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B.TECH-INFORMATION TECHNOLOGY
(R23-COURSE STRUCTURE & SYLLABUS)

B.Tech.– II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Discrete Mathematics & Graph Theory	3	0	0	3
2	BS&H	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Digital Logic &Computer Organization	3	0	0	3
4	Professional Core	Advanced Data Structures & Algorithms	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	Advanced Data Structures Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	Skill Enhancement course	Python Programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
		Total	16	2	8	20

B.Tech.– II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course-I	Optimization Techniques	2	0	0	2
2	Engineering Science/ Basic Science	Probability & Statistics	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Software Engineering	3	0	0	3
6	Professional Core	Operating Systems & Software Engineering Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	Skill Enhancement Course	Python with DJango	0	1	2	2
9	BS&H	Design Thinking & Innovation	1	0	2	2
		Total	15	1	10	21

Mandatory Community Service Project Internship of 08 weeks duration during summer vacation

1

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B.TECH-INFORMATION TECHNOLOGY
(R23-COURSE STRUCTURE & SYLLABUS)
II Year-I Semester

L	T	P	C
3	0	0	3

DISCRETE MATHEMATICS AND GRAPH THEORY
(Common to CSE, IT, CSE-AI&ML)

Course Objectives:
To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

Course Outcomes: At the end of the course students will be able to
1. Build skills in solving mathematical problems (L3).
2. Comprehend mathematical principles and logic (L4).
3. Demonstrate knowledge of mathematical modeling and proficiency in using mathematical software (L3).
4. Manipulate and analyze data numerically and/or graphically appropriate Software (L3).
5. Communicate effectively mathematical ideas/results verbally or in writing (L1).

UNIT–I: Mathematical Logic: (10)
Propositional Calculus: Statements and Notations, Connectives, Well Formed Formula, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms.
Theory of Inference for Statement Calculus: Consistency of Premises, Indirect Method of Proof.
Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory: (10)
Sets: Operations on Sets, Principle of Inclusion-Exclusion.
Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams.
Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

UNIT-III: Combinatorics and Recurrence Relations: (10)
Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.
Recurrence Relations:
Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations.

UNIT-IV: Graph Theory: (7)
Basic Concepts, Graph Theory and its Applications, Subgraphs.
Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs.

Unit-V: Multi Graphs: **(8)**
Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

TEXT BOOKS:
1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

REFERENCE BOOKS:
1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India publishers.
2. Discrete Mathematics, S. K. Chakraborthy and B. K. Sarkar, Oxford press, 2011.
3. Discrete Mathematics and its Applications with Combinatorics and GraphTheory, K.H. Rosen, 7th Edition, Tata McGraw Hill.

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester

L	T	P	C
2	1	0	3

UNIVERSAL HUMAN VALUES –
UNDERSTANDING HARMONY ANDETHICAL HUMAN CONDUCT

Course Objectives:
• To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
• To facilitate the development of a Holistic perspective among students towards lifeand profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
• To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:
• Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
• Identify one's self, and one's surroundings (family, society nature) (L1, L2)
• Apply what they have learnt to their own self in different day-to-day settings inreal life (L3)
• Relate human values with human relationship and human society. (L4)
• Justify the need for universal human values and harmonious existence (L5)
• Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics
The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.
The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I: Introduction to Value Education (6 lectures and 3 tutorials for practicesession)
Lecture 1: Right Understanding, Relationship and Physical Facility (HolisticDevelopment and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic HumanAspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II: Harmony in the Human Being (6 lectures and 3 tutorials for practice session) Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III: Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV: Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V: Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself
PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:
Textbook and Teachers Manual
a.   The Textbook
R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
b.   The Teacher's Manual
R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books
1.   *JeevanVidya: EkParichaya,* A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2.   *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3.   *The Story of Stuff* (Book).
4.   *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5.   *Small is Beautiful* - E. F Schumacher.
6.   *Slow is Beautifu*l - Cecile Andrews
7.   *Economy of Permanence* - J C Kumarappa
8.   *Bharat Mein Angreji Raj* – PanditSunderlal
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)

Mode of Conduct:
Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.
It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program onUniversal Human Values is deemed essential.

Online Resources:
1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf

2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester
DIGITAL LOGIC & COMPUTER ORGANIZATION

L	T	P	C
3	0	0	3

Course Objectives:

The main objectives of the course is to

- Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

UNIT – I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Boolean Theorems, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification(up to 4 variables), Combinational Circuits: Adders, Subtracter, Encoders, Decoders, Multiplexers and De- multiplexers.

UNIT – II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT – III:

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division.

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT – IV:

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read- Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT – V:

Input/ Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Text Books:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, Safwat Zaky, 6th edition, McGraw Hill

2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education.

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)

L	T	P	C
3	0	0	3

II Year-I Semester
ADVANCED DATA STRUCTURES & ALGORITHMS

Course Objectives:

The main objective of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

UNIT – I: Advanced Data Structures

AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

UNIT – II:

Introduction to Algorithm Analysis: Algorithm, types of algorithms, Algorithm specifications Performance analysis: Space and Time Complexity analysis, Asymptotic Notations.

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT – III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2ndEdition Universities Press

2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran,2nd Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,Introduction to Algorithms (youtube.com)

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester
OBJECT ORIENTED PROGRAMMING THROUGH JAVA

L	T	P	C
3	0	0	3

Course Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

UNIT I

Object Oriented Programming: Basic concepts-History of Java, Buzz Words, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables,Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Nested Classes, Passing Arguments by Value , Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static, Static Methods.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three- dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Final Class and Methods, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces,

Static Methods in Interface.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer. Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Text Books:

1)   JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2)   Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3)   JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1)   The complete Reference Java, 11th edition, Herbert Schildt, TMH
2)   Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1)   https://nptel.ac.in/courses/106/105/106105191/
2)   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618
816347_shared/overview

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester
ADVANCED DATA STRUCTURES LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

The objectives of the course is to
- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem-solving scenarios

Experiments covering the Topics:
- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
    a) Adjacency Matrix   b) Adjacency Lists
5. Write a program for finding the biconnected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job Sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press

2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, 2nd Edition, University Press

3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

Online Learning Resources:
1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

L	T	P	C
0	0	3	1.5

Course Objectives:
The aim of this course is to
- Practice object oriented programming in the Java programming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Experiments covering the Topics:
- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI Sample Experiments:

Exercise – 1:
a)   Write a JAVA program to display default value of all primitive data type of JAVA
b)   Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2
a)   Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
b)   Write a JAVA program to sort for an element in a given list of elements using bubble sort
c)   Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3
a)   Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
b)   Write a JAVA program implement method overloading.
c)   Write a JAVA program to implement constructor.
d)   Write a JAVA program to implement constructor overloading.

Exercise - 4
a)   Write a JAVA program to implement Single Inheritance
b)   Write a JAVA program to implement multi level Inheritance
c)   Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5
a)   Write a JAVA program give example for "super" keyword.
b)   Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
c)   Write a JAVA program that implements Runtime polymorphism

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses Exercise - **7**

a) Write a JAVA program for creation of Java Built-in Exceptions
b) Write a JAVA program for creation of User Defined Exception

Exercise - 8

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds,(Repeat the same by implementing Runnable)
b) Write a program illustrating is Alive and join ()
c) Write a Program illustrating Daemon Threads.

Exercise – 9

Write a JAVA program Producer Consumer Problem

Exercise – 10

Write a JAVA program that import and use the user defined packages

Exercise – 11

a) Write a java program that connects to a database using JDBC
b) Write a java program to connect to a database using JDBC and insert values into it.
c) Write a java program to connect to a database using JDBC and delete values from it

Exercise – 12

Build any Small Application by using Java

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester

L	T	P	C
0	1	2	2

PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE)

Course Objectives:

The main objectives of the course are to

• Introduce core programming concepts of Python programming language.

• Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries

• Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

UNTI-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Exercise - 1

1.   Write a program to find the largest element among three Numbers.
2.   Write a Program to display all prime numbers within an interval
3.   Write a program to swap two numbers without using a temporary variable.

Exercise - 2

1.   Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators
v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

2.   Write a program to add and multiply complex numbers
3.   Write a program to print multiplication table of a given number.

UNIT-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings. Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Exercise - 3

1.   Write a program to define a function with multiple return values.
2.   Write a program to define a function using default arguments.

Exercise - 4

1.   Write a program to find the length of the string without using any library functions.
2.   Write a program to check if the substring is present in a given string or not.

Exercise - 5

1.   Write a program to perform the given operations on a list:
       i. addition ii. insertion iii. Slicing

2. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement. Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Exercise - 6

1.   Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.

2.   Write a program to count the number of vowels in a string (No control flow allowed).

Exercise - 7

1.   Write a program to check if a given key exists in a dictionary or not.
2.   Write a program to add a new key-value pair to an existing dictionary.
3.   Write a program to sum all the items in a given dictionary. UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Exercise - 8

1.   Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2.   Python program to print each line of a file in reverse order.
3.   Python program to compute the number of characters, words and lines in a file.

Exercise - 9

1.   Write a program to create, display, append, insert and reverse the order of the items in the array.
2.   Write a program to add, transpose and multiply two matrices.

Exercise -10

1.   Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Exercise -11

1.   Python Program to demonstrate NumPy arrays creation using array () function.
2.   Python program to demonstrate use of ndim, shape, size, dtype.
3.   Python program to demonstrate basic slicing, integer and Boolean indexing.

Exercise -1*2*

1.   Python program to find min, max, sum, cumulative sum of array
2.   Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
   a.   Apply head () function to the pandas data frame
   b.   Perform various data selection operations on Data Frame
3.   Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1.   Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2.   Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3.   Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1.   https://www.coursera.org/learn/python-for-applied-data-science-ai
2.   https://www.coursera.org/learn/python?specialization=python#syllabus

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-I Semester
ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	--

Course Objectives:

▢   To make the students to get awareness on environment

▢   To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life

▢   To save earth from the inventions by the engineers.

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case   studies. – Energy resources:

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

    a.   Forest ecosystem.
    b.   Grassland ecosystem
    c.   Desert ecosystem
    d.   Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:
a.   Air Pollution.
b.   Water pollution
c.   Soil pollution
d.   Marine pollution
e.   Noise pollution
f.   Thermal pollution
g.   Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1.   Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2.   Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3.   S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4.   K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

☐ https://onlinecourses.nptel.ac.in/noc23_hs155/preview

☐ https://www.edx.org/learn/environmental-science/rice-university-ap-r- environmental-science-part-3-pollution-and- resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science+ +Part+3%3A+Pollution+and+Resources&source=edX&product_category=course& placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental- science

☐ http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science- I/Data%20Files/pdf/lec07.pdf

☐ https://www.youtube.com/watch?v=5QxxaVfgQ3k

Course Outcomes:

COs	Statements	Blooms Level
CO1	asp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	L2
CO2	derstand flow and bio-geo- chemical cycles and ecological pyramids.	L2
CO3	derstand various causes of pollution and solid waste management and related preventive measures.	L2
CO4	derstand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	L2
CO5	ustrate the causes of population explosion, value education and welfare programmes.	L3

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester
OPTIMIZATION TECHNIQUES
(Common to CSE(AIML),IT)

L	T	P	C
3	0	0	3

Pre-requisite:

Course Objectives:

1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

Course Outcomes: At the end of the course, student will be able to
1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
4. Solve decision t heory problems through the application of game theory Apply the replacement and queuing models to increase the efficiency of the system
5. Model the project management problems through CPM and PERT

UNIT I: Introduction and Classical Optimization Techniques :
Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems. **Classical Optimization Techniques :** Single variable Optimization, multi - variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II: Linear Programming :
Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction o f a general system of equations, motivation to the simplex method, simplex algorithm.

UNIT III: Transportation Problem:
Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem

UNIT – IV: SEQUENCING – Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three machines and two jobs through m-machines only.

THEORY OF GAMES: Introduction to decision theory – mini. max (max. mini) criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games - graphical method.

UNIT – V: Network Analysis: Project planning, scheduling and controlling – tools for project management – critical path method (CPM) – programme evaluation and review technique (PERT) – cost analysis and crashing – resource leveling – updating.

TEXT BOOKS:

1. "Engineering optimization: Theory and practice", S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Operations Research - An Introduction/Hamdy A Taha/Pearson publishers
3. Operations Research – Theory & publications / S.D.Sharma- Kedarnath / McMillan publishers India Ltd

REFERENCES:

1. "Optimization Methods in Operations Research and systems Analysis", by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition,
2. "Operations Research" by A.M Kolen and A.K Karney. McGraw-Hill Education (P)
3. "Operations Research" by Chandra and Kushwaha .S. Chandra and S.C Kushwaha (A) S.Chand Pubishing(p)

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester
PROBABILITY AND STATISTICS
(Common to CSE, IT, CSE-AI&ML)

L	T	P	C
3	0	0	3

Course Objectives:

To familiarize the students with the foundations of probability and statistical methods.

To impart probability concepts and statistical methods in various applications Engineering.

Course Outcomes: Upon successful completion of this course, the student should be able to

1. Classify the concepts of data science and its importance (L2).
2. Interpret the association of characteristics and through correlation and regression tools (L4).
3. Apply discrete and continuous probability distributions (L3).
4. Design the components of a classical hypothesis test (L3).
5. Infer the statistical inferential methods based on small and large sampling tests (L4).

Unit – I: Descriptive statistics and methods for data science: (8)

Data science, Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Type of variable: dependent and independent Categorical and Continuous variables, Data visualization, Measures of Central tendency, Measures of Variability , Skewness, Kurtosis.

UNIT – II: Correlation and Regression: (7)

Correlation: Correlation coefficient, Rank correlation.

Linear Regression: Straight line, Multiple Linear Regression, Regression coefficients and properties.

Curvilinear Regression: Parabola, Exponential, Power curves.

UNIT – III: Probability and Distributions: (14)

Introduction of Probability, addition theorem, Conditional probability, Baye's theorem. Random variables: Discrete and Continuous random variables.

Distribution functions: Probability mass function, Probability density function and Cumulative distribution functions, Mathematical Expectation and Variance, Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory: (8)

Introduction, Population and Samples, Sampling distribution of Means and Variance, Point and Interval estimations, Maximum error of estimate, Central limit theorem (without proof), Estimation using t- test.

UNIT – V: Test of Hypothesis: (8)

Introduction, Hypothesis, Null and Alternative Hypothesis, errors in sampling, Level of significance, One tail and two-tail tests.

Test of significance for large samples and small samples: Single and two means, single and

two proportions, Student's t- test, F-test, $\square^2$-test.

Text Books:

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 12/e, Sultan Chand & Sons Publications, 2020.

Reference Books:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson ,2007.
2. Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage publishers.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester
OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Objectives:

The main objectives of the course is to make student

☐   Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection

☐   Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.

☐   Illustrate different conditions for deadlock and their possible solutions.

UNIT - I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File- System Mounting, Partitions and Mounting, File Sharing.

Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:
1.   Operating System Concepts, Silberschatz A, Galvin P B, Gagne G,   10th Edition, Wiley, 2018.
2.   Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:
1.   Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2.   Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw-Hill, 2013

Online Learning Resources:
1.   https://nptel.ac.in/courses/106/106/106106144/
2.   http://peterindia.net/OperatingSystems.html

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester

L	T	P	C
3	0	0	3

DATABASE MANAGEMENT SYSTEMS

Course Objectives:

The main objectives of the course is to

• Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra

• Introduce the concepts of basic SQL as a universal Database language

• Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization

• Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

UNIT I:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT II:

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL:Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III:

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV:

Schema Refinement (Normalization):Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Coddnormal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V:

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock

based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:
1)   Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2)   Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:
1)   Introduction to Database Systems, 8thedition, C J Date, Pearson.
2)   Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3)   Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:
1)   https://nptel.ac.in/courses/106/105/106105175/
2)   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820 22456_shared/overview

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester
SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:
The objectives of this course are to introduce
- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

UNIT I:
Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.
Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT II:
Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.
Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:
Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling.approaches to software design.
Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)
Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.
User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:
Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing. Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000.SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT V:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost. Software Reuse: reuse-definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition,PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, Mc- Graw Hill International Edition.

Reference Books:

1. Software Engineering, Ian Sommerville,10thEdition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e- **Resources:**

1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012605895063871 48827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003 904735_shared/overview

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)

L	T	P	C
0	0	3	1.5

II Year-II Semester
OPERATING SYSTEMS & SOFTWARE ENGINEERING LAB

Course Objectives:

The main objectives of the course are to

☐   Provide insights into system calls, file systems, semaphores,

☐   Develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation

☐   Implement Bankers Algorithms to Avoid the Dead Lock

☐   acquire the generic software development skill through various stages of software life cycle

☐   generate test cases for software testing

Experiments covering the Topics:

☐   UNIX fundamentals, commands & system calls

☐   CPU Scheduling algorithms, thread processing

☐   IPC, semaphores, monitors, deadlocks

☐   Page replacement algorithms, file allocation strategies

☐   Memory allocation strategies

☐   Software Requirement Specification, DFD, CFD

☐   Software estimation, UML diagrams, test case design

Sample Experiments in Operating Systems:

1.   Practicing of Basic UNIX Commands.
2.   Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3.   Simulate UNIX commands like cp, ls, grep, etc.,
4.   Simulate the following CPU scheduling algorithms
       a)   FCFS b) SJF c) Priority d) Round Robin
5.   Control the number of ports opened by the operating system with
       a)   Semaphore b) Monitors.
6.   Write a program to illustrate concurrent execution of threads using pthreads library.
7.   Write a program to solve producer-consumer problem using Semaphores.
8.   Implement the following memory allocation methods for fixed partition
       a)   First fit b) Worst fit c) Best fit
9.   Simulate the following page replacement algorithms
       a)   FIFO b) LRU c) LFU
10.   Simulate Paging Technique of memory management.
11.   Implement Bankers Algorithm for Dead Lock avoidance and prevention
12.   Simulate the following file allocation strategies
       a)   Sequential b) Indexed c) Linked
13.   Download and install nachos operating system and experiment with it

Sample Experiments in Software Engineering:

1)   Perform the following, for the following experiments:
   i. Do the Requirement Analysis and Prepare SRS

ii.   Draw E-R diagrams, DFD, CFD and structured charts for the project.
     a.Course Registration System
     b. Students Marks Analyzing System
     c. Online Ticket Reservation System
     d. Stock Maintenance
2)   Consider any application, using COCOMO model, estimate the effort.
3)   Consider any application, Calculate effort using FP oriented estimation model.
4)   Draw the UML Diagrams for the problem a, b, c, d.
5)   Design the test cases for e-Commerce application (Flipcart, Amazon)
6)   Design the test cases for a Mobile Application (Consider any example from Appstore)
7)   Design and Implement ATM system through UML Diagrams.

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester

L	T	P	C
0	0	3	1.5

DATABASE MANAGEMENT SYSTEMS LAB

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Exercise - 1

1.   Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2.   Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.

Exercise - 2

1.   Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
2.   Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)

Exercise - 3

1.
a.   Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
b.   Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

Exercise – 4

1.   Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
2.   Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.

Exercise – 5

1.   Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

2.   Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

Exercise – 6

1.   Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

Exercise – 7

1.   Develop Programs using BEFORE and AFTER Triggers,Row   and   Statement Triggers and INSTEAD OF Triggers

Exercise – 8

1.   Create a table and perform the search operation on table using indexing and non- indexing techniques.

Exercise – 9

1.   Write a Java program that connects to a database using JDBC
2.   Write a Java program to connect to a database using JDBC and insert values into it
3.   Write a Java program to connect to a database using JDBC and delete values from it

Exercise – 10

1.   Bulid any simple Application

Text Books/Suggested Reading:

1.   Oracle: The Complete Reference by Oracle Press
2.   Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3.   Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester
PYTHON WITH DJANGO (SKILL ENHANCEMENT COURSE)

L	T	P	C
0	1	2	2

Course Objectives:
The main objectives of the course are to
- Design and build static as well as dynamic web pages and interactive web-based applications
- Web development using Django framework.
- Analyze and create functional website in Django and deploy Django Web Application on Cloud

UNIT-I :
Python libraries for web development :
Collections-Container datatypes, Tkinter-GUI applications, Requests-HTTP requests, BeautifulSoup4-web scraping, Scrapy, Zappa, Dash, CherryPy, Turbo Gears, Flask, Web2Py, Bottle, Falcon, Cubic Web, Quixote, Pyramid.

Sample Experiments:
1. Write a Python GUI program to import Tkinter package and create a window. Set its title and add a label to the window.
2. Write a Python program that designs a simple login form with labels and Entry widgets, arranging them in a grid using the Grid geometry manager.
3. Write a program using BeautifulSoup4 library for web scraping for a given URL
4. Develop a sample Hello World page using Flask framework
5. Develop a sample web page using CherryPy / Web2Py / Bottle Framework

UNIT-II:
Introduction to Django Framework
Understanding Django environment, Features of Django and Django architecture, MVC and MTV, Urls and Views, Mapping the views to URLs, Django Template, Template inheritance Django Models, Creating model for site, Converting the model into a table, Fields in Models, Integrating Bootstrap into Django, Creating tables, Creating grids, Creating carousels.

Sample Experiments:
1. Create a Sample "Hello World" Application using Django
2. Create a Login and Registration Page using MVC architecture in Django Framework
3. Create a sample page in Django by integrating BootStrap.
4. Create an application with Tables, grids in Django
5. Create a Django App with Carousels feature.

UNIT-III :
Integrating Accounts & Authentication on Django
Introduction to Django Authentication System, Security Problem &Solution with Django Creating Registration Form using Django, Adding Email Field in Forms, Configuring email settings, Sending emails with Django, Adding Grid Layout On Registration Page, Adding Page Restrictions, Login Functionality Test and Logout.

Sample Experiments:
1.   Create a registration page using Authentication System
2.   Create an application in Django to send emails using email settings and Grid Layout
3.   Create an application in Django using page restriction / authentication with Login and Logout Functionality
4.   Create a sample form using Django Forms

UNIT-IV:
Connecting SQLite with Django Database Migrations, Fetch Data From Database, Displaying Data On Templates, Adding Condition On Data, Sending data from url to view, Sending data from view to template, Saving objects into database, Sorting objects, Filtering objects, Deleting objects, Difference between session and cookie, Creating sessions and cookies in Django.

Sample Experiments:
1.   Create an app in Django which fetches data from database and show as list and also save objects in database
2.   Create an app in Django for performing CRUD operations on records in a database
3.   Create an app in Django which uses session management and cookies to store and manage user sessions.

UNIT-V:
Deploying Django Web Application on Cloud
Creating a functional website in Django, Four Important Pillars to Deploy, registering on Heroku and GitHub, Push project from Local System to GitHub, working with Django Heroku, Working with StaticRoot, Handling WSGI with gunicorn, setting up Database & adding users.

Sample Experiments:
1.   Create a website in Django with login, and registration page.
2.   Register on GitHub, and Heroku and deploy the website on Heroku with all the functionalities developed.
3.   Configure Django to handle static files.

Text books:
1.   Martin C.Brown, "Python: The Complete Reference Paper back", 4th Edition 2018, McGraw Hill Education.
2.   Reema Thareja, "Python Programming: Using Problem Solving Approach", 3rd Edition 2017, Oxford.
3.   Daniel Rubio, Apress, "Beginning Django Web Application Development and Deployment with Python", 2nd Edition 2017,Apress.

Reference Books:
1.   Tom Aratyn, "Building Django 2.0 Web Applications: Create enterprise-grade, scalable Python web applications easily with Django 2.0",2ndEdition 2018, Packt Publishing.
2.   Harry Percival, "Test-Driven Development with Python: Obey the Testing Goat: Using Django, Selenium and JavaScript",2nd Edition 2019, Kindle Edition.

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INFORMATION TECHNOLOGY
(R23 SYLLABUS)
II Year-II Semester
DESIGN THINKING & INNOVATION
(Common for all branches of Engineering)

L	T	P	C
1	0	2	2

Course Objectives: The objectives of the course are to

☐ Bring awareness on innovative design and new product development. Explain the basics of design thinking.
☐ Familiarize the role of reverse engineering in product development. Train how to identify the needs of
☐ society and convert into demand. Introduce product planning and product development process.
☐
☐ **UNIT – I Introduction to Design Thinking**

Introduction to elements and principles of Design, basics of design - dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development
Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation : Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design: Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.
Activity: Importance of modeling , how to set specifications, Explaining their own product design..

UNIT – V Design Thinking in Business Processes : Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition,Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.
Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:
1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

☐ https://https://nptel.ac.in/courses/110/106/110106124/

☐ https://nptel.ac.in/courses/109/104/109104109/

☐ https://swayam.gov.in/nd1_noc19_mg60/preview

☐ https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5