. Navigation from one page to another.
 b. Navigation within the page.
- 3. Write an HTML program for timetable generation using tables.
- 4. Write an HTML program to develop a static Home Page using frames.
- 5. Write an HTML program to develop a static Registration Form.

6. Write an HTML program to develop a static Web Page for Shopping Cart.

HTML5:

https://www.studocu.com/row/document/national-textile-university/web-development/lecture-4-5- html-5-lab-manual/48995731

Module-2: Layout Design of Web Pages	RBT Levels:L1,L2,L3	8 Hours					
Cascading Style Sheets: Introduction to CSS. What is CSS? CSS Sy	ntax, Location of Styles, Se	lectors, The					
Cascade: How Styles Interact, The Box Model, CSS Text Styling.							
Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.							
Textbook: T1							
Experiential Learning: (Experiments which can be conducted on	the concepts of contents))					
 Write HTML for demonstration of cascading stylesheets. a External style sheets. c. Inline styles. 	a. Embedded stylesheets.	b.					
 Design a web page using CSS which includes the following ii. Set a background image for both the page and single e for links iv. Working with layers v. Adding a Customized 	: I. Use different font and element on the page. iii. D cursor	text styles efine styles					
Module-3: Client-Side Scripting	RBT Levels:L1,L2,L3	8 Hours					
JavaScript: client-side scripting		1					
What Is JavaScript and What can it do? JavaScript Design princi JavaScript object, form	ples, where does script go	? Syntax,					
Textbook:T1 Experiential Learning: (Experiments which can be conducted on	the concents of contents						
conducted on	the concepts of contents,)					
1. Write a JavaScript to design a simple calculator to perfor	m the following operatior	ns:					
sum, product, difference, and quotient.							
 Write a JavaScript that calculates the squares and cubes of t outputs HTML text that displays the resulting values in an I Write a JavaScript code that displays text "TEXT-GROWI interval of 100 ms in RED COLOR, when the font size reacher in BLUE colour. Then the font size decreases to 5 pt. Develop and demonstrate a HTML5 file that includes JavaS following problems: 	 Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100 ms in RED COLOR, when the font size reaches 50 pt it displays "TEXT- SHRINKING" in BLUE colour. Then the font size decreases to 5 pt. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the fallewing methods. 						
1. Parameter: A string							
2. Output: The position in the string of the left-most vo	owel						
3. Parameter: A number	dar						
4. Output: The number with its digits in the reverse on	uer						
5. Write a JavaScript program to validate USER LOGIN pa	ge.						
6. Write a JavaScript program for validating REGISTRATION		8 Hours					
Introduction to Server-Side Development with PHP: What Is Se PHP, Program control, function, PHP arrays and Super-global: A Arrays.	rver-side Development? C rrays, S_GET and \$_POST	Quick Tour of super global					
Textbook T1							
Develop and demonstrate PHP Script for the following proble 1. Write a PHP Script to find out the Sum of the Individual Dig 2. Write a PHP Script to check whether the given number is Pa	ems: its. alindrome or not						

1. Write a program using PHP and HTML to create a form and display the details entered by the user

2. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.

3. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.

Module-5: Web Application Development	RBT Levels:L2,L3	8 Hours
Working with Databases:		

Databases and Web Development, SQL, PHP. MySQL API, Accessing MySQL in PHP.

Textbook: T1

Experiential Learning: (Experiments which can be conducted on the concepts of contents)

- 1. Create an HTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
- 2. Write a PHP program to insert the details entered by the user in the Registration form into MySQL database.
 - 3. Activity Based Learning (Suggested Activities in Class)/ Practical Based learning Mini Project:

Case Study:

Photo Sharing Web Application among friends and relatives (after travel, special occasions) **Follow on Courses:** Mobile Application and Web Technologies, Frameworks and MVC (AngularJS), React, python (Django, Flask, pip)

Resources for Advanced Learners:

- 1. PROGRAMMING THE WORLD WIDE WEB Robert W Sebesta, 4th Edition, Pearson Education, 2008
- David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1 st Edition, O"Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014
- 3. Uttam K.Roy, "Web Technologies", Oxford publishers.
- 4. An Introduction to Web Design and Programming –Wang-Thomson
- JavaScriptTM for programmers Deitel Developer series , Indian edition published by Dorling Kindersley India Pvt Ltd, Copyright 2010.

Suggested Learning Resources:

Textbooks:

1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson							
	Education India. (ISBN:978-9332575271)							
Webl	Web links and Video Lectures (e-Resources):							

- 1. Web Development (w3schools.com)
- 2. Web Technology GeeksforGeeks
- 3. <u>Web Technology Course (swayam2.ac.in)</u>

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

Mini Project

Course outcomes:					
CO1	Adapt HTML and CSS syntax and semantics to build web pages.				
CO2	Construct and visually format tables and forms using HTML and CSS				
CO3	Develop Client-Side Scripts using JavaScript				
CO4	Develop Server-Side Scripts using PHP to generate and display the contents dynamically.				

CO-PO Mapping															
CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
0															
CO1	3	2	3	-	-	-	-	-	-	-	-	2	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	-	2	3	2	2
CO3	3	2	3	-	2	-	-	-	-	-	-	2	3	2	2
CO4	3	2	3	1	2	-	-	-	1	1	-	2	3	2	2

	Finite Automata		
Course Title	and Formal	Semester	IV
	Language		
Course Code	CS261	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0:1.5	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	CSE/ISE		

Course objective is to:

- 1. To introduce the concepts of formal languages, grammar, and finite automata.
- 2. Enable students to learn and apply formal mathematical models to prove Grammar and Automata.
- 3. Help students to understand and apply finite state machines to solve problems in computing.
- 4. Make students understand the limitations of computation.

PREREQUISITES : This course requires that the students are familiar with Discrete Mathematical Structures, Graph Theory, and Analysis & Design of Algorithms (BCS401)

Module-1: Overview of Automata Theory	RBT Levels:L1,L2	7 Hours				
Mathematical Preliminaries: Sets, Graphs & Trees, Proof Techniques.						

Motivation: Modelling Hardware and Software Systems as Finite State Machines. A high-level introduction to Automata theory and its applicability to various domains.

Introduction to Automata: The Central Concepts of Automata Theory, Chomsky Hierarchy.

Digital Resource: D1. Textbook: 2 (1.1, 1.2, 11.4)

Module-2: Introduction to Finite Automata and Regular	RBT Levels:L1,L2	9 Hours
Languages		

Finite Automata: Deterministic Finite Automata; Nondeterministic Finite Automata; Conversion of NFA to DFA; Finite Automata with Epsilon-Transitions: Epsilon Closure, Conversion of Epsilon NFA to DFA, Equivalence and Minimization of Automata: Minimization using Table Filling Method.

Regular Expression and Languages: Regular Expressions; Finite Automata and Regular Expressions: Conversion using State Elimination & Kleene's Theorem, Conversion of Regular Expression to DFA.

Textbook:1 (2.1, 2.2, 2.3, 2.4, 3.1, 3.2**)**

Module-3: Properties of Regular Languages and Context-Free Grammars	RBT Levels:L1,L2,L3	9 Hours
Properties of Regular Languages: Proving Languages not to be Regular Languages using Pumping		

Properties of Regular Languages: Proving Languages not to be Regular Languages using Pumping Lemma.

Context-Free Grammars and Languages: Context-Free Grammars. Parse trees, Ambiguity in Grammars and Languages, Simplification of Context-free Grammars

Textbook: 1 (4.3, 5.1, 5.2, 6.1)

Properties of Context-Free Languages: Normal forms for CFGs (CNF & GNF).

Pushdown Automata: Definition of the Pushdown Automata; Deterministic Pushdown Automata.

Textbook: 1 (6.2, 7.1, 7.2)

Module-5: Turing Machine, Decidability and Complexity	RBT Levels:L1,L2,L3	8 Hours
Introduction To Turing Machine: The Turning Machine, Turing Thes	is, Variants of Turing	
Machine, Turing Machine with Complex Storage, Halting Problem		

Decidability: Recursive Language & Recursively Enumerable Language; Post's Correspondence problem.

Complexity: Efficiency of Computation, The Classes P and NP, Some NP Problems. Any

one of the following Case Studies:

Case Study: Elevator Control System

Model an elevator control system for a multi-floor building using automata theory. The system must handle requests from different floors efficiently, incorporating static and dynamic policies for halting. Also, it should dynamically adjust its behavior based on the load inside the elevator. Additionally, the system must handle emergencies such as power outages or system failures, ensuring safety and reliability. The automata involved should include components for request handling, movement control, door management, floor indication, load management, and emergency handling. Analysis can consider inflow and outflow on various floors and suggest better policies for lift operation.

Case Study: Network Control

Consider a scenario where a network experiences link failures due to hardware faults or network congestion. Model a Finite automata that can adapt to these changes by rerouting traffic along alternate paths, avoiding failed links and minimizing packet loss and latency. The finite automata representing routers continuously update their states and routing tables based on feedback from neighboring routers and network monitoring systems, ensuring that data packets reach their destinations efficiently despite the network disturbances.

Case Study: Natural Language Processing

Consider problem of tokenization with FSA for NLP that breaks down raw text into manageable units (words, numbers, punctuation) for further processing and analysis. The goal is to model a single, efficient FSA for text tokenization, focusing on efficient character separation and improvement at each step. Build an FSA to recognize individual characters, modify it to differentiate words from non-word characters based on transitions, and then modify it to identify and separate number sequences.

Textbook:1 (9.1, 9.3, 10.1, 10.2, 10.4, 10.5, 11.1, 12.1, 12.3, 14.1, 14.4, 14.5), Reference book: 1

Follow on Courses: Compiler Design, Natural Language Processing

Resources for Advanced Learners:
1. Kavi Mahesh, Theory of Computation: A Problem-solving Approach, John Wiley & Sons, Limited, 2012.

Suggested Learning Resources:

Textbooks:

1.	Peter Linz, An introduction to formal languages and automata, Jones and Bartlett Learning, 4th				
	Edition, 2009.				
2.	Christel Baier, Joost-Pieter Katoen, Principles of Model Checking, The MIT Press				
	Cambridge, Massachusetts London, England, 2008				
Refere	ence Books:				
1	Elain Rich, "Automata, Computability and Complexity: Theory and Applications", Pearson				
1.	Prentice Hall, 2019.				
Web li	inks and Video Lectures (e-Resources):				

NPTEL course on Model Checking by Prof. Srivathsan B.

https://onlinecourses.nptel.ac.in/noc20_cs38/preview

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

Flipped Class room

Course	Course outcomes:				
CO1	Understand the fundamental concepts of computational theory.				
CO2	Analyze the usage of finite automata in different areas of computer science.				
CO3	Design the models for various complex problems.				
CO4	Apply formal mathematical models to prove properties of formal languages				

CO-P	'O Ma	pping													
CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
PO															3
CO1	2	2	3	2	-	3	1	1	2	1	1	1	2	2	2
CO2	2	2	3	2	-	3	1	1	2	1	1	1	2	2	2
CO3	2	2	3	2	-	3	1	1	2	1	1	1	2	2	2
CO4	2	2	3	2	-	3	1	1	2	1	1	1	2	2	2

Course Title	Optimization Techniques	Semester	IV		
Course Code	CSE262	CIE	50		
Total No. of Contact Hours	40	SEE	50		
No. of Contact Hours/week	3:0:0.1.5	Total	100		
Credits	3	Exam. Duration	3 Hours		
Teaching Dept.	CSE/ISE				
Prerequisites: Engineering Mathematics					

Course objectives:

- 1. The objective of this course is to make students to learn principles of optimization
- 2. To implement the optimization Concepts for the structural engineering problems.
- 3. To evaluate different methods of optimization.

Modules

Module-1RBT Level: L1, L28 HoursIntroduction: Introduction to optimization, engineering applications of optimization, Formulation of
structural optimization problems as programming problems. Optimization Techniques: Classical
optimization techniques, single variable optimization, multivariable optimization with no constraints,
unconstrained minimization techniques and algorithms constrained optimization solutions by penalty
function techniques, Lagrange multipliers techniques and feasibility techniques.

Module-2RBT Level: L1, L2, L38 HoursLinear Programming: Linear programming, standard form of linear programming, geometry of linear
programming problems, solution of a system of linear simultaneous equations, pivotal production of
general systems of equations, simplex algorithms, revised simpler methods, duality in linear
programming.

Module-3	RBT Level: L2, L3	8 Hours
Non-linear programming: Non-linear programming, one dimension	nal minimization method	s, elimination
methods, Fibonacci method, golden section method, interpola	ation methods, quadrat	ic and cubic
methods, Unconstrained optimization methods, direct search m	ethods, random search	methods,
descent methods		

 Module-4
 RBT Level: L2, L3. L4
 8 Hours

 Constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different technique

Module-5

RBT Level: L2, L3. L4 8 Hours

Geometric programming: Geometric programming, conversion of NLP as a sequence of LP/ geometric programming. Dynamic programming: Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming

Course outcomes:		
On completion of this course, students are able to:		
CO1:Achieve Knowledge of design and development of problem solving skills. CO2:		
Understand the principles of optimization.		
CO3: Design and develop analytical skills.		
CO4: Summarize the Linear, Non-linear and Geometric Programming CO5:		
Understands the concept of Dynamic programming		
Question paper pattern:		
The question paper will have ten questions.		
There will be 2 full questions (with a maximum of four sub questions) from eachmodule.		
Each full question will have sub questions covering all the topics under a module.		
The students will have to answer 5 full questions, selecting one full question from eachmodule.		
Reference Books:		
1. Spunt, "Optimum Structural Design"- Prentice Hall		

- 2. S.S. Rao, "Optimization Theory and Practice"- Wiley Eastern Ltd.
- 3. Uri Krisch, "Optimum Structural Design"- McGraw Hill
- 4. Richard Bronson, "Operation Research"- Schaum's Outline Series
- 5. Bhavikatti S.S.- "Structural optimization using sequential linear programming"- Vikas publishing house

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=wEdZLKMMZ8o&list=PLwdnzlV3ogoXKKb9nABDWYltTDgi37IYD https://www.youtube.com/watch?v=GMTvoKRfxQw&list=PLGbjwqYC00hsy6XGalOBAphm2tdeLbgK0 https://www.youtube.com/watch?v=fszNBvdfKrY

Skill Development Activities Suggested

Conduction of technical seminars on recent research activities

• Group Discussion

		РО									
со	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3		3					3	3	3
CO2	3	3		3					3	3	3
CO3	3	3		3					3	3	3
CO4	3	3		3					3	3	3
CO5	3	3		3					3	3	3

Course Title	Special Topic	Semester	IV
Course Code	CS271	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/Week	2:0:0:1	Total	100
Credits	2	Exam. Duration	3 Hours
Teaching Dept.	CSE/ISE	•	•

Course objective: To enable students

- 1. Explore and understand emerging technologies and research domains.
- 2. Develop skills in selecting and defining a special topic within emerging technologies.
- 3. Conduct in-depth study and analysis of a selected special topic.
- 4. Design and develop a proof-of-concept, prototype, or study paper related to the special topic.

Module 1: Exploration into Emerging Technologies /Research Domains	RBT Levels: L1, L2	6 Hours			
Module 2: Selection of Special Topic	RBT Levels: L1, L2	6 Hours			
Module 3: Exploration & Study of Special Topic	RBT Levels: L1, L2	6 Hours			
Module 4: Preparation of Proof-of-Concept, Prototype or Study Paper Related to Special Topic	RBT Levels: L1 ,L2,L3	6 Hours			
Module 5: Demonstration & Report	RBT Levels: L1, L2	6 Hours			
Suggested Learning Resources:		-			
1. Online resources and articles					
2. Guest lectures from industry experts					
Course outcomes: At the completion of the course. The student shall be able to					
CO1 Identify and evaluate a surgery and future transferred					

01	Identify and explain current and future trends in emerging technologies
CO2	Conduct thorough research and analysis on a selected special topic.
CO3	Apply critical thinking, problem-solving, and communication skills in the context of emerging technologies
CO4	Design and develop innovative solutions, prototypes, or study papers related to the special topic

Indicative Topics

Domains	Sample Topics		
Computer Vision & Image Processing	Deep Learning for Computer Vision, Image Understanding and Analysis, Computer Vision for Robotics and Autonomous Systems, Medical Image Analysis, 3D Computer Vision, Edge AI for Computer Vision.		
Soft Computing	Fuzzy Logic and Systems, Neural Networks and Deep Learning, Soft Computing for Image Processing, Soft Computing for Natural Language Processing, Hybrid Soft Computing Models, Soft Computing for Robotics and Autonomous Systems.		
76			

Cloud & Edge	oud Infrastructure and Architecture, Cloud Security and Compliance, Cloud				
Computing	Migration and Deployment, Edge AI and Machine Learning, Edge Computing				
	for IoT and 5G, Cloud-Edge Application Development.				
Cyber Security & TC	Cyber Security and TC for Smart Cities, Cyber Security and TC for				
	Autonomous Vehicles, Cyber Security and TC for Autonomous Vehicles.				
Software	Digital Twin Architecture, Serverless Architecture and Computing,				
Architecture &	Blockchain Architecture and Development, Software Architecture for Edge				
Information	Computing, Information Management for IoT and Edge Computing				
Management					
Programming Paradigm	Object-Oriented Programming, Functional Programming, Declarative				
& its Applications	Programming, Event-Driven Programming				

Note: A dedicated teacher facilitator will be allotted to coordinate and to track progress, while students will be mentored by expert guides from their chosen domains, ensuring a comprehensive and industry-informed learning experience.

Course Title	UNIX Shell programming and GIT	Semester	IV
Course Code	CS272	CIE	50
Total No. of Contact Hours	30	Exam. Duration	2 Hours
No. of Contact Hours/week	2:2:0:1	Teaching Dept	CSE/ISE
Credits	2		

Course objective is to:

- 7. Help the students to understand the effective use of Shell scripting, commands and terminology.
- 8. Understand UNIX command syntax and semantics.
- 9. Identify, access, and evaluate UNIX file system.
- 10. Read and understand specifications, scripts and programs.
- 11. Familiarize students with basic command of Git
- 12. Understand how to collaborate and work with Remote Repositories

PREREQUISITES : This course requires that the students are familiar with Commands and programming language such as C programming.

Module-1: Introduction to Shell	RBT Levels: L1, L2,L3	6 Hours	
What is shell scripting? Importance of shell scripting, Different types of shells, creating shell script,			
making shell scripting executable, Shell input & output, Pipes and Filters, echo, print, read			
Module-2: System and File Management	RBT Levels: L1, L3	6 Hours	

Stages of a Process, Types of Process Management, Commands Used to Manage Processes like 'ps','top','kill','nice'.'renice','pkill', 'jobs', 'fg',' bg', Job scheduling commands like 'cron', 'at', 'batch'. Different types of Files, working with files, working with Directories, basic File Attributes - displaying, searching, comparing, accessing long files and Zip files.

Module-3: User Management	RBT Levels: L1,L3	6 Hours
Creating Users & Groups, Managing Users and Groups, Create Group, , Create a Account, Modify Account , Delete a Account	a Group, Modify a Group,	Delete a

Module-4: Introduction to Git	RBT Levels:L1,L2,L3	6 Hours

Setting Up and Basic Commands

Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.

Creating and Managing Branches

Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master." Write the commands to stash your changes, switch branches, and then apply the stashed changes.

Collaboration and Remote Repositories

Clone a remote Git repository to your local machine. Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch. Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.

20.06.2

Module-5: Git workflows	RBT Levels:L3,L4	6 Hours

Git Tags and Releases

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Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.

Analysing and Changing Git History

Given a commit ID, how would you use Git to view the details of that specific commit,

including the author, date, and commit message? Write the command to list all commits made by the author "John Doe" between "2023-01-01" and "2023-12-31." Write the command to display the last

five commits in the repository's history.

Sugg	Suggested Learning Resources:						
Refere	ence Books:						
1.	Unix Shell Programming, Prof: Yogesh HK						
2.	Unix Shell Programming, Yashwant Kanetkar						
3.	Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022,						
4.	Publisher(s): O'Reilly Media, Inc.						
5.	Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, https://git						
Web l	inks and Video Lectures (e-Resources):						
3. She	Il Scripting Tutorial						

4. Getting Started with Git

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

1. Create Git Project: Personal Portfolio Website

Objective: Create a Git repository for a personal portfolio website. The repository will include a simple HTML file and showcase basic Git operations such as initialization, staging, committing, branching, and merging.

Course	outcomes:
CO1	Ability to understand scripts and programs. Know the basics of Unix concepts and commands.
CO2	Ability to evaluate the UNIX file system and apply Changes in file system.
CO3	Ability to analyze authorizations for different users
CO4	Ability to use the basics commands related to git repository., Create and manage the branches, Apply commands related to Collaboration and Remote Repositories
CO5	Use the commands related to Git Tags, Releases and advanced git operations. Analyse and change the git history.

20.06.2

CO-PO Mapping															
CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS O1	PSO 2	PSO3
CO1	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO2	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO3	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO4	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	2	1	-	-	-	-	-	-	-	3	3	3

High-3, Medium-2, Low-1

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Course Title	Indian Knowledge Systems	Semester	IV
Course Code	CS273	Duration of CIE	2 hours
Total No. of Contact Hours	30	Credits	2
No. of Contact Hours/week	2:0:0:1	Teaching Dept.	CSE/ISE

Course objective is to:

- 1. Introduce students to the vast body of Indian Knowledge
- 2. Familiarize students with the Vedic Corpus
- 3. Make students aware of plurality of philosophical traditions in India and harmony among them.
- 4. Orient students to wisdom through ages as found in Puranas, Itihasa and other texts.
- 5. Inspire students by making them aware of early advances in Mathematics in India.

PREREQUISITES : None.		
Exposure to Sanskrit is desirable.		
Module-1: Introduction to the Indian Knowledge Systems	RBT Levels:L1,L2	6 Hours
Do we need Indian Knowledge Systems? Importance of	ancient knowledge. Defi	ning Indian
Knowledge Systems. The IKS Corpus – A Classification	Framework. Caturdasha-V	'idyashtana.
Historicity of IKS. Some unique aspects of IKS.		
T1: 1.1-1.6		
Module-2: Vedic Corpus	RBT Levels:L1,L2	6 Hours
Introduction to Vodas, The four Vodas, The Four Divisions of Fa	sch Voda Vodangas Vodic I	ifo T1:
incroduction to vedas. The four vedas. The Four Divisions of Ea	ich veua, veualigas, veuic i	lie II.
2.1-2.5		
Module-3: Indian Philosophical Systems	RBT Levels:L1,L2	6 Hours
Indian Philosophical Systems – Development and Features. Ve	dic schools of philosophy. S	ankhva
and Yoga schools of philosophy, Nyaya and Vaisheshika Schoo	l of philosophy, Purva-Mim	ansa
andVednata Schools of Philosophy, Non-Vedic philosophical sy	/stems	
11:3.1-3.6		
Module-4: Wisdom through the Ages	RBT Levels:L1,L2	6 Hours
Puranas, Ithihasa as a Source of Wisdom, Ramayana, Mahabha	irata, Niti-Sastras, Subhashi	ta
T3: 4.1-4.6		
Module-5: Indian Mathematics	RBT Levels:L1,L2,L3	6 Hours
Unique aspects of Indian Mathematics, Great Mathematicia	ns and their Contributions	5,
Arithmetic, Geometry, Trigonometry, Algebra, Binary mathema	atics and combinatorial algo	prithms,
magic squares		

T1:8.1-8.8

20.06.2

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Follow on Courses:

Resources for Advanced Learners:

https://nptel.ac.in/courses/111101080

Sugg	sested Learning Resources:
1.	Introduction to Indian Knowledge System, Concepts and Applications, B.Mahadevan, Vinayak
	Rajat Bhat, Nagendra Pavana R.N., Prentice-Hall India, 2022
Web	links and Video Lectures (e-Resources):

1. 2. https://onlinecourses.swayam2.ac.in/imb24_mg21/preview

https://onlinecourses.swayam2.ac.in/imb23 mg53/preview

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

Presentation

Course o	Course outcomes:					
CO1	Awareness of Indian Knowledge Systems and its vast scope.					
CO2	Awareness of Vedic Corpus and ability to understand the components					
CO3	Appreciation of pluralistic philosophical tradition in India					
CO1	Awareness of repositories of wisdom in Indian tradition and how they flow into day-to-day					
04	lives.					
CO5	Awareness and appreciation of early advances made in India in the field of mathematics					

CO-PO Mapping															
CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PO															
CO1	-	3	-	-	-	-	-	3	-	-	-	3	-	-	-
CO2	-	3	-	-	-	-	-	3	-	-	-	3	-	-	-
CO3	-	3	-	-	-	-	-	3	-	-	-	3	-	-	-
CO4	-	3	-	-	-	-	-	3	-	-	-	3	-	-	-
CO5	-	3	-	-	-	-	-	3	-	-	-	3	-	-	-

Arduino-Programming and Interfacing					
Course Code	CS274	Semester	IV		
L:T:P:S	0:0:2:0	CIE Marks	50		
Hrs. / Week	2	SEE Marks	50		
Credits	2	Total Marks	100		
Exam Hours	03				

Course	Course objectives: This laboratory course enables					
1.	To program Arduino for sensors and other devices.					
2.	To learn interfacing of Arduino with other devices.					
3.	To familiarize the students with the programming of Arduino for real time application.					

Pg	List of Experiments / Programs	Hours/Week	COs				
m.							
NO.							
Desi	gn and Write a program for the following Arduino based System.						
1	Automatic detection of Gas (LPG) leakage.	2	CO1				
2	Fire Detection using Arduino and Flame sensor.	2	CO1				
3	Controlling Relay shield from Bluetooth enabled device.	2	CO2				
4	Develop a Heart rate monitoring system.	2	CO2				
5	Design a Touch switch using Arduino and Touch sensor.	2	CO1				
6	Interface a speaker with Arduino.	2	CO2				
7	IOT based humidity and temperature monitoring system.	2	CO1				
8	Obstacle detection system.	2	CO1				
9	Automatically controlling the switching of a house outer lighting using photo resistance.	2	CO1				
10	Display a digital clock on the LCD.	2	CO1				
	Practice Programs						
1	Interface the Temperature sensor LM35 with Arduino.						
2	Interface 4x4 keypad with Arduino.						

Conduct of Practical Examination:

Experiment distribution: Students are allowed to pick one experiment.

Mark distribution: 100%

Course outcomes:

С

- С
- CO1: Able to understand the types, working and characteristics of different sensors, actuators and Transducers.
- CO2: Able to interface different devices with Arduino board.
- CO3: Able to perform real time application using Arduino.

CO-PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2		-	-	2	-	2	-	-	2	2	2
CO2	1	2	2	2	-	-	-	2	-	2	-	-	1	1	1
CO3	1	2	2	2	-	-	-	2	-	2			2	2	2

Course Title	Universal Human Values and Life Skills	Semester	IV
Course Code	HV257	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/Week	2:0:0	Total	100
Credits	2	Exam. Duration	3 Hours
Teaching Dept	Any Department		

Course objective is to:

С

This course is intended to:

• To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

• To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

• To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

• This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Introduction to Value Education :Introduction to Value Education :Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module – 2 RBT Level/s :L1, L2 06	6 Hours
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Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Module-3	RBT Level/s :L1, L2	06 Hours		
Module-4	RBT Level/s :L1, L2	06 Hours		
Hermony in the Network (Evistence - Understanding Hermony in the Network Internet educed and				

Harmony in the Nature/Existence : Understanding Harmony in the Nature, Interconnectedness, selfregulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Coexistence at All Levels, The Holistic Perception of Harmony in Existence

Module-5		RBT Level/s :L1, L2	06 Hours
Implicatio	ns of the Holistic Understanding – a Look at Professional E	thics :Natural Ac	ceptance of
Human V	alues, Definitiveness of (Ethical) Human Conduct, A Basis	for Humanistic	Education
Humanisti	c Constitution and Universal Human Order, Competence in	Professional Eth	ics Holistic
Technolog	ies, Production Systems and Management Models-Typical	Case Studies, St	rategies fo
Transition	towards Value-based Life and Profession		-
Suggeste	ed Learning Resources: Textbooks:		
	The Textbook A Foundation Course in Human Values ar	nd Professional F	thics. R R
1	Gaur & Asthana G P Bagaria 2nd Revised Edition Excel	Books New Delh	i 2019 ISB
-	978- 93-87034- 47-1		1,2013.100
	The Teacher's Manual for A Foundation Course in Hum	an Values and P	rofessional
2	Ethics R R Gaur R Asthana G	ian values and r	101233101181
Reference	Books		
1	Jeevan Vidya: Ek Parichaya, A Nagarai, Jeevan Vidya Brak	ashan Amarkan	tak 1000
2	Human Values A N Trinathi New Age Inth Dublishers N	ashan, Amar Kall aw Delhi 2004	un, 1999.
2	The Story of Stuff (Pook)	LVV DEIIII, 2004.	
<u>с</u>	The Story of My Experiments with Truth hy Mehandes h	aramchand Can	dhi
4 5	Small is Reputiful. E. E. Schumacher		uill
5	Sindi is Deductiui - E. F Schullidcher		
0			
Value Edu	cation websites,		
• https://v	www.uhv.org.in/uhv-ii		
• http://u	hv.ac.in.		
• http://w	ww.uptu.ac.in		
• Story of	Stuff		
 http://w 	www.stop/ofstuff.com		
• Al Gore	An Inconvenient Truth, Paramount Classics, LISA		
Charlin (Shanlin Modern Times United Artists USA		
	Modern Technology the Unteld Story		
	, Modern Technology – the Ontold Story		
	A., Right Here Right Now, Cyclewala Productions		
• <u>nttps://\</u>	www.youtube.com/channel/UCQxWr5QB_e2UnwxSwxXEkQw		
• <u>https://f</u>	dp-si.aicte-india.org/8dayUHV_download.php		
• <u>https://v</u>	www.youtube.com/watch?v=8ovkLRYXIjE		
• <u>https://v</u>	www.youtube.com/watch?v=OgdNx0X923I		
 <u>https://v</u> 	www.youtube.com/watch?v=nGRcbRpvGoU		
• <u>https://</u>	www.youtube.com/watch?v=sDxGXOgYEKM		
Activity_B	ased Learning (Suggested Activities in Class)/ Practical Based	llearning	
Teaching_l	ased Learning (Suggested Activities in Class)/ Fractical Dased	tegies which tes	chors can
	clearning Process (General Instructions) mese are sample stra	tegles, which tee	
	elerate the attainment of the various course outcomes.		.
I. IN	e methodology of this course is explorational and thus univer	sally adaptable. I	t involves a
sys	stematic and rational study of the human being vis-à-vis the re	est of existence.	
2. In	addition to the traditional lecture method, different types of i	nnovative teach	ing
me	ethods may be adopted so that the activities will develop stud	ents' theoretical	and
ар	plied skills.		
3. Sta	ate the need for UHV activities and its present relevance in the	e society and Pro	vide real-
	97		

4.	Support and guide the students for self-study activities. 5. You will also be responsible for

assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.

- 5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self evolution.
- 6. Encourage the students for group work to improve their creative and analytical skills.

Course outcomes:

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Course outcome (Course Skill Set) At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

Expected to positively impact common graduate attributes like:

- 1. Ethical human conduct
- 2. Socially responsible behaviour
- 3. Holistic vision of life
- 4. Environmentally responsible work
- 5. Having Competence and Capabilities for Maintaining Health and Hygiene
- 6. Appreciation and aspiration for excellence (merit) and gratitude for all

CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	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.

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

Course Title	NSS - Phase 2	Semester	IV
Course Code	NS258	CIE	50
Total No. of Contact Hours	25 Hours	SEE	0
No. of Contact Hours/week	0:2:0	Total	50
Credits	0	Exam. Duration	
Teaching Dept.	Any Department		

Course objective is to: National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work

2. Identify the needs and problems of the community and involve them in problem-solving

3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems

4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

Module:1	RBT Level/s :L1, L2	4 Hours

Organic farming

С

Indian Agriculture (Past, Present and Future) Connectivity for marketing. Waste management– Public, Private and Govt organization, 5 R's.Plantation and adoption of plants. Know your plants. Awareness on Organic farming.

Module:2	RBT Level/s :L1, L2	3 Hours
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Developing Water conservation techniques

To develop sustainable water management system, – Role of different stakeholders– Implementation Developing Sustainable Water management system for rural areas and implementation approaches.

Activity Based Programmes:

A. Campus Activities: Celebration of national importance days

Awareness Programmes – Preparing an actionable business proposal for enhancing the village income and approach for implementation. Importance of health, hygiene, and sanitation Healthy life style, HIV /AIDS, drugs and substance

Module: 4RBT Level/s :L1, L210 Hours

Off Campus Activities:

С

Govt. school Rejuvenation and helping them to achieve good infrastructure and results, Women Empowerment Programme, Health Camps, Blood grouping awareness and Blood donation, Legal awareness Programme, Literacy Programme, Water Conservation Programme, One Day Special Camp in a village (preferably in adopted village.

Course outcomes: At the completion of the course. The student shall be able to						
CO1	Describe the concept of Youth and compare the international definitions of the term Youth.					
CO2	Students will be able to appreciate our demographic advantage and its role in nation building.					
CO3	Know the growth and evolution of NSS and its role in Nation building through community service					
CO4	Visualize the signs, symbols, logo of NSS and understand their broader meaning.					

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

Course Title	Physical Education (PE) (Sports and Athletics) – Phase 2	Semester	IV
Course Code	PE258	CIE	50
Total No. of Contact Hours	25 Hours	SEE	0
No. of Contact Hours/Week	0:2:0	Total	50
Credits	0	Exam. Duration	
Teaching Dept	Sports		

Course objective:

Physical education aims to develop all aspects of the human personality through physical and sports activities. Being a subject of science, it has its own value in society and human life. Physical Education is a form of one of the most effective means of education imparted through exercises, fun activities and sports. It is an integral part of the education system. It caters to the need for development of the students on physical, mental and social aspects.

Module – 1	RBT Level/s :L1, L2	5 Hours
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Ethics and Moral Values:

- A. Ethics in Sports.
- B. Moral Values in Sports and Games

Module – 2	RBT Level/s :L1, L2	15 Hours
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Specific Games (Any one to be selected by the student)

- A. Volleyball Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
- B. Throw ball Service, Receive, Spin attack, Net Drop & Jump throw.
- C. Kabaddi Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
- D. Kho-Kho Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 up.
- E. Table Tennis Service (Fore Hand & Back Hand), Receive (Fore Hand & BackHand), Smash.
- F. Athletics (Track / Field Events) Any event as per availability of Ground.

Module - 3	RBT Level/s :L1, L2	5 Hours
Role of Organization and administration		

С

Course outcomes:

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

CO1	Understand the ethics and moral values in sports and athletics.
CO2	Perform in the selected sports or athletics of student's choice
CO3	Understand the roles and responsibilities of organization and administration of sports and games

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

course mile	Yoga for a Better Life - Phase 2	bga for a Better fe - Phase 2 IV			V			
Course Code	YG258	YG258 CIE 50						
Total No. of Contact Hours	25	SEE		0				
No. of Contact Hours/week	0:2:0	Total		50				
Credits	0	Exam. Dura	ation					
Teaching Dept								
 To enable the student to have good health. To practice mental hygiene. To possess emotional stability. To integrate moral values. To attain higher level of consciousness. 								
SEMESTER IV RBT Level/s :L1, L2 25 Hours								
Patanjali's Ashtanga Yoga, its i aparigraha Niyama :shoucha, sa Suryanamaskar12 count- 4 rour Asana, Need, importance of Asa precautionary measures and be a. Sitting 1. Sukhasana 2. Paschimottanasana	need and importance intosh, tapa, svaadhy ids of practice ana. Different types o nefits of each asana I	e. Yama :Ahi aya, Eshvaraj f asana. Asar Different type	msa, satya oranidhan. a its mean es of Asana	a, asteya, br ing by name is	ahmacarya, , technique,			

Suggested Learning Resources:

Textbooks:

Nadishodhana

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- $1. \ {\rm Yogapravesha}$ in Kannada by Ajitkumar
- 2. Light on Yoga by BKS Iyengar
- 3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
- 4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru

5. Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources): Refer

- links
 - https://youtu.be/KB-TYlgd1wE
 - <u>https://youtu.be/aa-TG0Wg1Ls</u>

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as;

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

• Physical

- 1. Improved body flexibility and balance
- 2. Improved cardiovascular endurance (stronger heart)
- 3. Improved digestion
- 4. Improved abdominal strength
- 5. Enhanced overall muscular strength
- 6. Relaxation of muscular strains
- 7. Weight control
- 8. Increased energy levels
- 9. Enhanced immune system

Mental

- 1. Relief of stress resulting from the control of emotions
- 2. Prevention and relief from stress-related disorders
- 3. Intellectual enhancement, leading to improved decision-making skills

• Spiritual

- 1. Life with meaning, purpose, and direction
- 2. Inner peace and tranquility
- 3. Contentment

Course At the	Course outcomes: At the completion of the course. The student shall be able to							
CO1	Understand the meaning, aim and objectives of Yoga.							
CO2	Perform Suryanamaskar and able to Teach its benefits.							
	04							

CO3	Understand and teach different types of Pranayama, Asanas by name, its importance, methods	

	and ber	and benefits.											
CO4	Instruct	Instruct Kapalabhati and its need and importance.											
CO5	Coach c	Coach different types of Kriyas , method to follow and usefulness.											
CO-PO	Mapping	3											
CO/PO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				1			1	1					1
CO2				1			1	1					1
CO3				1			1	1					1
CO4				1			1	1					1

High-3, Medium-2, Low-1

CO5

Course Title	Social Connect and Responsibilities	Semester	IV
Course Code	SC259	CIE	50
Total No. of Contact Hours	25	SEE	0
No. of Contact Hours/week	0:0:2	Total	50
Credits	0	Exam. Duration	
Teaching Dept	Any Department		•

Course objectives:

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- Provide a formal platform for students to communicate and connect to the surrounding.
- Create a responsible connection with the society.
- Understand the community in general in which they work.
- Identify the needs and problems of the community and involve them in problem –solving.
- Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

General Instructions - Pedagogy :

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

- 1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
- 2. State the need for activities and its present relevance in the society and Provide reallife examples.
- 3. Support and guide the students for self-planned activities.
- 4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- 5. Encourage the students for group work to improve their creative and analytical skills.

Part I:

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - Objectives, Visit, case study, report, outcomes.

Part II :

Heritage walk and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes.

97

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Part III :

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes. **Part IV:**

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V :

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Course At the	Course outcomes: At the completion of the course. The student shall be able to					
CO1	Communicate and connect to the surrounding.					
CO2	Create a responsible connection with the society.					
CO3	Involve in the community in general in which they work.					
CO4	Notice the needs and problems of the community and involve them in problem –solving.					
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.					
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic					

	attitudes.		
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Duration:

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. Program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic and poetry) Faculty mentors have to design the evaluation system as per VTU guidelines of scheme & syllabus.

Pedagogy – Guidelines :

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

SI No	Торіс	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Plantatio n and adoption of a tree:	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	2. Heritag M e walk indi and or crafts corner:		Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Governm ent Schemes officers/ campus etc	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	Organic farming and waste managemen t:	May be individual or team	Farmers land / parks / Villages visits / Roadside/ community area / College campus etc	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	4. Water M conserva ind tion: & or conserv ation techniqu es		Villages/ City Areas / Grama Panchayat/ public associations/Governm ent Schemes officers / campus etc	site selection / proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5. Food walk: Pract ices in societ V		May be individual or team	Villages/ City Areas / Grama Panchayat/ public associations/Governm ent Schemes officers/ campus etc	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of	Action (Execution of Activities)								
SI.NO	Practic	e Session Desc	ription						
1	Lecture session in field to start activities								
2	Students Presentation on Ideas								
3	Commencement of activity and its progress								
4	Execution of Activity								
5	Execution of Activity								
6	Execution of Activity								
7	Execution of Activity								
8	Case study based Assessment, Individu	al performance	2						
9	Sector/ Team wise study and its consolidation								
10	Video based seminar for 10 minutes by each student At the end of semester with Report.								
•	At last consolidated report of all activities submitted as per the instructions and s	es from 1 st to 5 ^t cheme.	th , compiled report should be						
	Assessment Details		LE and SEE)						
	Weightage	CIE – 100%	• Implementation strategies of the project (NSS work)						
Field Vi	sit, Plan, Discussion	10 Marks	 The last report should be 						
Comme Case sti	encement of activities and its progress udy based Assessment	20 Marks	signed by NSS Officer, the HOD and principal.						
Individu	al performance with report	20 Marks	At last report should be evaluated						
Sector v	wise study & its consolidation 5*5 = 25	25 Marks	Finally the consolidated mark						
Total m	arks for the course	100 Marks	sheet should be sent to the university and also to be made available at LIC visit.						
For ea	ch activity, 20 marks CIE will be evalua	ted for IA marl	cs at the end of semester, Report						
and as	sessment copy should be made availabl	le in the depart	ment.						

Students should present the progress of the activities as per the schedule in the prescribed practical

session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

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