Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for

Second Year B. Tech.

(Computer Engineering)

2020 Pattern

Department of

Computer Engineering

Vision and Mission of the Department

- **Vision**

  "Excellence in the field of Computer Engineering for rendering services to the industry and society".

- **Mission**

  - To empower our students for substantial contribution to economical, technological, entrepreneurial and social progress of the society.
  - To strive for excellence at different levels and diverse dimensions in the field of computer engineering.
  - To encourage students to pursue research and advanced studies for better adaptability towards globalization.

Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** Use knowledge to write programs and integrate them with the hardware/software products in the domains of embedded systems, data Science, networking and web technology.
- **PSO b:** Participate in planning and implement solutions to cater to business – specific requirements, displaying team dynamics and professional ethics.

Program Outcomes (POs)

At the end of program, students should be able to:

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

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

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

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

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

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

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

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

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

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

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

12. Life-long learning: 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.

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Department of Computer Engineering

Second Year B.Tech.

Pattern 2020

Syllabus Structure

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

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Department of Computer Engineering

S.Y. B. TECH. COMPUTER ENGINEERING, SEMESTER III (PATTERN 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/ TW		
ES21201CS	Analog and Digital Electronics*	TH	3	0	2	20	30	20	30	25	125	4
CSUA21202	Computer Architecture and Organization*	TH	3	0	2	20	30	20	30	25	125	4
ES21203CS	Discrete Mathematics	TH	3	1	0	20	30	20	30	25	125	4
CSUA21204	Fundamentals of Data Structure*	TH	3	0	2	20	30	20	30	25	125	4
ES20205	Universal Human Values 2	TH	2	1	-	20	30	20	30	25	125	3
CSUA21206	Object Oriented Programming (Java)	CE	1	0	4	-	-	-	-	50	50	3
ES21207CS	Critical and Design Thinking	CE	1	0	2	-	-	-	-	50	50	2
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		**16**	**2**	**12**	**100**	**150**	**100**	**150**	**225**	**725**	**24**

***Indicates PR/OR**

BoS Chairman **Dean Academics** **Director**

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Department of Computer Engineering

S.Y. B. TECH. COMPUTER ENGINEERING, SEMESTER IV (PATTERN 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR /TW		
ES22201CS	Probability and Statistics	TH	3	1	0	20	30	20	30	25	125	4
CSUA22202	Advanced Data Structure *	TH	3	0	2	20	30	20	30	25	125	4
CSUA22203	Database Management System*	TH	3	0	2	20	30	20	30	25	125	4
CSUA22204	Operating System*	TH	3	0	2	20	30	20	30	25	125	4
CSUA22205	Theory of Computation	TH	3	0	-	20	30	20	30	-	100	3
CSUA22206	IT Workshop (Python)	CE	1	0	4	-	-	-	-	50	50	3
ES22207CS	Soft Skills	CE	1	0	2	-	-	-	-	50	50	2
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		**17**	**1**	**12**	**100**	**150**	**100**	**150**	**200**	**700**	**24**

***Indicates PR/OR**

BoS Chairman **Dean Academics** **Director**

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Department of Computer Engineering

SEMESTER – III

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Department of Computer Engineering

ES21201CS : Analog and Digital Electronics

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
PR/OR: 25 Marks

Prerequisites :

- Basic Electronics Engineering

Course Objectives :

- To learn basic digital circuit design techniques.
- To study the implementation of digital circuits using combinational logic.
- To explain and implement circuits using sequential logic.
- To explain the basics of Logic Families.
- To illustrate the concept of PLD's.
- To show the implementation of digital circuits using VHDL.

Course Outcomes:

After completion of the course, student will be able to

1. Simplify Boolean algebraic expressions for designing digital circuits using KMaps. (Analyzing)
2. Apply digital concepts in designing combinational circuits. (Applying)
3. Make use of digital concepts in designing sequential circuits. (Applying)
4. Develop mini digital circuit application. (Creating)
5. Construct digital circuits using PLA and PAL. (Creating)
6. Design digital circuits using VHDL. (Creating)

Unit I: Number System and Logic Minimization Techniques

Number System: Introduction, Binary number System, Sign-Magnitude representation, One's and Two's complement representation, Binary arithmetic, 2's complement arithmetic, Octal number System, Hexadecimal number System, Basic theorems and properties.
Logic minimization: Representation of truth-table, Sum of Product (SOP) form, Product of Sum (POS) form, Simplification of logical functions, Minimization of SOP and POS forms using K-Maps up to 4 variables and Quine-McCluskey Technique, realization of logic gates.

Unit II: Combinational Logic

Design of Combinational Logic: Code converter - BCD, Excess-3, Gray code, Binary Code. Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Look ahead carry generator, Multiplexers (MUX): MUX (IC 74153, 74151), MUX tree, Demultiplexers (DEMUX)- Decoder. (IC 74138, IC 74154). DMUX Tree, Implementation of SOP and POS using MUX, DMUX, Comparators, Parity generators and Checker, One bit, Two bit, 4-bit Magnitude Comparator.

Unit III: Sequential Logics

Flip-flop: SR, JK, D, T; Preset & Clear, Master and Slave Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flip Flop.
Registers: Buffer register, shift register (SISO, SIPO, PISO& PIPO), Applications of shift registers.

Unit IV: Counters

Counters: Asynchronous counter. Synchronous counter, ring counters, Johnson Counter, Modulus of the counter (IC 7490).
Synchronous Sequential Circuit Design: Models – Moore and Mealy, State diagram and State Tables, Design Procedure, Sequence generator and detector.
Asynchronous Sequential Circuit Design: Difference with synchronous circuit design, design principles and procedure, applications.

Unit V: Logic Families

Classification of logic families: Unipolar and Bipolar Logic Families, Characteristics of Digital ICs: Speed, power dissipation, figure of merits, fan-out, Current and voltage parameters, Noise immunity, operating temperature range, power supply requirements.
Transistor-Transistor Logic: Operation of TTL, TTL characteristics.
CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations- Wired Logic, Open drain outputs.
Interfacing: TTL to CMOS and CMOS to TTL.
Digital Circuit Implementation using IOT: Introduction and applications of Raspberry pi and Arduino architecture.

Unit VI: Introduction to PLD's & VHDL

Introduction to PLD's: - PAL, PLA, Applications of PLAs to implement combinational and sequential logic circuits, FPGA and CPLD.
VHDL: Introduction to HDL, Data Objects & Data Types, Attributes., VHDL- Library, Design Entity, Architecture, Modeling Styles, Concurrent and Sequential Statements.
Design Examples: VHDL for Combinational Circuits-Adder, MUX, VHDL for Sequential Circuits, Synchronous and Asynchronous Counter.

Text Books :

1 R. P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, 2003, ISBN0 – 07 – 049492 – 4.

2 J. Bhaskar, "VHDL Primer" 3rd Edition, Pearson Edition.
3 Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL Design", McGraw Hill, ISBN–13:978-1-25-902597-6.
4 G.K.Kharate, "Digital Electronics", Oxford University Press.

Reference Books :

1 John Yarbrough, "Digital Logic applications and Design" Thomson.
2 Flyod "Digital Principles", Pearson Education.
3 Malvino, D.Leach "Digital Principles and Applications", 5th edition, Tata McGraw Hill.
4 Douglas L. Perry, "VHDL Programming by Example", Tata McGraw Hill.
5 G. K. Kharate, "Digital Electronics", Oxford University Press.

List of Assignments:

Students need to apply their knowledge of digital electronics and design the circuits.

1 Number system conversion and 2's compliment arithmetic.
2 Realize Full Adder and Subtractor using a) Basic Gates and b) Universal Gates.
3 Design and implement Code Converters-Binary to Gray and BCD to Excess-3.
4 Design and Realization of BCD Adder using 4-bit Binary Adder (IC 7483).
5 Design of Ripple Counter using JK-Flip Flops.
6 Design 3 bit Synchronous Up/Down Counter using JK-Flip Flop.
7 Design and implement Mod -N counter using IC-7490.
8 Simulation of - Full adder using behavioural modeling style of VHDL.
9 Simulation of – 4:1 MUX using data flow modeling style of VHDL.
10 Mini project: Students are expected to apply their knowledge to design and develop a digital system as a part of this project.

CSUA21202 : Computer Architecture and Organization

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
PR/OR: 25 Marks

Prerequisites:

- None

Course Objectives:

- To identify the elements of modern instructions sets and explain their impact on processor design.
- To study memory management in microprocessor.
- To study protection mechanism of microprocessor.
- To explain the function of each element of a memory hierarchy, identify and compare different methods for computer I/O.
- To understand various computer arithmetic techniques.
- To study pipelined architecture in microprocessors.

Course Outcomes:

After completion of the course, student will be able to

1. Demonstrate the use of Instruction sets in assembly programming.
2. Comprehend segmentation and paging techniques.
3. Compare segment descriptors and different privileges levels.
4. Sketch the concepts of memory and I/O.
5. Solve numerical problems using computer arithmetic techniques.
6. Use of Pipeline Architecture.

Unit I : Introduction to Microprocessor

Architecture of 8086 and 80386DX, Register set, Flags, Physical address space of 8086, Data types, Addressing Modes, 80386DX Instruction Set.

Unit II : Memory Management

Memory Management in 80386-Segment Translation, Page Translation, Combining Segment and Page Translation.

Unit III : Protection

Operating in Real Mode, Virtual x86 Mode, Protection: Need of Protection, Overview of 80386DX protection Mechanism, Privilege levels.

Unit IV : Memory Organization

Characteristics of memory system, The memory hierarchy, Cache Memory- Cache memory

principles, Replacement algorithms, Write policy, One level and two level cache, I/O modules- Module function and I/O module structure, Programmed I/O, Interrupt driven I/O.

Unit V: Computer Arithmetic Techniques

The Arithmetic and Logic Unit, Multiplication of positive numbers, Signed operand multiplication, Booths algorithm, Integer division, Floating point representation – IEEE standard.

Unit VI : Processor Organization

Instruction Cycle-Indirect cycle and Data flow, Instruction Pipelining- Pipelining Strategy, Pipeline performance, Pipeline hazards, Comparative study of modern 64 bit multi core processors.

Text Books :

1 W. Stallings, ―Computer Organization and Architecture: Designing for performance‖, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7th Edition**.**
2 Zaky S, Hamacher, ―Computer Organization‖, 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.
3 Douglas Hall, "Microprocessors & Interfacing", McGraw Hill, Revised 2nd Edition, 2006 ISBN 0-07-100462-9

Reference Books :

1 John P Hays, ―Computer Architecture and Organization‖, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rd Edition.
2 Intel 64 and IA-32-bit architectures Software Developer's Manual, Volume 3A, Intel, (Digital Content PDF: 253668.pdf)
3 A. Ray, K. Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing",Tata McGraw Hill,2004 ISBN 0-07-463841-6

List of Assignments :

- Assignments 1 and 2 are mandatory
- Implement any 4 from assignments 3 to 8

1. Multiply the following using Booth's Algorithm
   Multiplicand = +11
   Multiplier = -6
2. Perform Division of following numbers using Restoring Division Algorithm
   Dividend= 1011
   Divisor=0011
3. Write 64-bit ALP to "Hello World" in NASM
4. Write 64-bit ALP to accept number and display it on screen.
5. Write 64-bit ALP to convert HEX 4-digit input to BCD 5-digit output.
6. Write 64-bit ALP to accept the numbers from user and perform addition of 2 numbers and display the result on screen.

7. Write 64-bit ALP to perform following string operations
   i) Length of String
   ii) Reverse of String
8. Write 64-bit ALP to perform multiplication of two 8-bit hexadecimal number with successive addition.

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ES21203CS : Discrete Mathematics

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Tutorial : 1 Hr/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
TW: 25 Marks

Prerequisites :
- Basic Algebra

Course Objectives :
- To study basic of logic and set theory
- To understand notion of functions and relations
- To study fundamental principles of graphs
- To study fundamental principles of trees elementary combinatorial processes
- To study fundamental principles of counting
- To introduce basic concepts of algebraic structures

Course Outcomes :

After completion of the course, student will be able to
1. Demonstrate use of logical arguments, proof techniques and set theory principles. (Understanding)
2. Illustrate type, properties and solution of relations and functions. (Understanding)
3. Solve the problems using graph methods and algorithms. (Applying)
4. Apply tree models and methods for obtaining solutions of applications involving searching, prefix code and vertex connectivity. (Applying)
5. Apply principles of counting to solve counting problems. (Understanding & Applying)
6. Prove elementary properties of modular arithmetic and explain their applications in Computer Science,

Unit I : Mathematical Logic and Set Theory

Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy Sets, Combination of sets, Venn Diagrams, Finite and Infinite sets, Uncountably infinite sets, Principle of inclusion and exclusion, multisets.

Unit II : Functions and Relations

Functions, Composition of functions, Invertible functions, Discrete Numeric functions and

Generating functions, Job scheduling Problem.
Properties of Binary Relations, Closure of relations, Warshall's algorithm, Equivalence Relations and Partitions, Partial ordering relations and Lattices, Chains and Anti-chains.
Recurrence Relations : Recurrence Relation, Linear Recurrence Relations with constant Coefficients, Homogeneous Solutions, Total solutions, Solutions by the method of generating functions

Unit III : Graphs

Basic terminology, Representation of graph in computer memory, Multigraphs and Weighted graphs, Subgraph, Isomorphic graph, Complete ,Regular and Bipartite graphs, Operation on graph, Paths and Circuits, Hamiltonian and Euler paths and circuits, Shortest path in weighted Graph (Dijkstra's algorithm), Factors of a graph, Planar graph and Travelling salesman problem, Graph colouring

Unit IV : Trees

Trees, Rooted trees, Path length in rooted trees, Prefix codes and optimal prefix codes, Binary search trees, Tree traversals, Spanning trees, Fundamental circuits and cut set, Minimal spanning trees, Kruskal's and Prim's algorithms for minimum spanning tree, The Max flow –Min cut theorem (transport network)

Unit V : Counting

Permutations and Combinations: Rule of sum and product, Pigeonhole principle, Permutations, Combinations, Binomial Coefficients and identities, Algorithms for generation of Permutations and Combinations

Unit VI : Algebraic Structures

The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, and congruence relations, Rings, Integral Domains and Fields, coding theory, Polynomial Rings and polynomial Codes, **Case Study-** Brief introduction to Galois Theory –Field Theory and Group Theory

Textbooks :

1 Kenneth H. Rosen, "Discrete Mathematics and its Applications", 6th edition, McGraw-Hill, 2007. ISBN 978-0-07-288008-3.
2 C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 6th edition,TataMcGraw-Hill, 2008, ISBN 10:0-07-066913-9.
3 R. Johnsonbaugh, "Discrete Mathematics", 5th Edition, Pearson Education, 2001 ISBN 81 –7808 – 279 – 9.

Reference Books :

1 B. Kolman, R. Busby and S. Ross, "Discrete Mathematical Structures", 4th Edition, Pearson Education, 2002, ISBN 81-7808-556-9
2 N. Deo, "Graph Theory with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4
3 Eric Gossett, "Discrete Mathematics with proof", 2nd edition, Wiley Student

Edition, ISBN: 978-81-265-2758-8

List of Assignments : Tutorial based on following –

Assignment 1: Mathematical Logic and Set Theory

1. A survey on sample 25 new cars being sold out at a local auto dealer was conducted to see which of three popular option Air Conditioner (A), Radio (R), Power Windows(W) were already installed. The survey found 15 had Air Conditioners, 12 had Radios, and 11 had Power Windows. 5 had Air Conditioner and Power Windows, 9\ had Air Conditioner and Radio, 4 had Radio and Power Windows. Three had all three options. Find number of cars which had:
   (i)only one of the option
   (ii)at least one of the option
   (iii)none of the options.

Use principle of inclusion exclusion

2. Draw Venn diagram and prove the expression.
3. Prove by induction that for all n > 1

$$\frac{n(n+1)(n+2)}{3} = 1.2 + 2.3 + \ldots\ldots\ldots\ldots + n(n+1)$$

4.Show that (p ∧ q) -> (p -> q) is a tautology.

5.Consider the following:

p : This system is good
q : This system is cheap
Write each of the following statement in symbolic form.

(i) This system is good and cheap
(ii) This system is not good but cheap
(iii) This system is neither good nor cheap
(iv) This system is good or cheap

6. A survey has been taken on modes of travels. Each respondent was asked to check bus, train or automobile as major modes of travelling for work. More than one answer was permitted. The result, reported outcome were as follows:
Bus-40 people, train-45 people, automobile-100 people, bus and train-20 people, bus and automobile-15 people, train and automobile-20 people and all three modes-5 people. How many people completed a survey from? Apply principle of inclusion and exclusion.

7.Use mathematical induction to show that:

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots\ldots\ldots\ldots + \frac{1}{n(n+1)} = \frac{n}{n+1} \quad \text{for all } n \geq 1$$

8. Define the terms Universal Quantifier and Existential Quantifier.

Assignment 2: Functions and Relations

1. Draw Hasse diagram for any relation. Determine the chains and anti-chains.
2. Let A= {1,2,3} and B={a,b,c,d}. In each case state whether the given

function (if defined) is injective, subjective, objective.
f={(1,a),(2,d),(3,b)} g={(1,a),(2,a),(3,d)}
h={(1,a),(1,b),(2,d),(3,c)} j={(1,a),(2,b)}

3. Find homogeneous solution of a recurrence relation: $a_n=11a_{n-1} - 39a_{n-2} + 45a_{n-3}$ for $a_0=5$, $a_1=11$, $a_2=25$.
4. Find the transitive closure of R by Warshall's algorithm. Where A= {1,2,3,4,5,6} and R={(x-y);|x-y|=2}
5. Explain with example –
(i)Equivalence relation
(ii)Partial ordering relation
6. Consider the following relation on {1, 2, 3, 4, 5, 6}: R= {(i, j) | |i-j|=2} Is R transitive? Is R reflexive? Is R symmetric?
7. Let f, g, h be the functions from N to N, where N is the set of natural numbers so that f(n)=n+1, g(n)=2n, h(n)=0 if n is even and h(n)=1 if n is odd. Determine fof, fog, gof, goh, hog, fogoh
8. Let R be the relation on the set A. A={5,6,8,10,28,36,48}. Let R={(a,b)| a is a divisor of b}. Draw the Hasse diagram. Compare with diagraph. Determine whether R is equivalence relation.

Assignment 3 : Graphs

1.Solving the shortest path by using Dijkstra's algorithm in any graph.
2.Define following terms with suitable examples:
a. Planar Graph
b. Complete Graph
c. Connected and Disconnected Graph
3. Show that in a connected planar graph with 6 vertices and 12 edges, each of the regions is bounded by 3 edges.
4. Explain adjacency matrix and adjacency list with example.
5. Explain term eulerian path and circuit with example.
6. Explain multigraph with example.
7. Define Graph Kn, Kmn.
8. Find whether K6 and K3,3 graphs are isomorphic or not.

Assignment 4: Trees

1. Draw binary search tree for input data 200,100,300,50,150,400,10,75,125,175. Which is a root, leaf nodes and interior nodes?
2.For any sets of weights construct an optimal binary Prefix code.
3.19 lamps are to be connected to single electrical outlet, using extension Cords , each of which has 4 outlets. Find the number of extension cords needed and draw corresponding tree.
4.Find the minimum cost spanning tree of any graph using Prim's algorithm.
5. Find the minimal flow in any transport network using labeling procedure. Determine the corresponding minimum cut
6. Use Kruskal's algorithm to find minimum spanning tree (MST) of any given graph.
7. Draw the unique binary tree when inorder and preorder traversal of tree is given.

8. What is total number of nodes in a full binary tree with 20 leaves?

Assignment 5: Counting

1. In how many ways can seven men and seven women sit down at a round table in such a way that no two men sit next to each other?
2. One card is drawn from a pack of cards. Express each of the following probabilities:
   a. The card is the king of diamonds
   b. The card is ace
   c. The card is 9 or 10
   d. The card is a spade
3. A bag contains 3 red & 5 black balls & second bag contains 6 red & 4 black balls. A ball is drawn from each bag. Find the probability that:
   a. Both are red
   b. Both are black
   c. 1 is red & 1 is black
4. Find the number of arrangements that can be made out of the letters:
   a. ASSASSINATION b. GANESHPURI
5. A pair of dice is thrown. Find the probability that the sum is 10 or greater if:
   a. 5 appears on first die. b. 5 appear on at least one die.
6. Show that if 7 colours are used to paint 50 bicycles, at least 8 bicycles will be the same colour.
7. Suppose repetitions are not permitted
   a. How many ways three digits numbers can be formed from six digits 2,3,4,5,7,9?
   b. How many of these numbers are less than 4000?
8. Explain Pigeonhole Principle.

Assignment 6: Algebraic Structures

1. Let (Z, *) be an algebraic structure, where Z is the set of integers and the operation * is defined by n * m = maximum of (n, m). Show that (Z, *) is a semi group. Is (Z, *) a monoid? Justify your answer
2. In a group (G, *), Prove that the identity element is unique.
3. Explain Galois theory
4. Explain Isomorphism and Homomorphism of two semigroups.
5. Show that (F, +, .) is a field where F is set of all rational numbers and + and . are ordinary addition and multiplication operations?
6. Define Normal subgroup and rings with example
7. Prove that

$$((a + b\sqrt{2}), +, *)$$

Where a, b belongs to R is Integral domain
8. Explain Polynomial codes and Polynomial rings

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Department of Computer Engineering

CSUA21204 : Fundamentals of Data Structure

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
PR/OR: 25 Marks

Prerequisites : Computer Fundamentals

Course Objectives :

- To understand the different ways of data representation
- To develop the ability to synthesize and analyze algorithms
- To study linear data structures and their applications.
- To understand concepts about searching and sorting techniques.
- To enable students to write algorithms for solving problems with the help of fundamental data structures.

Course Outcomes :

After completion of the course, student will be able to

1. Understand arrays and their implementation with basics of algorithm analysis.(Understand)
2. Synthesize and analyze algorithms with respect to time and space complexity
3. Apply various linear data structures using sequential and linked organization for problem solving and programming.(Apply)
4. Apply advanced linear data structure stack for problem solving and programming.(Apply)
5. Apply advanced linear data structure queue for problem solving and programming. (Apply)
6. Select appropriate searching and/or sorting techniques in the application development.(Evaluate)

Unit I : Introduction to Data Structures

Concept of data, functions, difference between compiler and interpreter, Abstract Data Types (ADT),data structure and its types, Difference between individual variables against Data Structures, Array, Pointers, Analysis of algorithm(Frequency count method)

Unit II : Concept of sequential organization

Concept of Linear data structures, Concept of ordered list, Storage representations of ordered list such as row major, column major and their address calculation. Representation of sparse matrix using arrays, application of array in polynomial representation and algorithm for sparse matrix addition, simple and fast transpose, pointer to an arrays, array of pointers, String Manipulation.

Unit III : Linear Data Structure- Linked Lists

Concept, Comparison of Sequential and linked organizations, Linked list as an ADT, Singly Linked List, Doubly Linked List and Circular Linked Lists with all operations like Creations, insertion (all positions), Deletion (all positions),

Unit IV : Linear Data Structures –Stack

Stacks: Concept of stack, Stack as an ADT, push and pop operation, Stack implementation using array and linked list, application of stack for expression conversion (numericals infix-postfix, prefix and (numerical postfix)evaluation, Recursion concept and use of internal stack.(program infix-postfix CE)

Unit V : Linear Data Structures-Queue

Concept of queue, Queue as an ADT, Linear queue implementation using array and linked list, Circular queue, Priority queue, Doubly ended queue, Multi-queues, Applications of Queue.

Unit VI : Searching, sorting and hashing techniques

Linear & Binary search, Bubble sort, Selection sort, Insertion Sort, Merge Sort, Quick Sort & complexity Analysis of algorithms. **Hash tables:** Basic concepts, Hash function, collisions, Collision resolution techniques, Applications

Text Books :

1 Horowitz and Sahani, ―Fundamentals of Data Structures in C++, University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926.
2 R. Gillberg, B. Forouzan, ―Data Structures: A Pseudo code approach with C, Cenage Learning, ISBN 9788131503140.
3 A. Tanenbaum, Y. Langsam, M. Augenstein: Fundamentals of Data Structure, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.

Reference Books :

1 M. Weiss, ―Data Structures and Algorithm Analysis in C++, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
2 Introduction to Algorithms 3rd Edition by Thomas H. Cormen, Charles E.Leiserson, Ronald L Rivest,& Clifford Stein, MIT Press ,Cambridge MA USA ,ISBN 978-81-203-4007-7
3 A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson

Education, 1998, ISBN-0-201-43578-0

List of Assignments (Any 5) : Programming Language: C++

1. Perform following string operations with and without pointers: 1. Length 2. Copy 3.Concat 4. Compare 5.Reverse.
2. Accept conventional matrix and convert it into sparse matrix. Implement simple transpose and Fast transpose algorithms on sparse matrix.
3. Create a database using array of structures and perform following operations on it: i. Add record ii. Display Database iii. Search record (binary search) iv. Delete record
4. Create a Singly linked list for employee data and perform a. insertion b. deletion c. search d. modify
5. Implement polynomial using Doubly Linked List and perform Addition/ Multiplication of Polynomials
6. Implement polynomial using Doubly/Circular Linked List and perform Evaluation of polynomial
7. Perform implementation of STACK using array
   a. Push an element on to stack
   b. Pop an element
   c. Demonstrate overflow simulations on stack
   d. Display stack
8. Perform implementation of STACK using Linked List
   a. Push an element on to stack
   b. Pop an element
   c. Demonstrate overflow simulations on stack
   d. Display stack
9. Implement stack for expression conversion (infix to postfix)
10. Perform implementation of Queue using array and Linked List
    a. Enqueue
    b. Dequeue
11. Pizza parlor accepting maximum n orders. Orders are served in FCFS basis. Order once placed can't be cancelled. Write C++ program to simulate the system using circular Queue.
12. Sort the data in ascending order using Bubble sort (Display pass by pass output) and search a particular data using Binary search.

    OR

    Implement Quick Sort to sort the given list of numbers. Display corresponding list in each pass.
13. Sort the data in ascending order using Selection sort (Display pass by pass output) and search a particular data using binary search.

    OR

    Implement Quick Sort to sort the given list of numbers. Display corresponding list in each pass.

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Department of Computer Engineering

ES21205 : Universal Human Values 2

Teaching Scheme
Credits : 3
Lectures : 2 Hrs/week
Tutorial : 1 Hr/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
TW: 25 Marks

Prerequisites :

- Universal Human Values – I

Course Objectives :

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Outcomes :

After completion of the course, student will be able to

1. Become more aware of themselves, and their surroundings family, society, nature.
2. Become more responsible in life.
3. To handle problems with sustainable solutions.
4. Have better critical ability.
5. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
6. To apply what they have learnt to their own self in different day-to-day settings in real life.

Unit I : Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course,
Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration,
Continuous Happiness and Prosperity- A look at basic Human Aspirations,
Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority,
Understanding Happiness and Prosperity correctly- A critical appraisal of the current

scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit II : Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body',
Understanding the needs of Self ('I') and 'Body' - happiness and physical facility,
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer),
Understanding the characteristics and activities of 'I' and harmony in 'I',
Understanding the harmony of I with the Body, correct appraisal of Physical needs, meaning of Prosperity in detail.

Unit III : Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness, Trust and Respect as the foundational values of relationship
Understanding the meaning of Trust; Difference between intention and Competence,
Understanding the meaning of Respect, Difference between respect and Differentiation; the other salient values in relationship,
Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals,
Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit IV : Understanding Harmony in the Nature and Existence - Whole existence as Coexistence with Implications of the Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values , Definitiveness of Ethical Human Conduct,
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order
b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Discussion on the conduct as an engineer or scientist.

Text Book:

1 Human Values and Professional Ethics by R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

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).
4 The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5 Small is Beautiful - E. F Schumacher
6 Slow is Beautiful - Cecile Andrews
7 Economy of Permanence -J C Kumarappa
8 Bharat Mein Angreji Raj – Pandit Sunderlal
9 Rediscovering India - by Dharampal
10 Hind Swaraj or Indian Home Rule -by Mohandas K. Gandhi
11 India Wins Freedom - Maulana Abdul Kalam Azad
12 Vivekananda - Romain Rolland (English)
13 Gandhi - Romain Rolland (English)

List of Assignments : (Any 7 for Tutorial)

1 Practice session to discuss natural acceptance in human being.
2 Practice session to discuss the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking- disliking.
3 Practice session to discuss the role others have played in making material goods available to me. Identifying from one's own life.
4 Practice session to differentiate between prosperity and accumulation.
5 Practice session to discuss program for ensuring health vs dealing with disease.
6 Practice session to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc.
7 Practice session to reflect on Gratitude as a universal value in relationships. Discuss with scenarios.
8 Practice session to reflect on Gratitude Elicit examples from students' lives.
9 Practice session to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
10 Case Study session e.g. to discuss the conduct as an engineer or scientist etc.

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Department of Computer Engineering

CSUA21206: Object Oriented Programming

Teaching Scheme
Credits : 3
Lectures : 1 Hr/week
Practical : 4 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): -
In-Semester Examination(ISE): -
Skills & Competency Exam(SCE): -
End Semester Examination(ESE): -
TW: 50 Marks

Prerequisites :

- Computer Fundamentals

Course Objectives :

- To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
- To use the object-oriented paradigm in program design.
- Provide programming insight using OOP constructs.
- To lay a foundation for advanced programming.

Course Outcomes :

After completion of the course, student will be able to

1. Understand the concept of OOP.
2. Apply concept and use of re-usability
3. Develop application using concept of polymorphisms
4. Implement application using generic programming concepts
5. Percept the utility and applicability of OOP.

Unit I : An Overview of Java

Object-Oriented Programming, Data Types, Variables, and Arrays, Operators in Java-new and delete, Access Specifiers (Private, Public, Protected, default).

Class Fundamentals: Declaring an Objects, Introducing methods , constructors , Parameterized Constructors , this keyword, Static keyword, Static method,Garbage Collection , The finalize( ) Method

Unit II : Inheritance and Packages & Interfaces

Inheritance Basics, Using super, Method Overloading (Function and constructor),overriding methods, Using Abstract Classes, Using final with Inheritance, The Object Class, Packages, Access Protection, Interfaces.

Exception Handling:

Exception Types, Using try and catch, throw, finally , Java's Built-in Exceptions

Unit III: Application development in Java

AWT in java , AWT event handling ,event classes ,event listener(Text , Mouse), event adapter, button, text, check box.

Text Books :

1. Java: A Beginner's Guide, Herbert Schildt
2. Head First Java, Kathy Sierra & Bert Bates2nd Edition Publisher – Shroff/O'Reilly

Reference Books :

1. Java the Complete Reference, Herbert Schildt

List of Assignments :

1. WAP in java that calculates the grade of N students based on the marks entered by user in each subject. Program prints the grade based on this logic. If the average of marks is >= 80 then prints Grade 'A' If the average is <80 and >=60 then prints Grade 'B' If the average is <60 and >=40 then prints Grade 'C' else prints Grade 'D'
2. Develop an object oriented program in java to create a database of Covid_Patient information system containing the following information: Name, ID, Date of Birth, Blood group, Test_Report, Contact address, telephone number, Aadhar Number etc using 1.Constructor,2 Constructor Overloading
3. Derive a subclass called Student from the superclass Computer_Engg. The class Student inherits all the member variables (Name,Roll_Number,GR_Number,hobbies,etc) and methods (getGR(), getName(), among others) from its superclass Computer_Engg, also further defines a variable called area_of_interest,marks & two public methods getmarks() and getarea_of_interest().
4. Rahul, Rohit. Rohan wants to take a loan from Banks; they approach different banks having differ ROI rates of interest. Rahul approached SBI where Rohit and Rohan approached HDFC and ICICI respectively the ROI of SBI,HDFC,ICICI is 8.4%, 7.3%, 9.7%. While each bank has a class which provides a common method getrateofinterest(). Calculate the rate of interest Rahul, Rohit and Rohan pays to banks for the loan of 5 Lakh Rs. each. Assume the required variable for calculating ROI
5. Create User defined exception to check the following conditions and throw the exception if the criterion does not meet. a. User stays in Pune/ Mumbai/ Bangalore / Chennai b. User has 4-wheeler City, Vehicle from the user and check for the conditions mentioned above. If any of the condition not met then throw the exception. If user does not enter proper input throw the exception.

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ES21207CS : Critical and Design Thinking

Teaching Scheme
Credits : 2
Lectures : 1 Hr/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): -
In-Semester Examination(ISE): -
Skills & Competency Exam(SCE): -
End Semester Examination(ESE): -
TW: 50 Marks

Prerequisites :

- None

Course Objectives :

- To learn and enhance personal critical thinking skills
- To learn the basics and importance of Design Thinking
- Gain practice in the successful application of design thinking techniques to address key industry problems

Course Outcomes :

After completion of the course, student will be able to

1. Demonstrate an enhanced level of critical thinking
2. Realize the importance of Design Thinking while selecting solution to problems
3. Apply Design Thinking techniques to solution choices

Unit I : Basics of Design Thinking

Introduction to Design Thinking, its use in an Organization, overall approach, Key habits of effective Design Thinkers, Importance of iteration, How to observe, reflect and make Importance of User Research

Unit II : Techniques used in Design Thinking

Appreciate Empathy through listening , Ideation, Storyboarding, and Prototyping,
User feedback and the Loop, Different types of user feedback, Applicable Domains, Digital vs Physical, Technology Specializations

Unit III: Critical Thinking and Story Telling

Introduction to Critical Thinking, Types of thinking, Benefit of Critical Thinking, Steps to Critical Thinking, How to do critical thinking, Recognizing assumptions, reasoned arguments, impacts identification and drawing conclusions
Impactful storytelling, Benefits of Story Telling, Practicing Story telling

Text Books :

1. Bryan Lawson, "How designers think: The design process demystified", 2nd Edition, Butterworth Architecture, Nigel Cross, "Design Thinking", Berg Publishers - 2011
2. Ben Crothers, "Design Thinking Fundamentals", O'Reilly

Reference Books :

1. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations", HarperCollins – 2009
2. Susan Weins Chenk, "Hundred things every designer needs to know about people", New Riders Publication
3. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", Wiley Publication
4. Roger L. Martin, "Design of Business: Why Design Thinking is the Next Competitive Advantage" Harvard Business Press
5. Karl Ulrich, "Design: Creation of Artifacts in Society" - 2011
6. Bala Ramadurai, "Karmic Design Thinking"
7. T. Amabile, "How to kill creativity", SAGE Publication - 2006
8. William Lidwell, Kritina Holden, Jill Butler, "Universal principles of Design ", Rockport Publishers
9. Bella Martin, Bruce Hanignton, Bruce M Hanington "Universal methods of design", Rockport Publishers - 2012
10. Roman Kizanie, "Empathy: Why it matters, how to get it", Tarcher Perigee Publishers
11. Karla McLaren, "The Art of Empathy: A complete Guide to life's most essential skill", Sounds True Publishers

List of Assignments :

1. For a problem statement conduct user research (Virtual Classroom improvement, Reducing Carbon Footprint Reduction, Plastic Use, Conduction of Online College Annual Event etc.)
2. Use DT Techniques (Empathy map) to identify Top 3 problems of the problem selected in (1)
3. Do ideation and identify top 3 solutions for the problem selected in (1)
4. Present an idea using story telling technique

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SEMESTER – IV

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Department of Computer Engineering

ES22201CS : Probability and Statistics

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Tutorial : 1 Hr/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
TW: 25 Marks

Prerequisites: Expected to know the following concepts:
Basics of Derivatives, Integration, Trigonometry, Vector algebra and complex number, Introduction of Statistics and Probabilities.

Course Objectives:

- Engineers with the ability to analyse the data for a given problem and represent in the mathematical and statistical form
- Engineers with ability to systematically solve the problems using knowledge of probability, distributions, sampling and formulating hypothesis
- Engineers with the ability to carry out test of hypothesis, and apply the concept of correlation and regression, goodness of fit and distributions
- Engineers with the ability to infer the data using inference methods
- Engineers with the ability to understand the hypothesis testing
- Engineers with the ability to solve the problems on regression analysis

Course Outcomes :

After completion of the course, student will be able to

1. Learn the concepts of descriptive and inferential statistics, and levels of data measurement and basic statistics that will be used to summarize data.
2. Apply statistical concepts and probability theory to analyse data that can assist present and future business managers in making better decisions.
3. Estimate the population mean with a known and an unknown population standard deviation with the z statistic, and t statistic respectively and population variance using the chi-square distribution.
4. Understand confidence intervals and perform statistical inference
5. Perform hypothesis testing with theory of estimation
6. Perform regression analysis on a data set

Unit I : Basic Probability and Statistics Concepts

The concept of a discrete sample space in probability theory. The definition of an event. The definition of a probability distribution., Measures of central tendency, Random variables, expectation and variance. Coefficient of Variation, Moments, Skewness and Kurtosis.

Unit II : Probability Distributions

Discrete distributions: Bernoulli trials, Geometric, Binomial and Hypergeometric and Negative Binomial distributions, Poisson distribution. Continuous distributions: normal, uniform and exponential continuous distributions Exercises based on the analysis of applications to computer science.

Joint probability distributions. Linearity of expectation. Higher moments of a random variable, moment generating function. Computing the moments of geometric, binomial, normal and Poisson distributions.

Conditional Probability, Conditional expectation of a random variable with respect to an event. Bayes' Theorem and examples of applications in computer science.

Unit III : Probability Inequalities and Markov Chains

Markov's Inequality, Chebyshev's inequality, Weak Law of Large Numbers, Central Limit Theorem

Markov Chains, Estimating Properties of Markov Chains, Hidden Markov Models and Dynamic Programming, Introduction to Stochastic Processes – Markov process classification of states – Examples of Markov Chains, Stochastic Matrix, limiting probabilities

Unit IV: Non-parametric and Parametric Inferences

Basics of inference Simple examples, Empirical PMF, Sample mean, bias, se, MSE, Empirical Distribution Function (or eCDF), Kernel Density Estimation (KDE), Statistical Functionals, Plug-in estimator

Confidence Intervals: Percentiles, quantiles, Normal-based confidence intervals, DKW inequality

Parametric Inferences: Consistency, Asymptotic Normality, Basics of parametric inference, Method of Moments Estimator (MME), Properties of MME, Basics of Maximum Likelihood Estimator (MLE), Properties of MLE

Unit V : Hypothesis Testing

Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. Special tests of significance for large samples and small samples (F, chi- square, z, t- test), ANOVA

Unit VI: Correlation and Regression

Correlation: Coefficient of Correlation

Regression Analysis, Linear and Non-linear Regression, Multiple regression

Bayesian Inferencing : Bayesian reasoning, Bayesian inference, Priors, Conjugate priors

Text Books :

1. William Feller, An introduction to probability theory and its applications.
2. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Wiley, Year- 2018, ISBN- 1119409535
3. Sheldon Ross, A first course in probability.

Reference Books :

1. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Introduction to Linear Regression Analysis, Wiley, 2012
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).(*ISBN* 978-0-470-45836-5.)
3. Ken Black, Business Statistics for Contemporary Decision Making, 6thEdition, Wiley
4. David Stirzaker, Elementary probability
5. All of Statistics: A Concise Course in Statistical Inference" by Larry Wasserman (Springer publication).

List of Assignments for Tutorial:

1 Assignment of central tendency and dispersion.

2 Assignment on Regression and Correlation.

3 Assignment on probability distributions

4 Assignment on testing of hypothesis

5 Assignment on C.F & P.I, Method of Variation of Parameters, Cauchy's and Legendre's DE

6 Assignment on Fourier Transform (FT)

7 Assignment on Z-Transform

8 Assignment on Line integral, Greens Theorem, Gauss divergence Theorem.

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CSUA22202 : Advanced Data Structure

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
PR/OR: 25 Marks

Prerequisites :	
•	Fundamentals of Data Structure, Object Oriented Programming, Computer Programming Fundamentals
Course Objectives :	
•	To explain fundamentals of data structures and their applications essential for programming/problem solving
•	To familiarize students with basic data structures and their use in fundamental algorithms
•	To understand advanced data structures to solve problems in various domains.
•	To enable students to write algorithms for solving problems with the help of fundamental data structures
Course Outcomes :	
	After completion of the course, student will be able to
1.	Understand trees data structure and their implementation with basics of algorithm analysis.(Understand & Apply)
2.	Apply effective and efficient searching data structure (Apply)
3.	Implement graph data structures using sequential and linked organization for problem solving and programming.(Understand and Apply)
4.	Understand the data structure required for compiler design.(Understand and Apply)
5.	Understand different file organization in JAVA. (Understand and Apply)
6.	Select appropriate nonlinear data structure for problem solving and programming (Evaluate)

Unit I : Trees

Difference between linear and non-liner data structure, Trees and Binary trees- basic terminology, representation using linked organization, Binary tree- properties, converting general tree to binary tree, binary tree traversals recursive and non-recursive: depth first and

breadth first. Binary Search Tree (BST), BST operations

Unit II : Advanced Trees

Threaded binary tree- concepts, in order traversal of in-order threaded binary tree**.** AVL Trees, Indexing and Multiway Trees, Types of search tree, B-Tree, B+Tree, Splay, Red Black Tree, Trie Tree

Unit III : Graphs

Basic Concepts, Storage representation, Adjacency matrix, adjacency list, Traversals-depth first search and-breadth first search, Minimum spanning Tree: Prims and Kruskal Algorithm, Dijkstra's Single source shortest path, Applications of Graph

Unit IV : Tables

Symbol Table: Notion of Symbol Table, Heap data structure, Min and Max Heap, Heap sort implementation, applications of heap.Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques: linear probing, quadratic probing, rehashing, chaining without replacement and chaining with replacement

Unit V : File Organization

File Handling and Organization in Java, Java I/O Classes and interfaces, Files in Java, Types of files: Text file and Binary File, Steam: Byte Stream, Character Stream, Util class

Unit VI : Applications of Data Structures

Applications: Use of binary tree in gaming, expression tree-evaluation and Huffman's coding, Data structure used in social networking and Google map, Applications of hash table in merkle tree, Patricia trie, Applications of heap data structures, Symbol Table and Files

Text Books :

1 Brassard and Bratley- Fundamentals of Algorithmics, Prentice Hall India/Pearson education, ISBN 13-9788120311312
2 A. Tanenbaum, Y. Langsam, M. Augenstein: Fundamentals of Data Structure, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
3

Reference Books :

1 Introduction to Algorithms 3rd Edition by Thomas H. Cormen, Charles E. Leiserson,Ronald L Rivest,& Clifford Stein, MIT Press ,Cambridge MA USA, ISBN 978-81-203-4007-7
2 Data structures, Algorithms and Applications in Java by Satraj Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
3 R. Gilberg, B. Forouzan, "Data Structures: A pseudo Code Approach with C++",

Cengage Learning, ISBN 9788131503140.
4 Java: The Complete Reference, Seventh Edition by Herbert Schildt

List of Assignments :

Programming Language : Java

1 Implement binary search tree and perform following operations: a. Insert, b. Delete, c. Display (Inorder) d. Search e.BFS (Level wise print)

2 Construct an expression tree from postfix/prefix expression and perform recursive and non- recursive In-order, pre-order and post-order traversals

3 You are given an undirected weighted graph with nodes and edges. The nodes are numbered from and to. Find the total weight of the minimum spanning tree, as well as one specific minimum spanning tree using Prims/Kruskal's algorithm. Note that there may be multiple different minimum spanning trees. You need to construct any one of them.

4 A customer wants to travel from source A to destination B. He books a cab from source A to reach destination B. Calculate a shortest path by avoiding real time traffic to reach destination B.

5 Consider a friends' network on face book social web site. Model it as a graph to represent each node as a user and a link to represent the fried relationship between them. Store data such as date of birth, number of comments for each user.
1.Find who is having maximum friends
2.Find who has post maximum and minimum comments
3. Find users having birthday in this month.

6 Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure. Analyze the algorithm.

7 Implement IsSpell utility (1. Create Hash table and write in file 2. Enter Word 3. Search word 4. Exit)

8 Implement student database (Roll number, Name of student, Gr. Number, Class etc.) using text or binary files in JAVA.

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CSUA22203 : Database Management System

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
PR/OR: 25 Marks

Prerequisites :

- Discrete Mathematics, Data Structure and Algorithms

Course Objectives :

- To understand the fundamental concepts of database management
- To provide a strong formal foundation in database concepts, technology
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design
- To learn basic issues of transaction management and concurrency control
- To learn and understand various Database Architectures and Applications
- To learn a powerful, flexible and scalable general purpose database to handle big data applications.

Course Outcomes :

After completion of the course, student will be able to

1. Remember the concepts of file processing and design E-R Model for given requirements and convert the same into database tables.(Remember).
2. Apply database techniques such as SQL & PL/SQL(Apply).
3. Evaluate database design concept such as normalization.(Evaluate).
4. Analyze transaction management techniques in relational database System.(Analyze).
5. Comprehend various database architectures in real time environment. (Comprehend).
6. Apply advanced database programming concepts in Big Data applications.(Apply).

Unit I : Introduction to DBMS

Introduction to Database Management Systems, Advantages of a DBMS over file-processing Systems, Database-System purpose and applications, Levels of Database Systems, Database

Languages, Data Models, Components of a DBMS and overall structure of a DBMS, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, types of Keys, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables

Unit II : Relational Algebra, SQL and PL/SQL

Introduction to Relational Algebra, SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: Concept of Stored Procedures and Functions, Cursors, Triggers

Unit III : Relational Database Design

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Functional Dependencies: Basic concepts, closure of set of functional dependencies, closure of attribute set, canonical cover, Decomposition: lossless join decomposition and dependency preservation, The Process of normalization, 1NF, 2NF, 3NF,BCNF, 4NF, 5NF.

Unit IV : Database Transactions and Query Processing

Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Testing conflict and view serializability, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Timestamping Methods, Different Crash Recovery methods such as Shadow Paging and Log-Based Recovery: Deferred and Immediate, Checkpoints, Introduction to Query Processing and Query Optimization

Unit V : Database architecture

Introduction to Database Architectures: Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases. Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database

Unit VI : Advances in Databases and Big Data

Introduction to NoSQL, Structured verses Unstructured data, Different NoSQL Data Models, NoSQL using MongoDB, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL using MongoDB, Introduction to Hadoop, Hive and HiveQL

Text Books :

1 Abraham Silberschatz ,HenryKorth , S.Sudarshan,"Database System

concepts",5th Edition ,McGraw Hill International Edition.

2 Elmasri R., Navathe S., "Fundamentals of Database Systems", 4* Edition, PearsonEducation, 2003, ISBN 8129702282

3 Pramod J. Sadalage and Martin Fowler, ―NoSQL Distilled‖, Addison Wesley, ISBN10: 0321826620, ISBN-13: 978-0321826626

4 "Managing and Using MySQL", Reese G., Yarger R., King T., Williums H, 2nd Edition, Shroff Publishers and Distributors Pvt. Ltd., ISBN 81 - 7366 - 465 – X

5 MongoDB: The Definitive Guide by Kristina Chodorow

6 Programming **Hive**: Data Warehouse and Query Language for Hadoop. by Dean Wampler, Jason Rutherglen & Edward Capriolo. O'Reilly Media

Reference Books :

1 Ramkrishna R., Gehrke J., "Database Management Systems", 3rd Edition, McGrawHill, 2003, ISBN 0-07- 123151 –X.

2 C J Date, ―An Introduction to Database Systems‖, Addison-Wesley, ISBN: 0201144719.

3 Connally T., Begg C., "Database Systems", 3rd Edition, Pearson Education, 2002, ISBN 81-7808-861-4

4 MongoDB , O'Reilly Publications.

5 Hadoop, O'Reilly Publications

6 http://docs.mongodb.org/manual/

List of Assignments :

1 Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View , Index and Sequence also implement SQL DML statements with operators, functions, Set operators, Clauses.

2 Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.

3 Write a PL/SQL code to implement all types of cursor and display employee number, name and salary of 5 highest paid employees using cursor.Employee(employee no, employee name, join_date, designation, salary).

4 PL/SQL Stored Procedure and Stored Function : Write a PL/SQL procedure to find the number of students ranging from 100-80%, 79-70%, 69-60%,59-50 & below 49% in each course from the Student_course table given by the procedure as parameter. Student_course(Roll_no,Course,Couse_code,Semester,Total_Marks,Percentage)

5 Database Trigger (Row level and Statement level triggers, Before and After Triggers):Write a database trigger on Employee table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in to a new table when the Employee table is updated. Employee(employee no, employee name, join_date, designation, salary).

6 Design and Develop MongoDB Queries using CRUD operations.

7 Implement aggregation, indexing and MapReduce with suitable example using MongoDB.

8 MiniProject: Consider any database application and implement MYSQL/MongoDB database connectivity with Java/PHP/Python.

Bansilal Ramnath Agarwal Charitable Trust's
Vishwakarma Institute of Information Technology, Pune-48
(An Autonomous Institute affiliated to Savitribai Phule Pune University)
Department of Computer Engineering

CSUA22204 : Operating System

Teaching Scheme
Credits : 4
Lectures : 3 Hrs/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks
PR/OR: 25 Marks

Prerequisites :

- Computer Organization and Architecture

Course Objectives : Computer Organization and Architecture

- To provide understanding of the concepts like virtualization, concurrency and persistence in operating systems.
- To study the design and implementation of scheduling and memory management policies in Operating systems.
- To demonstrate the working of concurrency and locking mechanism in operating systems
- To provide insights of I/O management in Operating Systems
- To make them aware of advanced topics e.g. data protection, distributed systems in Operating Systems.
- To teach the case studies of xv6 and Linux OS

Course Outcomes :

After completion of the course, student will be able to

1. Summarize the concepts of virtualization, concurrency and persistence
2. Implement proper scheduling and memory management policies for the OS
3. Analyze concurrency and locking mechanism in OS
4. Describe the I/O management in OS
5. Express the advanced topics in OS
6. Compare the working of xv6 and Linux OS

Unit I : Introduction to Operating Systems and Process

Introduction to operating systems, Virtualizing The CPU, Virtualizing Memory, Concurrency, Persistence, Design Goals, Some History

The Process: Process abstraction, System calls for Process management, Process Creation: A Little More Detail, Process States, Data Structures, Process execution mechanisms Process

API, Process Control and Users, Useful Tools.

Unit II : Scheduling

Workload Assumptions, Scheduling Metrics, First In, First Out (FIFO), Shortest Job First (SJF), Shortest Time-to-Completion First (STCF), A New Metric: Response Time, Round Robin, Incorporating I/O, The Multi-Level Feedback Queue, The Priority Boost, Attempt, Better Accounting, Multiprocessor Scheduling, Synchronization, Cache Affinity, Single-Queue Scheduling Multi-Queue Scheduling, Linux Multiprocessor Schedulers.

Unit III : Address Spaces

Early Systems, Multiprogramming and Time Sharing, The Address Space, Memory API**:** Types of Memory, The malloc() Call, The free() Call, Common Errors, Underlying OS Support, Segmentation, Fine-grained vs. Coarse-grained Segmentation, Free-Space Management**,** Paging, A Memory Trace, Faster Translations (TLBs), TLB Basic Algorithm, TLB Issue: Context Switches, Replacement Policy, Hybrid Approach: Paging and Segments, Beyond Physical Memory: Mechanisms**,** Swap Space, The Page Fault, Page Fault Control Flow, When Replacements Really Occur.

Unit IV : Concurrency

Shared Data, Uncontrolled Scheduling, The Wish For Atomicity, **Thread API :** Why Use Threads?, Thread Creation, Thread Completion **Locks :** The Basic Idea, Pthread Locks, Building A Lock, Evaluating Locks, Controlling Interrupts, Failed Attempt: Just Using Loads/Stores, Building Working Spin Locks with Test-And-Set, Compare-And-Swap, Load-Linked, Fetch-And-Add, Different OS, Different Support, **Semaphores:** A Definition, Binary Semaphores (Locks) Semaphores For Ordering, The Producer/Consumer (Bounded Buffer) Problem, Reader-Writer Locks The Dining Philosophers, How To Implement Semaphores, Common Concurrency Problems.

Unit V : I/O Devices

System Architecture, A Canonical Device, The Canonical Protocol, Lowering CPU Overhead With Interrupts, More Efficient Data Movement With DMA, Methods Of Device Interaction, Fitting Into The OS: The Device Driver, Case Study: A Simple IDE Disk Driver, **Hard** Disk Drives, Files and Directories, The Fast File System, File System Implementation.

Unit VI : Advanced topics in OS

Data Integrity and Protection: Disk Failure Modes, Handling Latent Sector Error, Detecting Corruption: The Checksum, Using Checksums, Distributed Systems, Case Studies of: The **xv6** operating system, The **Linux** Operating Systems.

Text Books :

1 Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau "Operating Systems: Three Easy Pieces", Arpaci-Dusseau Books, March, 2015
2 Stallings William., "Operating Systems", Fourth Edition, Prentice Hall of

India,2001

Reference Books :

1 Silberschatz, A, Galvin, P.B, and Gagne, G., "Operating System Principles", Eight Edition, John Wiley & Sons, 2008.
2 Bach Maurice J. "The Design of the UNIX Operating System", Second Edition Prentice Hall of India, 2001

List of Assignments :

All the assignments should be conducted on Latest version of Open Source

Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading

1 Study the Basic Linux commands
2 write a program to implement an address book with the options given below: a) create address book b) view address book c) Insert Record d) Delete a record e) Modify a record f) Exit
3 Process control system calls: The demonstration of fork, execve and wait system calls along with zombie and orphan states.
4 Write a program to show the demonstration of Scheduling Algorithms: 1) FCFS 2) SJF 3) Priority Scheduling
5 Thread management using pthread library. Implement matrix multiplication using multithreading. Application should have pthread_create, pthread_join, pthread_exit. In the program, every thread must return the value and must be collected in pthread_join in the main function. Final sum of row column multiplication must be done by main thread (main function).
6 Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate producer-consumer problem with counting semaphores and mutex.
7 Case Study: XV6
Linux Kernel configuration, compilation and rebooting from the newly compiled kernel.

Links for Laboratory Assignments :
https://www.cse.iitb.ac.in/~mythili/os/
http://homes.cs.washington.edu/~tom/nachos/
http://web.cecs.pdx.edu/~walpole/class/cse513/project/syscall.html
http://web.cecs.pdx.edu/~walpole/class/cse513/project/syscall.html

Bansilal Ramnath Agarwal Charitable Trust's
Vishwakarma Institute of Information Technology, Pune-48
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Department of Computer Engineering

CSUA22205 : Theory of Computation

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): 20 Marks
In-Semester Examination(ISE): 30 Marks
Skills & Competency Exam(SCE): 20 Marks
End Semester Examination(ESE): 30 Marks

Prerequisites : Basic Mathematics, Discrete Structure

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Course Objectives :

- Formalization of notion of problems via formal languages
- Study the abstract computing models called Automata
- Understand the hierarchy of classes of formal languages & grammars
- Study Decidability & Undecidability of problems

Course Outcomes :

After completion of the course, student will be able to

1. Design of automata or hypothetical machines as language descriptors or recognizer
2. Construct Regular expression & its conversion to automata & vice versa
3. Design grammar for language classes
4. Apply the mathematical preliminaries with the help of proofs and lemmas for language derivation
5. Understand the hierarchy of classes of formal languages &automata
6. Illustrate the concept of decidability & Undecidability of problems

Unit I : Theory of Automata:

Basic Mathematical Objects: Sets, Logic, functions, Relations, Strings.
Definition of finite Automata(FA), Description of FA, Transition Systems, Acceptability of a String by a FA , Non deterministic FA, Equivalence of DFA and NFA, FA with output: Moore and Mealy machines-Definitions, Models, inter-conversion, minimization of FA

Unit II : Regular Expressions (RE) and Languages :

Recursive definition of regular expression, regular set, identities of regular expressions, Conversion of NFA With epsilon moves to DFA, Conversion-RE to DFA , Conversion-DFA to RE, Equivalence of R.E, Equivalence of FA, Pumping lemma for regular languages, Closure properties of regular languages, Applications of R.E

Unit III : Grammar:

Grammar- Definition, representation of grammar, Chomsky hierarchy,
Context Free Grammar- Definition, Derivation, sentential form, parse tree, inference, derivation, parse tree, ambiguity in grammar and language, Simplifications of context free Grammar-Eliminating unit productions, useless symbols, and Null-productions, Normal Forms for CFG- Chomsky normal form, Greibach normal form .
Regular Grammar- Definition, left linear, right linear grammar, Interconversion between left linear and right linear regular grammar

Unit IV Push Down Automata:

Push Down Automata- Definition, Notation, acceptance by final state, acceptance by empty stack, Equivalence of PDA and CFG- Grammar to PDA, PDA to Grammar, Deterministic PDA and Non Deterministic PDA. Closure Properties of CFLs

Unit V : Turing Machines:

Turing machine Model, Representation of Turing machine, Language acceptability by Turing machine, Design of Turing machine. Types of TM. Halting Problem

Unit VI Recursively Enumerable Languages:

Recursively Enumerable and Recursive, Properties of recursive and recursively enumerable languages, Post correspondence problem,
Undecidability: Reducing one problem to another, Other unsolvable Problems. Tractable and Intractable Problems

Text Books :

1 Mishra K., Chandrasekaran N., 'Theory of Computer Science (Automata, Languages and Computation)", Second Edition, Prentice Hall of India
2 John C Martin. "Introduction to Language and Theory of Computation", Third edition, Tata McGraw- Hill

Reference Books :

1 Hopcroft J., Motwani R., Ullman J., "Introduction to Automata Theory, Languages and Computations", Third edition, Pearson Education Asia
2 Michael Sipser, "Introduction to The Theory of Computation " ISE
3 Vivek Kulkarni, "Theory of Computation", Oxford University Press

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Department of Computer Engineering

CSUA22206 : IT Workshop (Python)

Teaching Scheme
Credits : 3
Lectures : 1 Hr/week
Practical : 4 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): -
In-Semester Examination(ISE): -
Skills & Competency Exam(SCE): -
End Semester Examination(ESE): -
TW: 50 Marks

Prerequisites :

- Fundamentals of Data Structures, Object Oriented Programming, Data Structures and Files

Course Objectives :

- To understand the programming fundamentals using python
- To understand the object oriented programming concept using python
- To understand the different data structure and algorithm using python.
- To understand the data processing and data connectivity using python

Course Outcomes :

After completion of the course, student will be able to

1. Understand programming fundamental using python language.
2. Apply object oriented programming concept using python language.
3. Implement data structure and algorithm using python language.
4. Implement MYSQL database connectivity with python for Database navigation operations such as select, create, insert, delete, update.

Unit I : Fundamentals of Programming Language

Introduction to programming, Algorithms, Pseudo Code, variables, operators, decision constructs, iteration constructs, data types, operators, implicit/explicit type conversions, functions, control structures, collections, list, array, string, set, dictionary, exception handling, recursion

Unit II : Data Structures & OOP basics

Introduction to data structures, Linked List, Stack, Queue, Trees, Graphs, Hashing & Hash Tables, Linear & binary search algorithm,
OOP Basics: self, collection objects, static attribute, static method, relationships, inheritance, abstract class, abstract method

Unit III : Data Processing and Data base Connectivity

Data Processing : NumPy, NumPy, Arrays, Shaping and transposition, Mathematical Operations, Indexing and slicing, Broadcasting, NumPy Array Attributes, Descriptive Statistics methods, matrices

Python Database Integration – Pre-requisites and Installation, SELECT Operation, CREATE and INSERT Operation, UPDATE Operation, DELETE Operation.

Unit IV : Data Analysis Libraries in Python

Overview of Python Libraries for Data Scientists, reading data using pandas, Data frame, Data Frame data types, Data Frames attributes, Exploring data frames, Data Frames methods, group by method, filtering, Slicing, sorting, missing value, Aggregation Functions in Pandas.

Text Books :

1 Zed A. Shaw, "Learn PYTHON The Hard Way", Pearson, ISBN:978-93-325-8210-1ISBN:978-81-315-2903-4
2 Kenneth A Lambert and B L Juneja, "Fundamentals of PYTHON", CENGAGE Learning,ISBN:978-81-315-2903-4
3 Timothy Budd, "Exploring Python", McGraw Hill Publication, ISBN: 9780073523378, August 2010.

Reference Books :

1 Allen B Downey, "Think PYTHON", O'Rielly, ISBN: 13:978-93-5023-863-9, 4th Indian Reprint 2015
2 Perl Black Book, 2nd Edition: Steven Holzner, Dreamtech Press

List of Assignments :

1 Create loops using both while and for and perform following task .Given an array A of N numbers (integers), write a program which prints the sum of the elements of array A with the corresponding elements of the reverse of array A. e.g If array A has elements [1,2,3], then reverse of the array A will be [3,2,1] and the resultant array should be [4,4,4]

2 Using use defined functions, perform matrix operation for symmetric and binary matrix. A function should return True or false accordingly.

3 Define a class student which must have properties like id, name, age, marks for maths, science, English, total, percentage, status, grade . Make two function one for inputting data
id ,name, age, maths, science, english
another function for doing calculation
total, percentage, status and grade .Status will be passed if the student gets more than 50 marks in every subject
Grade will be
a if percentage >=75
b if percentage >=60 and <75

c if percentage >=50 and <60
otherwise no grade

4 Implement list as stack and queue and perform add element and delete element in it

5 Write a Python Program for handling various string operations.

6 Create a suitable application like Library Management system, Employee data handling, Payroll system, Vaccination centre application, Aadhar card data processing etc.) Using Numpy, Pandas Library OR database connectivity operation in Python.

ES22207CS : Soft Skills

Teaching Scheme
Credits : 2
Lectures : 1 Hr/week
Practical : 2 Hrs/week

Examination Scheme
Continuous Internal Evaluation(CIE): -
In-Semester Examination(ISE): -
Skills & Competency Exam(SCE): -
End Semester Examination(ESE): -
TW: 50 Marks

Prerequisites :

- Basic knowledge in communication and a good understanding of English

Course Objectives :

- To encourage the all-round development of students by focusing on soft skills.
- To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes :

After completion of the course, student will be able to

1. Effectively communicate through verbal/oral communication and improve the listening skills
2. Write precise briefs or reports and technical documents.
3. Actively participate in group discussion / meetings / interviews and prepare and deliver presentations.
4. Become more effective individual through goal/target setting, self-motivation and practicing creative thinking.
5. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality

Unit I : Self-Awareness and Self Development

a) **Self-Assessment**, Self-Appraisal, SWOT, Goal setting - Personal & career - Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting,

b) **Career Planning**, Personal success factors, Handling failure, Depression and Habit,

relating SWOT analysis & goal setting, prioritization.

c) **Other Skills**

- **Time management**- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to priorities using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action
- **Stress management**- understanding the stress & its impact, techniques of handling stress
- **Problem solving skill**, Confidence building Problem solving skill, Confidence building

Corporate / Business Etiquettes - Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment) Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit II : Communication Skill

a) **Importance of communication**, types, barriers of communication, effective communication

b) **Speaking Skills** – Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

c) **Listening Skills:** Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening

d) **Group Discussion** - characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

e) **Presentation skills** - planning, preparation, organization, delivery.

f) **Written Skills** – Formal & Informal letter writing, Report writing, Resume writing – Sentence structure, sentence coherence, emphasis. Paragraph writing. letter writing skills - form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

References:

1 Soft skills Training – A workbook to develop skills for employment by Fredrick H. Wentz
2 Personality Development and Soft skills, Oxford University Press by Barun K. Mitra
3 The Time Trap: the Classic book on Time Management by R. Alec Mackenzie
4 Interview skills that win the job: Simple Techniques for answering all the tough questions, Allen and Unwin

List of Assignments :

1 SWOT analysis
2 Personal & Career Goal setting – Short term & Long term
3 Presentation Skill
4 Letter/Application writing
5 Report writing
6 Listening skills
7 Group discussion
8 Resume writing
9 Public Speaking
10 Stress management
11 Team Activity-- Use of Language laboratory