



Department of Computer Science and Engineering **(Accredited by NBA)**

Vision of the Department

To craft professionally skilled engineers with research orientation, innovative insights and a passion for life-long learning to meet the needs of Industry and Society.

Mission of the Department

- M1:** To offer need based curriculum in collaboration with industry.
- M2:** To inculcate professional skills with innovative thinking to address societal problems of multidisciplinary nature.
- M3:** To provide a congenial environment to learn and exhibit soft skills.
- M4:** To promote research culture and the need for life-long learning.

Program Educational Objectives (PEOs) - UG

- PEO1:** Excel in professional career and higher education by acquiring knowledge in mathematical, computing and engineering principles.
- PEO2:** Analyze societal problems and provide technically competent solutions.
- PEO3:** Possess academic excellence through innovative insights, soft skills and life-long learning.

Program Outcomes (POs) - UG Engineering Graduates will be able to:

- PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
- PO2: Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.



PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs) - UG

PSO1: Demonstrate the uses of knowledge by writing programs and integrate them with hardware/software products in multidisciplinary environment.

PSO2: Participate in planning and implementation of solutions to cater the industry specific requirements.



Scheme of Teaching and Examination-2022 (160 Credits Scheme, NEP)
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
 (Effective from the academic year 2022-23)

III Semester BE

Academic year: 2023-24

SI No	Course Code		Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs
1	BS	22SS301	Statistics and Probability	MA	3	-	-	3	50	50	100	3
2	PC	22CS302	Data Structures	CS	3	-	-	3	50	50	100	3
3	PC	22CS303	Computer Organization and Digital Circuits	CS	3	-	2	4	50	50	100	3
4	PC	22CS304	Object Oriented Programming	CS	3	-	2	4	50	50	100	3
5	PC	22CS305	Operating System	CS	3	-	-	3	50	50	100	3
6	PC	22CS306	Dept. Skill lab-I (Data Structures and its Applications)	CS	-	-	4	2	50	50	100	3
7	HS	22HV307	Universal Human Values	HS	2	-	-	1	50	-	50	-
8	ES	22EN308	Environmental Studies	HS	2	-	-	1	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				Total	22	-	8	21	400	300	700	-
Credits Distribution: Basic Science (BS) = 08+08+3 = 19, Engineering Science (ES) = 10+11=21, Humanities & Social Sciences (HS) = 1+2=03, Program Core (PC) = 02+16 = 18, Total Credits=20+20+21 = 61.												



Department: Computer Science and Engineering		Semester: III
Subject: Statistics and Probability		
Subject Code:	22SS301	L – T – P - C: 3-0-0-3

Sl. No	Course Objectives
1	Introduce the concept of correlation and regression and fitting of a curve.
2	Apply discrete and continuous probability distributions for single and two variables in analyzing the probability models arising in engineering field.
3	To understand the concepts of the stochastic process of a statistic and estimation of parameters
4	Develop analytical capability and to impart knowledge of Probability, Statistics and Queuing

Unit	Description	Hrs
I	Statistical Methods: Correlation and regression- Karl Pearson’s coefficient of Correlation, Regression analysis- lines of regression (without proof), rank correlation, problems. Curve fitting: Curve fitting by the method of least squares- Fitting of the straight line, second degree parabola and exponential form of the curve $y = abx$ (All results without proof) –Problems.	08
II	Probability Distributions: Review of basic probability theory. Random variables (Discrete and Continuous), Probability of mass/density functions, Binomial distribution, Poisson’s distribution, Exponential distribution and Normal distribution (without derivations) and problems.	08
III	Joint probability distributions: Joint probability distribution for discrete random variables, Mathematical expectations, Covariance and Correlation. Analysis of variance: Definition and properties, one way classification, verification within and between treatments.	07
IV	Markov Chain: Probability Vector, Stochastic Matrix, Regular Stochastic Matrix, definition of Markov Chain, Transition Probabilities and Transition probability Matrix, Higher Transition Probabilities, state transition diagram, stationary distribution of regular Markov chains, problems. Queuing theory: Introduction, Concepts and M/G/1 and M/M/1 queuing systems, problems.	09
V	Sampling and Statistical Inference: Sampling distributions, Concepts of hypothesis, standard error and confidence interval, Type-1 and Type-2 errors, Level of significance, One tailed and two tailed tests. Z-test: for single mean, for single proportion. Student’s t – distribution, Chi-square test for goodness of fit.	08



Course Outcomes:

Course outcome	Descriptions
CO1	Understand the concepts of Curve Fitting, Correlation, Regression, probability distribution and Markov chain.
CO2	Formulate and solve mathematical problems on probability distribution, sampling theory and queuing theory.
CO3	Analyze the behavior of Markov chain-based problems in the long run and compute the correlation, covariance of random variables using joint PDF concept.
CO4	Apply the concepts of Analysis variance, testing of hypothesis and queuing models in engineering fields.

Course Articulation Matrix

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

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Higher Engineering Mathematics	B.S. Grewal	43 rd Edition Khanna Publications, 2015. ISBN:9788174091956
2	Introduction to Probability Models	Sheldon M. Ross	Elsevier, 9 th Edition, 2007

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Probability, Random Variables and Stochastic Process	Athanosios Papoulis & S. Unnikrishna Pillai	Tata McGraw Hill, 4 th Edition, 2002.
2	Higher Engineering Mathematics	B.V. Ramana	1 st Edition, Tata McGraw-Hill, 2006. ISBN:9780070634190



Department: Computer Science and Engineering		Semester: III	
Subject: Data Structure			
Subject Code:	22CS302	L - T - P - C:	3-0-0-3

SI. No	Course Objectives
1	To provide the knowledge of basic data structures and their implementations.
2	Define and Analyze the concepts of Linear & Non-Linear Data Structures.
3	To understand importance of data structures in context of writing efficient programs.
4	To develop skills to apply appropriate data structures in solving real world problems.

Unit	Description	Hrs
I	Pointers and Structures revisited, Stacks and its applications: Pointers and Structures revisited: accessing variables through pointers, passing pointers to a function, pointers to pointers, array of pointer, memory allocation functions,. Structure definition and declaration, Types of structures. Stacks: Definition and Examples, Representing Stacks in C. Example: infix, postfix and prefix: basic definitions and examples, evaluating a postfix expression with program, converting an expression from infix to postfix with program. Recursion: binary search and towers of Hanoi.	08
II	Queue, Circular queue and Priority queue: Queues: The Queue and its Sequential Representation, C implementation of Queue. Circular Queue, and The priority queue – Array implementation of priority queue.	08
III	Singly Linked List, Circular Singly Linked List: Inserting and removing nodes from a list, Header nodes, Array implementation of lists, limitations of array implementation. Linked implementation of Stack, linked implementation of queue. Circular lists: primitive operations on circular list.	08
IV	Doubly linked list, Circular Doubly linked list: Doubly linked lists: Inserting and removing nodes from a double linked list. Primitive operations on circular doubly linked list.	08
V	Trees: Basic tree concepts: Terminology, tree representation, Binary trees: properties, binary tree structure. Binary tree traversals: Tree traversal techniques: preorder, inorder and postorder, Expression trees: infix, postfix and prefix traversal. General trees: Changing general tree to binary tree, insertion into general trees.	08



Course Outcomes:

Course outcome	Descriptions
CO1	Interpret the basic concepts of data structures and their operations.
CO2	Explicate the working principle of linear and non-linear data structures
CO3	Evolve a code snippet for the implementation of data structure for an application development.
CO4	Distinguish and Involve concepts of linear and non-linear data structures to solve a problem.

Course Articulation Matrix

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

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Data Structures: A Pseudocode Approach with C	Richard F. Gilberg and Behrouz A. Forouzan	Second Edition, Cengage publication, 2007, ISBN- 13: 9788131503140
2	Data Structure using C	Aaron M. Tenenbaum, YedidyahLangsam and Moshe	Data Structure using C

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Data Structures and Program Design in C	Robert Kruse, C L Tondo, Bruce Leung, ShashiMogalla	PHI, 2 nd Edition, 2015,ISBN-13: 978- 0132883665.
2	Data Structures	Seymour Lipschutz	McGraw Hill publications, 2018, ISBN-13:978-0-070198-4



Department: Computer Science and Engineering		Semester: III
Subject:	Computer Organization and Digital Circuits	
Subject Code:	22CS303	L – T – P – C: 3 – 0 – 2 – 4

Sl. No	Course Objectives
1	Understand the operating of digital circuits and sensors.
2	Equip with the skills to design and analyze combinational and sequential digital circuits.
3	Understand the basic structure and operations of a digital computer.
4	Learn the design philosophy of central processing unit.
5	Demonstrate the working of I/O unit and memory unit.

Unit	Description	Hrs
I	Combinational logic circuits: Multiplexers, De-multiplexers, Decoder: BCD to Decimal Decoders, Seven Segment Decoders, Combinational circuit design using MUX IC 74153 and Decoder IC 74138. Encoders, Magnitude Comparator Introduction to HDL & HDL Implementation of combinational Circuits.	08
II	Sequential Circuits: Introduction to Flip-Flops: Basic RS latch RS Flip-Flop, Gated Flip- Flops: JK FF, D FF, T FF. Various representations of flip flops and Flip flop conversions. Register: Types of Registers: Serial In – Serial Out, Serial In – Parallel out, Parallel in Serial Out, Parallel In – Parallel Out, Universal Shift Register, and Applications of Shift Registers. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counter Changing the Counter Modulus. HDL implementation of sequential circuits	08
III	Introduction to Computer Organization: Basic Structure of Computers: Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes. Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses. Standard I/O Interfaces.	08
IV	Basic Processing Unit: Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic operation, Fetching a word from Memory, Storing a word in Memory. Execution of complete Instruction: Branch Instructions. Multiple-Bus Organization, Hardwire Control, Multi programmed Control	08
V	Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.	08



LAB CONTENT

Sl. No	Experiment Description
1	Truth table verification of logic gates using IC trainer Kit
2	Simplify the given expression using K-Map and write the logic circuit for the simplified expression. Simulate the working of the simplified logic Circuit using Multisim
3	Write the Verilog code to simulate the working of Half and Full adder
4	Design Half adder, Full adder, 4 bit adder (IC7483) and 4 bit comparator (IC7485) using Mutisim and verify the working
5	Write the Verilog code to simulate the working of 4:1 Mux and 8:1 Mux
6	Design using Multisim and verify the working of (a) 2: 4 decoder using NAND gates (b) Simulate decade counter using IC7490 and display counter output from 0-9 using BCD to 7 segment decoder IC 7447
7	Write the Verilog code of D flip-Flop and verify their working
8	Design 3 bit Asynchronous Up/Down counter for the given modulus using Multisim and verify their working
9	Design of Carry look-ahead-adder
10	Design of ALU
11	Design of CPU

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the basic concepts of digital circuit.
CO2	Design and Analyze simple combinational and sequential logic circuits
CO3	Analyze the basic organization of a central processing unit.
CO4	Discuss the functionality of I/O and memory management hardware.

Course Articulation Matrix

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



Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Digital Principles and Applications	Donald P Leach, Albert Paul Malvino	8 th Edition, McGraw Hill, 2014 ISBN-9789339203405
2	Computer Organization	Carl Hamacher, Z Vranesic S Zaky	5 th Edition, McGraw Hill, 2011 ISBN-13:9781259005275

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Digital Principles and Design	Donald D Givone	3 rd Edition, 2003, Mc Hill Publications ISBN: 0072525037
2	Computer Organization and Architecture: Designing for performance	William Stallings	10 th Edition, Pearson, 2010, ISBN:9 8-0-13-4101613
3	Computer System Architecture	Morris Mano	3 rd Edition, PHI, 2016 ISBN: 978-9332585607



Department: Computer Science and Engineering	Semester: III
Subject: Object Oriented Programming	
Subject Code: 22CS304	L - T - P - C: 3 - 0 - 2 - 4

Sl. No	Course Objectives
1	Understand the fundamentals of object-oriented programming in Java, including defining classes, Objects, invoking methods
2	Understand the principles of inheritance, packages and interfaces.
3	Understand generic programming and implement generic classes and methods.
4	Design and develop reliable Object oriented programs.

Unit	Description	Hrs
I	Fundamentals of Object Oriented Programming: Introduction, Object oriented Paradigm, Basic Concepts of OOP, Benefits of OOP and Applications of OOP. Java Environment, Simple Java Program, An Application with Two Classes, Java Program Structure, Implementing a Java Program, Java Virtual Machine, Command Line Arguments.	08
II	Classes, Objects and Methods; Inheritance Classes, Objects and Methods: Introduction, Defining a Class, Fields Declaration, Methods Declaration, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members. Inheritance: Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract Methods and Classes, Visibility Control.	08
III	Packages and Interfaces Packages: Defining a Package, Finding Packages and CLASSPATH, A Short Package Example, Access protection: An Access Example, Importing Packages. Interfaces: Defining an Interface, Implementing Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces, Default Interface Methods: A More Practical Example, Multiple Inheritance Issues, and Use Static Methods in an Interface.	08
IV	Exception Handling and Generics Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch: Displaying a Description of an Exception, Multiple Catch Clauses, throw, throws, finally. What Are Generics? A Simple Generics Example, The General Form of a Generic Class, Creating a Generic Method, Generic Constructors, Some Generic Restrictions.	08
V	Programming with I/O I/O Basics, Streams, Byte Streams and Character Streams, The Predefined Streams, Reading Console Read the values, Reading Characters, Reading Strings, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Automatically Closing a File.	08



LAB CONTENT

Sl. No	Experiment Description
1	Exercise to demonstrate Constructor Overloading.
2	Exercise to demonstrate Inheritance.
3	Exercise to demonstrates Dynamic Method Dispatch (Run time Polymorphism).
4	Exercise to demonstrate different combinations of Access Specifiers.
5	Exercise to demonstrate Interface creation and its implementation.
6	Exercise to demonstrate Exception Handling.
7	Exercise to demonstrate Generic Class.
8	Exercise to demonstrate Reading and Writing Files.

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the Object Oriented Programming concepts and apply the same to design programs.
CO2	Design and implement object oriented solutions involving multiple objects, packages & Interfaces.
CO3	Develop simpler, reliable and reusable programs using exception handling and Generics.
CO4	Illustrate the versatility of I/O Operations in programs.

Course Articulation Matrix

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



Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Programming with Java	E Balagurusamy	6 th Edition McGraw Hill, 2019, ISBN13-89351343202, ISB10-9351343200
2	Java -The Complete Reference	Herbert Schildt	9 th Edition, Tata McGraw Hill, 2014, ISBN:978-0-07180856-9

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Introduction to JAVA Programming	Y. Daniel Liang	10 th Edition, Pearson Education, 2015, ISBN-13:9780133761313



Department: Computer Science and Engineering		Semester: III
Subject:	Operating System	
Subject Code:	22CS305	L - T - P - C: 3-0-0-3

Sl. No	Course Objectives
1	To learn the classes of operating system, design architecture and system calls.
2	To understand the concepts of process synchronization and scheduling through various algorithms.
3	To gain knowledge on system concepts that includes Mutual exclusion algorithms and deadlock detection algorithms
4	To learn the mechanisms involved in resource management in an OS

Unit	Description	Hrs
I	Introduction to Operating Systems and System Structures: What operating systems do? Computer System architecture System Structures : Operating System Services, System calls; Types of system calls; Operating System structure;	8
II	Process Management: Process concept: Overview; Process scheduling; Operations on processes; Inter process communication. Multithreaded Programming: Overview: Motivation, Benefits; Multithreading models; CPU Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms: First Come, First Served Scheduling, Shortest-Job First Scheduling, Priority Scheduling, RoundRobin Scheduling.	8
III	Process Synchronization: Background; The Critical section problem; Peterson's solution; Mutex Locks; Semaphores; Classical problems of synchronization. Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection; Recovery from deadlock	8
IV	Memory Management: Memory Management Strategies: Background; Swapping, Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy- on write; Page replacement; Allocation of frames; Thrashing.	8
V	Storage Management: File System: File concept; Access methods; File system mounting. Implementing File Systems: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Mass storage structures; Disk structure ; Disk attachment; Disk scheduling; Disk management	8



Course Outcomes:

Course outcome	Descriptions
CO1	Explore the fundamental concepts of various operating system services
CO2	Describe various process management techniques to solve problems in multi-process environment.
CO3	Select and apply suitable techniques for efficient management of system resources
CO4	Analyze the performance of various resource management technique

Course Articulation Matrix

CO \ PO/PSO	PO/PSO													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3						2		2		
CO2	3	3	2	3								2		
CO3	3	3	3	3								2		
CO4	2	2	2	2								2		

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Operating System Principles	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	9 th Edition, Wiley-India, 2016. ISBN: 978-1-118—06333-0

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Operating systems	D.M Dhamdhare	3 rd Edition, Tata McGraw Hill, 2017 ISBN:9781259005589
2	An Introduction to Operating Systems: Concepts and Practice	P.C.P. Bhatt	4 th Edition, PHI (EEE), 2013. ISBN: 9788120348363



Department: Computer Science and Engineering	Semester: III
Subject: Dept. Skill Lab – I (Data Structures and its Applications)	
Subject Code: 22CS306	L – T – P - C: 0-0-4-2

Sl. No	Course Objectives
1	To develop skills to design and analyse simple linear and nonlinear data structures.
2	To Strengthen the ability to identify and apply suitable data structure for the given real world problem.
3	To gain knowledge in practical applications of data structures.

LAB CONTENT

Sl. No	Experiment Description
1	Write a C program to construct a stack of integers and to perform the following operations on it: a. Push b. Pop c. Display The program should print appropriate messages for stack overflow and stack underflow.
2	Write a recursive C programs for the following: a. Searching an element on a given list of integers using the binary search method. b. Solving the Towers of Hanoi problem.
3	Write a C Program to convert and print a given valid parenthesized infix expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) , /(divide) to suffix / postfix expression.
4	Write a C program to evaluate a valid suffix / postfix expression using stack. The suffix / postfix expression is read as a non-negative single digit operands and binary operators + (plus), - (minus), * (multiply) , /(divide)
5	Write a C program to simulate the working of a Queue of integers using an array. provide the following operations: a. Insert b. Delete c. Display The program should print appropriate messages for Queue full and Queue empty.
6	Write a C program to simulate the working of a Circular Queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display The program should print appropriate messages for Circular Queue full and Circular Queue empty.
7	Write a C program to simulate the working of a Priority Queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display
8	Write a C program using dynamic variables and pointers, to construct a Singly Linked List consisting of the following information in each node: student ID (integer), student name (string) and semester (integer). The operations to be supported are: a. The insertion operation:



	<p>i. At the front of a list ii. At the back of the list iii. At any position in the list</p> <p>b. Deleting a node based on student id. c. Searching a node based on student id and update the information content. d. Displaying all the nodes in the list.</p> <p>(Note: Only either (a, b and d) or (a, c and d) may be asked in the examination).</p>
9	<p>Write a C program using dynamic variables and pointers, to construct a Doubly Linked List consisting of the following information in each node: student ID (integer), student name (string) and semester (integer). The operations to be supported are:</p> <p>a. Create a doubly linked list by adding each node at the front. b. Insert a new node to the left of the node whose key value is read as an input c. Delete the node of a given data, if it is found, otherwise display appropriate message. d. Display the contents of the list.</p> <p>(Note: Only either (a, b and d) or (a, c and d) may be asked in the examination).</p>
10	<p>Write a C Program to</p> <p>a. Construct a binary search tree of integers. b. Traverse the tree using inorder, preorder and postorder methods. c. Display the elements in the tree.</p>

Case Studies:

- Cashflow Manager** - allows users to have track of their day-to-day cash inflow and outflow. This application has to support user getting a clear idea of their income and expenses. The application has to make users aware of needless expenses and helps to understand money management.
- Mini Voting System** - allows groups to securely conduct votes and elections. A high-quality online voting system should balance ballot security, convenience, and the overall requirements of an organization's voting event.
- Bank Management System** - users can perform banking activities like in a real bank. This particular file should contain all the details of requirement collection from the user end.
- Automated Teller Machine (ATM)** - enables bank customers to access their accounts without visiting the bank. When a user requires to withdrawing cash, they have to enter their PIN number (personal identification number) and the amount to be withdrawn should be displayed in the form of 100s, 500s, and 1000s. Once their withdrawal was successful, the amount should be debited from their account.

Course Outcomes:

Course outcome	Descriptions
CO1	Elicit the Working principles of data structures.
CO2	Identity and Apply appropriate data structure for efficient data storage and Retrieval.
CO3	Illustrate the role of data structures in improving the efficiency of a code snippet.



Course Articulation Matrix

PO/PSO CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO1	1	2		1	2									
CO2		2	3	1										
CO3		3	3	2										
CO4														



Department: Computer Science and Engineering		Semester: III
Subject: Universal Human Values		
Subject Code:	22HV307	L – T – P - C: 2–0–0–1

Department: Common to all branches of engineering
Semester: III (Group-1.branches-CE/ME/EEE/CSE/AI&ML)
Semester: IV (Group-2.branches –ISE/ECE/ETE/MLE/DSE)

Sl. No	Course Objectives
1	This introductory course input is intended: 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
2	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.
3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
4	This course is intended to provide a much needed orientation input in value education to the young enquiring minds.

COURSE TOPICS

The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hour duration. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue

Unit	Description	Hrs
I	Introduction to Value Education: 1.Understanding Value education-Need, Guidelines, content, Role of education-Sanskar 2. Process for Value Education- Self-exploration, the Dialogue Within. 3. Continuous Happiness and Prosperity – the Basic Human Aspirations 4. Right Understanding, Relationship and Physical Facility 5. Exploring the Meaning of Happiness and Prosperity. 6. Method to Fulfill the Basic Human Aspirations	06
II	Harmony in the Human Being: 7. Understanding the Human being (As the Co-existence of the Self and Body) 8. Distinguishing between the Needs of the Self and the Body 9. The Body as an Instrument of the Self-The response of the self and the body 10: Understanding Harmony in the Self-State of imagination 11: understanding Harmony of the Self with the Body	06



	12: Programme to ensure self-regulation and Health-Nurturing the body	
III	Understanding Harmony in the Family and Society 13: Harmony in the Family – the Basic Unit of Human Interaction 14: Values in Human-to-Human Relationship 15: 'Trust' – the Foundational Value in Relationship 16: 'Respect' – as the Right Evaluation 17: Other Naturally Acceptable Feelings in Relationship-Affection, Care, Guidance, Reverence, Glory, Gratitude and Love 18: Vision for the Universal Human Order-from family to world family	06
IV	Understanding Harmony in the Nature/Existence: 19: Understanding Harmony in the Nature 20: Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature 21:Realizing Existence as Co-existence at All Levels 22: The Holistic Perception of Harmony in Existence	04
V	Implications of the Holistic Understanding – a Look at Professional Ethics 23: Natural Acceptance of Human Values 24: Definitiveness of (Ethical) Human Conduct 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order 26: Competence in Professional Ethics 27: Holistic Technologies, Production Systems and Management Models- Typical Case Studies 28: Strategies for Transition towards Value-based Life and Profession	06

Course Outcomes:

Course outcome	Descriptions
CO1	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability, also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO3	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.
CO4	This is only an introductory foundational input. It would be desirable to follow it up by a) Faculty-student or mentor-mentee programs throughout their time with the institution b) Higher level courses on human values in every aspect of living



SUGGESTED ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions; self-assessment will be used in evaluation.

Example: Assessment through 2-Tests, each carries 25 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Course Articulation Matrix

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

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	A Foundation Course in Human Values and Professional Ethics,	R R Gaur, R Sangal G P Bagaria,	Excel Books, New Delhi,2010
2	The Teacher’s Manual Teachers’ Manual for A Foundation Course in Human Values and, Professional Ethics,	R R Gaur, R Asthana, G P Bagaria	2 nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2



Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Jeevan Vidya: EkParichaya,.	A Nagaraj,	Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values,	A.N. Tripathi,	New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book). . i)Small is Beautiful ii)Slow is Beautiful	- E. F Schumacher. - Cecile Andrews	
4	The Story of My Experiments with Truth	- by Mohandas Karamchand Gandhi	



Department: Computer Science and Engineering		Semester: III
Subject: Environmental Studies		
Subject Code:	22EN308	L – T – P - C: 2–0–0–1

Department: Common to all branches of engineering
Semester: III (Group-1.branches-CE/ME/EEE/CSE/AI&ML)
Semester: IV (Group-2.branches –ISE/ECE/ETE/MLE/DSE)

Sl. No	Course Objectives
1	To analyze an overall impact of specific issues and develop environmental management plan.
2	Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development.
3	To gain knowledge on different types of pollution in the environment.
4	To analyze an overall impact of specific issues and develop environmental management plan. Environment.

COURSE TOPICS

The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hour duration.

Unit	Description	Hrs
I	Introduction: Environment - Components of Environment Ecosystem: Types of Ecosystem, Balanced ecosystem. Human Activities – Food, Shelter, And Economic & Social Security, Effects of human activities on environment- Agriculture, Housing, Industry, Mining & Transportation. Environmental Impact Assessment (EIA), Sustainable Development.	06
II	Natural Resources -Introduction, types of resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water. Mineral resources, Forest Wealth. Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle.	06
III	Energy – Different types of energy, Conventional sources & Non-conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	04
IV	Environmental Pollution – Air Pollution & Automobile Pollution Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.	06
V	Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management -Sources, Characteristics & Disposal methods. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs) , Environmental Education	06



Course Outcomes:

Course outcome	Descriptions
CO1	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability, also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO3	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.
CO4	This is only an introductory foundational input. It would be desirable to follow it up by a) Faculty-student or mentor-mentee programs throughout their time with the institution b) Higher level courses on human values in every aspect of living

Course Articulation Matrix

CO \ PO/PSO	PO/PSO													
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
CO1	2	2	1	1	1	3	3	2	2	2	1	3		
CO2	2	2	1	1	1	3	3	2	2	2	1	1		
CO3	2	2	1	1	1	3	3	2	2	2	1	1		
CO4	2	2	1	1	1	3	3	2	2	2	1	1		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Environmental Studies	Benny Joseph	Tata McGraw– Hill Publishing Company Limited (2005), Delhi.
2	Environmental Studies	.R Rajagopalan	From Crisis to Cure”, Oxford University Press, 2005,



Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Environmental Science and Engineering	Aloka Debi,	Universities Press (India) Pvt. Ltd. 2012
2	Environmental Studies	R.J.Ranjit Daniels and Jagadish Krishnaswamy,	Wiley India Private Ltd., New Delhi(2009),
3	Text Book of Environmental and Ecology”,	Dr.Pratiba Sing, Dr.AnoopSingh and Dr.Piyush Malaviya,	Acme Learning Pvt. Ltd. New Delhi
4	Environmental Science – working with the Earth	G.Tyler Miller Jr.,	Eleventh Edition, Thomson Brooks /Cole, 2006

SUGGESTED ASSESSMENT:

Internal Assessment through 2-Tests, each carries 25 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.



Scheme of Teaching and Examination-2022 (160 Credits Scheme, NEP)
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
 (Effective from the academic year 2022-23)

IV Semester BE

Academic year: 2023-24

Sl No	Course Code	Course Title	Teaching Dept.	L	T	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs	
1	BS 22SS401	Combinatorics and Advanced Linear Algebra	MA	3	-	-	3	50	50	100	3	
2	PC 22CS402	Software Engineering	CS	3	-	-	3	50	50	100	3	
3	PC 22CS403	Design and Analysis of Algorithms	CS	3	-	2	4	50	50	100	3	
4	PC 22CS404	Embedded Systems and IoT	CS	3	-	2	4	50	50	100	3	
5	PC 22CS405	Automata Theory and Computation	CS	3	-	-	3	50	50	100	3	
6	PC 22CS406	Dept.Skill lab-II (Python Programing)	CS	-	-	4	2	50	50	100	3	
7	HS 22SK407	Skill Development-1	HS	2	-	-	1	50	-	50	-	
8	HS 22CI408	Constitution of India	HS	2	-	-	1	50	-	50	-	
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				Total	19	-	8	21	400	350	750	-

Credits Distribution: Basic Science (BS)=08+08+3+3 = 22, Engineering Science (ES) = 10+11 = 21, Humanities & Social Sciences (HS)=1+2+2 = 5, Program Core (PC) = 02+16+16 = 34, Total Credits = 20+20+21+21 = 82. Total 60 AICTE Activity points need to earn by each regular student and Total 35 AICTE Activity points need to earn by each Lateral entry student at the end of 2nd Year BE.



Department: Computer Science and Engineering		Semester: IV
Subject: Combinatorics and Advanced Linear Algebra		
Subject Code:	22SS401	L – T – P - C: 3–0–0–3

Sl. No	Course Objectives
1	To introduce the concept of generating function, exponential generating functions.
2	Describe the concepts of Derangements, Rook polynomials.
3	To solve simultaneous algebraic equations using methods of matrix algebra.
4	To introduce concepts of inner products to matrix decomposition.

Unit	Description	Hrs
I	The principle of Inclusion and Exclusion: The principle of Inclusion and Exclusion, Generalizations of Principle. Derangements, Rook Polynomials, Arrangements with forbidden positions.	08
II	Generating functions: Ordinary Generating functions, Definition and problems. Computational Techniques, Partition of Integers, Exponential generating function, problems.	07
III	Vector spaces: Solution of system of equations by LU decomposition method. Vector space, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence (all statements only). Basis and Dimensions: Basis and Dimensions of Vector space and problems.	09
IV	Linear transformation: Introduction, Linear Mappings, Kernel and Image of a linear transformations, Matrix representation of linear transformations, Range space, Null space, Nullity, Rank-Nullity Theorem, Singular and Nonsingular linear transformations (all statements only), Problems.	08
V	Inner Product spaces: Inner product, norms of a vector, angle between vectors. Orthogonal vectors, orthogonal and orthonormal basis, projections of a vector. Gram-Schmidt orthogonalization process, QR-factorization (all statements only), problems. Diagonalization of a matrix (symmetric matrices) and singular value decomposition, Problems.	08



Course Outcomes:

Course outcome	Descriptions
CO1	Understand the concept Principle of inclusion-exclusion, Rook polynomial, generating function, vector space, linear transformations
CO2	Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.
CO3	Apply the knowledge of Rook polynomial, linear algebra to model and solve that appears in engineering sciences.
CO4	Apply the idea of generating functions, transformations and orthogonal projection in Engineering field.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	4													
CO2	4	3												
CO3	4	3												
CO4	4	3												

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	5 th Edition, 2006, Pearson Education, ISBN-13: 978-81-7758-424-0.
2	Linear Algebra and its Applications	David C. Lay,	3 rd Edition, 2002, Pearson Education India, ISBN-13: 978-81-7758-333-5.

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Linear Algebra and its Applications	Gilbert Strang	4 th Edition, 2006, Cengage Learning India Edition, ISBN: 81-315-0172-8.



Department: Computer Science and Engineering		Semester: IV
Subject: Software Engineering		
Subject Code:	22CS402	L – T – P - C: 3–0–0–3

Sl. No	Course Objectives
1	To gain the knowledge of systematic and disciplined approach for software development and identification of customer requirements for the development of SRS document.
2	To understand different software process models, architectural styles, software system design approaches and their appropriate application.
3	Understand the agile manifesto, principles and the context of agile concrete techniques of design and development that agile teams use to apply.
4	To Appreciate the need of project management and software testing methods.

Unit	Description	Hrs
I	Introduction to Software Engineering: Introduction, Professional software development, Software engineering ethics. Software processes - Software process models, Process activities, Coping with changes, Process Improvement.	08
II	Requirements Engineering: Functional and non-functional requirements, Requirements engineering processes, Requirements elicitation, Requirements specification, Requirements validation, Requirements change.	08
III	System Modeling: Context models, Interaction models, Structural models, Behavioral models. Architectural design - Architectural design decisions, Architectural views, Architectural patterns, Application architectures.	08
IV	Software Evolution: Evolution Process, Legacy Systems, Software Maintenance. Agile Software Development - Agile methods, Agile development techniques, Agile project management, Scaling agile methods	08
V	Software Testing: Development testing, Test-driven development, Release Testing, User Testing. Project Management : Risk Management, Managing People, Teamwork	08

Course Outcomes:

Course outcome	Descriptions
CO1	Able to map client requirements into software specifications by understanding software development life cycle.
CO2	Design and develop software models.
CO3	Able to apply the business values by adopting evolutionary approaches to software development.
CO4	Capable of managing the project and able to assess the software for its robustness.



Course Articulation Matrix

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

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Software Engineering	Ian Sommerville	10 th Edition ISBN 978-0-13-394303-0, By Ian Sommerville, published by Pearson

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Software Engineering – A Practitioners approach	Roger.G. Pressman	7 th Edition Tata McGrawhill, 2010 ISBN 978-0-07-337597-7
2	Foundations of Software Testing	Aditya P Mathur	Pearson Education, First Edition, 2011, ISBN-13: 978-8131759080



Department: Computer Science and Engineering		Semester: IV
Subject: Design and Analysis of Algorithms		
Subject Code:	22CS403	L – T – P - C: 3 – 0 – 2 – 4

Sl. No	Course Objectives
1	Learn the concepts of recursive and non-recursive algorithms.
2	Know different Algorithm Design Techniques for effective problem solving.
3	Analyze the algorithm with respect to space and time complexity.
4	Understand basic efficiency classes and asymptotic notations to express the complexity.

Unit	Description	Hrs
I	Introduction, Fundamentals of the Analysis of Algorithm Efficiency: What is an Algorithm? Fundamentals of algorithmic problem solving, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Non-Recursive and recursive Algorithms with Examples. Brute Force: Selection Sort, String Matching, Exhaustive Search.	08
II	Divide and Conquer: Merge Sort, Quick Sort, Finding the minimum and maximum element in an array. Decrease and Conquer: Insertion Sort, DFS, BFS and Topological Sorting.	08
III	Transform and Conquer: Balanced Search Trees: AVL Tree and 2-3 Tree, Heaps and Heap Sort. Space and Time Tradeoffs: Input Enhancement in String Matching: Horspool's algorithm,	08
IV	Dynamic Programming: Floyd's Algorithms, Knapsack Problem and Memory Functions. Greedy Technique: Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm.	08
V	Back tracking: n-Queen's Problem, Subset-Sum Problem. Branch and Bound: Assignment Problem and Traveling Salesman Problem.	08

LAB CONTENT

Sl. No	Experiment Description
1	Write a C program to sort a set of elements using Quick sort using divide and conquer technique.
2	Write a C program to finding the Maximum and Minimum element in an array of n integers using divide and conquer technique.
3	Write a C program to print the vertices of the directed acyclic graph in topological order using source removal method.



4	Write a C program to sort a set a set of elements using Heap sort.
5	Write a C program to implement Horspool algorithm for String Matching.
6	Write a C program to solve Knapsack problem and print the solution vector using Dynamic Programming.
7	Write a C program to find single source shortest path using Dijkstra's algorithm from a given source vertex in a weighted connected graph.
8	Write a C program to implement 'n' queens algorithm using backtracking.

Course Outcomes:

Course outcome	Descriptions
CO1	Understand the basic concepts of design and analysis of algorithms.
CO2	Demonstrate various techniques for designing and developing algorithms.
CO3	Design an algorithm using various design techniques and analyze its complexity to rank order of growth.
CO4	Solve the given problem instance using appropriate algorithm design technique.

Course Articulation Matrix

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

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Introduction to the Design & Analysis of Algorithms	Anany Levitin	3 rd . Edition, Pearson Education, 2012 ISBN-13: 978-0-13-231681-1



Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Algorithms	Cormen T.H, Leiserson C.E. & Rivest R.L	3 rd Edition, PHI, 2009, ISBN-13: 9780262033848
2	Computer Algorithms/C++	Ellis Horowitz, Satraj Sahni and Rajasekaran	2 nd Edition, Universities Press, 2014, ISBN-13: 978-8173716119



Department: Computer Science and Engineering		Semester: IV
Subject: Embedded Systems and IOT		
Subject Code:	22CS404	L – T – P – C: 3 – 0 – 2 – 4

Sl. No	Course Objectives
1	Acquire the fundamental knowledge about embedded system, IoT, Arduino architecture, sensors & Actuators
2	Learn Arduino programming and interfacing with sensors
3	Gain the knowledge about Arduino based IoT application projects
4	Learn to Design wifi modules using Arduino based IoT modules

Unit	Description	Hrs
I	INTRODUCTION TO EMBEDDED AND IoT SYSTEMS Introduction to Embedded and IoT Systems: Definition, components of embedded and IoT Systems, Embedded and IoT Systems design Process, Examples of Embedded and IoT systems– Mobile Phone, RFID Robotics, Biomedical Applications, Brain Machine Interface, smart homes, self-driving vehicles etc...	08
II	Arduino Microcontroller for embedded systems: Arduino embedded platform, Arduino Architecture, Arduino programming structure, installing the Arduino IDE, Introduction to Arduino IDE, Arduino syntax, Getting Started with Arduino. A Simple Arduino "Hello World" Program Digital I/O Functions, Analog I/O Functions, Advanced I/O Functions, Timer Functions, Communication Functions, Interrupt Functions. A simple Arduino program in C for LED blinking.	08
III	Sensors and Actuators interfacing with Arduino: Sensors: Classification, Roles of sensors in IoT. Actuators: Classification, Roles of actuators in IOT. Difference between sensors and actuators. Arduino interfacing and programming with- Light Sensors (LDR & Photodiodes), Temperature Sensors (IR and DTH11) for fire detection, object detection and line tracking. Moisture sensor for rain detection, Ultrasonic Sensors (HC-SR04) to determine the distance of an object	08
IV	Wireless communication with Arduino: Infrared Transmitter and Receiver Module, Introduction to IR Transmitter/Receiver Module, Wireless Radio Frequency Module, 2.5GHz Wireless RF Transceiver Module, Demonstration, Bluetooth - HC-05 Module, GSM/GPRS Module, A6 GSM/GPRS Module & Demonstration, Wi-Fi Module & Demonstration, Zigbee module	08
V	IoT based Embedded Systems: Defining IoT, Characteristics of IoT, design of IoT, Functional blocks of IoT, Communication models & APIs, IoT platforms, ESP8266-Introduction. Domain specific applications of IoT: Home automation, Industry applications, Environmental applications. IoT Cloud Platform and IoT client applications on mobile phones. .	08



LAB CONTENT

Sl. No	Experiment Description
1	Introduction to IoT toolkit – Familiarization with Arduino/Raspberry Pi/ ESP8266/ NodeMCU and perform necessary SW installations
2	Experiment to interface temperature sensor DHT11 and write a program to print the temperature and humidity reading
3	Build a Motion detector using a PIR sensor and display appropriate messages
4	Controlling the LED with a push button – turn on /turn off LED photo resistors LDR) – switch on the LED when light level goes below a particular threshold.
5	Rain Indicator using a Rain sensor and a water source
6	Controlling two actuators using Arduino
7	Creation of things speak account
8	Actuator controlling through cloud
9	DHT11sensor data to cloud
10	IoT based air pollution control system

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the basic concepts of Embedded system, IoT, Sensors and actuators.
CO2	Analyse sensor & actuator arduino modules to detect and control physical quantities
CO3	Design Arduino based IoT systems
CO4	Demonstrate wireless communication using Arduino based IoT module
CO5	Use of modern tools to develop smart home, smart city and smart agricultural hobby projects in team.

Course Articulation Matrix

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



Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Designing Embedded Systems with Arduino	Tianhong Pan, i Zhu	Springer Nature Singapore Pvt Ltd. ISBN 978-981-10-4417-5, 2018
2	Embedded Systems	Raj Kamal, TM	8th Edition, Mcgraw Hill, ISBN: 9789339203405 2014,
3	Internet of Things – A hands-on approach	Arshdeep Bahga, Vijay Madiseti	Universities Press, 2015

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Digital principles and Design	Donald D Givone	3rd Edition , Mc Hill Publications ISBN:007252503,2003,
2	Arduino Fundamentals and Applications	Prof. Amit Kumar Mishra	BFC Publications, ISBN: 9789390478590, 2021
3	Arduino and Raspberry Pi Sensor Projects for the Evil Genius	Robert Chin	McGraw-Hill Education, ISBN: 9781260010893, 2018



Department: Computer Science and Engineering		Semester:	IV
Subject: Automata Theory and Computation			
Subject Code:	22CS405	L – T – P - C:	3-0-0-3

Sl. No	Course Objectives
1	Understand core concepts in Automata and Theory of Computation.
2	Identify different Formal Language Classes and their Relationships.
3	Prove or disprove theorems in Automata Theory using their properties.
4	Compare finite automata, Push Down Automata and Turing Machines as Mathematical models of computation.

Unit	Description	Hrs
I	Introduction to Finite Automata Why study Automata Theory, The Central Concepts of automata theory: Alphabets, Strings, Languages, Problems, Set-Formers as a way to define languages, Definition of DFA, How a DFA processes strings, Simpler notations for DFA's, Extending the transition function to strings, The language of a DFA, Nondeterministic Finite Automata(NFA),An informal view of NFA, Definition of NFA, An Extended Transition Function, The language of NFA, Equivalence of DFA and NFA, Finite Automata with Epsilon-transitions.	08
II	Regular Expressions and Languages, Properties of Regular Languages Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions: Lexical Analysis, Finding Patterns in Text; Proving Languages Not to be Regular, Closure properties of Regular Languages, Equivalence and Minimization of Automata, Testing equivalence of states, Testing equivalence of Regular Languages, Minimization of DFA's.	08
III	Context-Free Grammars and Languages Context-Free Grammars, An informal example, Definition of Context-Free Grammars, Derivations using a Grammar, The language of a grammar, Sentential forms, Parse Trees, Constructing Parse Trees, The yield of a Parse tree, Inferences, Derivations and Parse Trees Applications of Context-Free Grammars, Parsers, The YACC Parser-Generator, Ambiguity in Grammars and Languages, Ambiguous Grammars, Removing ambiguity from grammars, Leftmost derivations as a way to express ambiguity, Inherent ambiguity.	08
IV	Pushdown Automata Definition of the Pushdown Automata, Informal Definition, Formal Definition, A Graphical Notation for PDA's, Instantaneous Descriptions of a PDA, The Languages of a PDA, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty stack, Equivalence of PDA's and CFG's, From Grammars to PDA's, From PDA's to Grammars, Definition of Deterministic PDA.	08



V	<p>Properties of Context-Free Languages, Turing Machines, Decidability</p> <p>Normal Forms for CFG's, Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating ϵ - Productions, Eliminating Unit Productions, Chomsky Normal Form.</p> <p>The Turing Machine: Notation for the Turing Machine, Instantaneous Descriptions for Turing Machines, Transition Diagrams for Turing Machines, The Language of a Turing Machine.</p> <p>Decidability: Definition of an algorithm, Decidability, Decidable languages, Undecidable languages, Halting problem of TM, Post correspondence problem.</p>	08
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Course Outcomes:

Course outcome	Descriptions
CO1	Explain the concepts of Automata and its applications.
CO2	Develop mathematical proofs for different types of computational models..
CO3	Design computational models to accept a given language and simulate the design.
CO4	Demonstrate the relationship among different components of automata theory.

Course Articulation Matrix

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



Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Automata Theory, Languages and Computation	John E Hopcroft, Rajeev Motwani, Jeffery D Ullman	3 rd Edition, Pearson Education Limited, 2014, ISBN-13:9781292039053
2	Theory of Computer Science : Automata Languages and Computation	K L P Mishra, N Chandrasekaran	3rd Edition, PHI, 2016 ISBN - 9788120329683

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Languages and Theory of Computation	John C Martin	4 th Edition, Tata McGraw –Hill Education, 2013, ISBN: 978-0-07-066048-9.
2	An Introduction to Formal Languages and Automata	Peter Linz	6 th Edition, Narosa Publishing House, 2016, ISBN: 9781284077254



Department: Computer Science and Engineering	Semester: IV
Subject: Dept. Skill Lab – II (Python Programming)	
Subject Code: 22CS406	L – T – P - C: 0 – 0 – 4 – 2

SI. No	Course Objectives
1	Understand the purpose and practical application of various Python programming constructs
2	Explore the operational principles of various Python data structures
3	Gain hands on experience on using Python Libraries for efficient data manipulation, analysis and visualization
4	Understand the purpose and practical application of various Python programming constructs

LAB CONTENT

SI. No	Experiment Description
Minimum of two lab exercises have to be conducted on each of the following topics and the students have to submit case studies by integrating all the concepts.	
1	Python Data Types, Operators and Expressions Conditionals and Iterations Functions and Modules Strings and Tuples
2	Lists, Dictionaries and Sets File handling Exception Handling
3	NumPy Arrays: Creating NumPy Arrays Array Indexing Reshaping Arrays Array Math Array Assignment Manipulating Tabular Data using Pandas: Pandas Series Pandas Data Frame Data Visualization using Matplotlib and Seaborn: Plotting Line Charts Plotting Bar Charts Plotting Pie Charts



	Plotting Scatter Plots Plotting Using Seaborn
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Course Outcomes:

Course outcome	Descriptions
CO1	Demonstrate expertise in handling various Python programming constructs
CO2	Identify and use appropriate data structures for efficient data representation and access
CO3	Develop Python scripts to analyze and visualize datasets

Course Articulation Matrix

PO/PSO CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
CO1	1											3		
CO2	1	3			1							3		
CO3	1	3			1			3	3			3		



Department: Computer Science and Engineering		Semester:	IV
Department: Common to all branches of engineering			
Semester: III (Group-2.branches - ISE/ECE/ETE/MLE/DSE)			
Semester: IV (Group-1.branches -CE/ME/EEE/CSE/AI&ML)			
Subject: SKILL DEVELOPMENT-I			
Subject Code:	22SK407	L – T – P - C:	1-1-0-1

SI. No	Course Objectives
1	Improve Communication Skills: Enhance students' ability to express ideas clearly, listen actively, and adapt communication style to different contexts and audiences.
2	Foster Effective Teamwork: Develop students' teamwork skills, including cooperation, active participation, conflict resolution, and leveraging diverse strengths for collaborative success.
3	Enhance Leadership Abilities: Cultivate leadership qualities by helping students develop self-awareness, problem-solving skills, and decision-making abilities
4	Promote Professional Etiquette: Instill a sense of professionalism in students, emphasizing appropriate workplace behavior, business etiquette, and ethical conduct.

COURSE TOPICS

The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hour duration.
The syllabus for the lectures is given below

Unit	Description	Hrs
I	Communication Skills: Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening. Communication with Confidence & Clarity: Interaction with people, the need the uses and the methods, Getting phonetically correct, using politically correct language, Debate & Extempore.	06
II	Assertive Communication: Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive. Presentation Skills Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, How to make effective presentations, body language & Dress code in presentation, media of presentation	05
III	Team Work : Team Work and its important elements Clarifying the advantages and challenges of team work Understanding bargains in team building Defining behavior to sync with team work Stages of Team Building Features of successful teams. Body Language & Proxemics : Rapport Building - Gestures, postures, facial	05



	expression and body movements in different situations, Importance of Proxemics, Right personal space to maintain with different people.	
IV	<p>Group discussion, Motivation and Stress Management :</p> <p>a. Theory & Evaluation : Understanding why and how is the group discussion conducted.</p> <p>b. Techniques of group discussion</p> <p>c. Discussion on FAQs of group discussion</p> <p>d. Body language during group discussion</p> <p>Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques. Individual Counseling & Guidance, Career Orientation. Balancing Personal & Professional Life</p>	06
V	<p>Interview Skills, Professional Practice :</p> <p>a. Personal and Group Interviews</p> <p>b. Mock Interviews - Questions asked & how to handle them</p> <p>c. Body language in interview</p> <p>d. Etiquette, Dress code in interview</p> <p>e. Behavioral and technical interviews</p> <p>f. Practice on stress interviews, technical interviews, General HR interviews</p> <p>Professional Practice: Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behavior at different Hierarchical Levels. Positive Attitude, Self-Analysis and Self-Management. Professional Ethics values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects. Balancing Personal & Professional Life</p>	06

Course Outcomes:

Course outcome	Descriptions
CO1	Improved Communication Skills: Students will demonstrate enhanced verbal and written communication abilities, effectively expressing ideas, actively listening, and adapting their communication style to different situations.
CO2	Effective Teamwork and Collaboration: Students will exhibit improved teamwork skills, actively contributing to group projects, resolving conflicts constructively, and leveraging the strengths of team members to achieve shared goals.
CO3	Professional Etiquette and Conduct: Students will display professional behavior, adhering to workplace etiquette, demonstrating appropriate appearance, punctuality, and practicing ethical conduct in professional settings.
CO4	Strengthened Aptitude Skills: Students will demonstrate improved aptitude skills, including logical reasoning, analytical thinking, and problem-solving abilities, enabling them to excel in competitive exams, interviews, and real-life problem-solving scenarios



Course Articulation Matrix

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

Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Technical Communication Principles and Practices,	Meenakshi Raman and Sangeeta Sharma,	Oxford Publishers, 2004
2	Tools for Talking When Stakes are High,	Kerry Patterson, Joseph Grenny, Ron McMillan, Crucial Conversation	McGraw-Hill Publication, ISBN: 9780071772204

SUGGESTED ASSESSMENT:

Internal Assessment through 2-Tests, each carries 25 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.



SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY- TUMAKURU

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

Academic year 2023-2024



Department: Computer Science and Engineering		Semester: IV	
Department: Common to all branches of engineering			
Semester: III (Group-2.branches- ISE/ECE/ETE/MLE/DSE)			
Semester: IV (Group-1.branches – CE/ME/EEE/CSE/AI&ML)			
Subject: Constitution of India			
Subject Code:	22CI408	L – T – P - C:	0–2–0–1

Sl. No	Course Objectives
1	To be familiar with salient features and preamble of the constitution of India. Including fundamental rights of the citizen of India and types of Fundamental rights
2	To understand the relevance of directive principles under part-IV, and the responsibilities of the individuals towards society.
3	To understand the powers and functions of the Legislature, Executive, and judicial bodies.
4	To provide the information of FDs, Electoral Process, emergencies and amending procedures.

COURSE TOPICS

The course has 28 lectures in 5 Units. The 2- lecture hours per week of 1-hour duration.

The syllabus for the lectures is given below

Unit	Description	Hrs
I	Introduction, Meaning and definitions. Salient features, Sources, Constituent Assembly, Drafting Committee. Preamble to the constitution of India.	06
II	Fundamental rights under part III – details of exercise of rights, Scopes & Limitations and, important cases	06
III	Relevance of directive principles of state policy under part-IV Fundamental duties and their significance-part-IV A	06
IV	Union Executive- President, Prime minister, Parliament and Supreme Court of India. State Executive – Governors, Chief Ministers, State legislature and High Courts.	04
V	Constitutional Special Provisions for Scheduled Castes and Tribes, Women, Children and backward classes. Emergency provisions under Part XVIII. Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th, and 91st Constitutional amendments.	06



Course Outcomes:

Course outcome	Descriptions
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations
CO2	Understand the freedom, rights and restrictions including directives, through fundamental duties
CO3	Understand the importance of the three main organs of the constitution, Viz-the legislature, the executive and the judiciary.
CO4	Understand the power and functions of political institutions established throughout the country

Course Articulation Matrix

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

Text Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	Introduction to the Constitution of India” (student edition)	DurgaDas Basu,	EEE, 19 th / 20 th Edn.,2001
2	An Introduction to Constitution of India	MV Pylee.	Volume-1 Vikas Publishing, 2002



Reference Books:

SI No	Text Book title	Author	Volume and Year of Edition
1	An Introduction to Constitution of India”	Brij kishore Sharma,	prentice-Hall of India, Volume-12002
2	Constitution of India and Professional Ethics	V. Rajaram	Second Edition New Age International Publication. 2011

SUGGESTED ASSESSMENT:

Internal Assessment through 2-Tests, each carries 25 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.