

Curriculum Book of SE (AI&DS)



**PUNE VIDYARTHI GRIHA'S
COLLEGE OF ENGINEERING AND TECHNOLOGY AND
G K PATE(WANI) INSTITUTE OF MANAGEMENT, PUNE-9
(AFFILIATED TO UNIVERSITY OF PUNE, PUNE)**

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE DEPARTMENT

CURRICULUM BOOK

ACADEMIC YEAR: 2022-23

**FOR THE PROGRAMME
S. E. (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

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**PUNE VIDYARTHI GRIHA'S
COLLEGE OF ENGINEERING AND TECHNOLOGY AND
G K PATE(WANI) INSTITUTE OF MANAGEMENT, PUNE-9
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VISION

“TO ACHIEVE EXCELLENCE IN ENGINEERING EDUCATION”

MISSION

- **To satisfy all stakeholders**
- **To develop ethical, highly motivated engineering professionals with good human values, requisite skills and competencies**
- **To adopt innovative teaching mechanisms**
- **To promote research culture**
- **To contribute to country's economic development**
- **To be responsive to changes in technology, socio-economic and environmental conditions**

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Artificial Intelligence and Data Science Department

Vision of the Department

“To become a center of excellence for education in Artificial Intelligence and Data Science with holistic development approach”.

MISSION

- 1) To create a research based educational ecosystem by adopting interdisciplinary and multi-disciplinary approach.
- 2) To impart fundamental and advanced engineering knowledge to provide sustainable solutions to the industry and other stakeholders.
- 3) To nurture social and ethical values in students for the progress of society and nation.

PROGRAM EDUCATIONAL OBJECTIVES

- **PEO1:** Apply problem solving skills to address the societal and environmental issues.
- **PEO2:** Practice Ethical AI and become Responsible Data Scientist.
- **PEO3:** Embrace lifelong learning to accommodate fast paced technical world of Artificial Intelligence.
- **PEO4:** Exhibit interpersonal and intra-personal skills to become a leader in the domain of AI&DS.

PROGRAM OUTCOMES

Engineering Graduate will be able to...

- PO1: Engineering Knowledge:** Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
- PO2: 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.
- PO3: Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
- PO4: Conduct Investigations of Complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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- PO5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
- PO6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7: Environment and Sustainability:** Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practices.
- PO9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10: Communication:** Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11: Project Management and Finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.
- PO12: Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES

AI&DS Engineering graduate will

- Demonstrate proficiency in collecting, cleaning, and analyzing diverse datasets using state-of-the-art tools and techniques
- Exhibit the machine learning expertise and deep learning competency to design and train neural networks for various applications
- Adhere to professional standards and ethical principles in their AI and data science work, respecting data privacy, confidentiality, and intellectual property rights

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| Savitribai Phule Pune University | | | | | | | | | | | | | | |
|---|--|---|-----------|----------|------------------------------|---------|-----------|-----------|------|-------|---------------|-----------|----------|-------|
| Second Year of Artificial Intelligence and Data Science (2020 Course) | | | | | | | | | | | | | | |
| (With effect from Academic Year 2021-22) | | | | | | | | | | | | | | |
| Semester-III | | | | | | | | | | | | | | |
| Course Code | Course Name | Teaching Scheme (Hours/Week) | | | Examination Scheme and Marks | | | | | | Credit Scheme | | | |
| | | Lecture | Practical | Tutorial | Mid-Sem | End-Sem | Term work | Practical | Oral | Total | Lecture | Practical | Tutorial | Total |
| 210241 | Discrete Mathematics | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | -- | - | 03 |
| 210242 | Fundamentals of Data Structures | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 210243 | Object Oriented Programming (OOP) | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 210244 | Computer Graphics | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 217521 | Operating Systems | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 217522 | Data Structures Laboratory | - | 04 | - | - | - | 25 | 50 | - | 75 | - | 02 | - | 02 |
| 217523 | OOP and Computer Graphics Laboratory | - | 04 | - | - | - | 25 | 25 | - | 50 | - | 02 | - | 02 |
| 217524 | Operating Systems Laboratory | - | 02 | - | - | - | 25 | - | - | 25 | - | 01 | - | 01 |
| 217525 | Business Communication Skills | - | 02 | - | - | - | 25 | - | - | 25 | - | 01 | - | 01 |
| 217526 | Humanity and Social Science | - | - | 01 | - | - | 25 | - | - | 25 | - | - | 01 | 01 |
| 217527 | Audit Course 3 | Grade | | | | | | | | | | | | |
| Total | | 15 | 12 | 01 | 150 | 350 | 125 | 75 | - | 700 | - | - | - | - |
| Total Credit | | | | | | | | | | | 15 | 06 | 01 | 22 |
| 217526: Options for Audit Course 3 | | | | | | | | | | | | | | |
| Audit Course Code | | Audit Course Title | | | | | | | | | | | | |
| 217527-I | | Green Construction and Design | | | | | | | | | | | | |
| 217527-II | | Social Awareness and Governance Program | | | | | | | | | | | | |
| 217527-III | | Environmental Studies | | | | | | | | | | | | |
| 217527-IV | | Smart Cities | | | | | | | | | | | | |
| 217527-V | | Foreign Language (one of Japanese/Spanish/French/German). Course contents for Japanese(Module 1) are provided. For other languages institute may design suitably. | | | | | | | | | | | | |

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Curriculum Book Semester I

Curriculum Book of SE (AI&DS)

Discrete Mathematics

| | | | |
|--|--|------------------------------------|-------------------------------------|
| Course Title: Discrete Mathematics | | Course Number: | Course Code: 210241 |
| Year: 2022-23 | | Semester: I | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial: - | |
| Course Assessment Methods | Direct methods | In-semester Examination : 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments , Presentation s | Quiz, Q&A session, Group Discussion |
| Prerequisites | 110005: Programming and Problem Solving | | |
| Course Objectives | | | |
| 1 | To introduce students to understand, explain, and apply the foundational mathematical concepts at the core of computer science. | | |
| 2 | To understand use of set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context. | | |
| 3 | To acquire knowledge of logic and proof techniques to expand mathematical maturity. | | |
| 4 | To learn the fundamental counting principle, permutations, and combinations. | | |
| 5 | To study how to model problem using graph and tree. | | |
| 6 | To learn how abstract algebra is used in coding theory. | | |
| Course Outcomes | | | |
| CO1 | Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly. | | |
| CO2 | Apply appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts. | | |
| CO3 | Design and analyze real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction. | | |
| CO4 | Specify, manipulate and apply equivalence relations; construct and use functions and apply these concepts to solve new problems. | | |
| CO5 | Calculate numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics. | | |
| CO6 | Model and solve computing problem using tree and graph and solve problems using appropriate algorithms | | |

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| CO7 | Analyze the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures. |
| Course Contents | |
| Unit-I | Set Theory and Logic |
| | Introduction and significance of Discrete Mathematics, Sets – Naïve Set Theory (Cantor's Set Theory), Axiomatic Set Theory, Set Operations, Cardinality of set, Principle of inclusion and exclusion. Types of Sets – Bounded and Unbounded Sets, Diagonalization Argument, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Powerset, Propositional Logic – logic, Propositional Equivalences, Application of Propositional Logic- Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction |
| | Practical/Tutorial |
| Unit-II | Relations and Functions |
| | Relations and their Properties, n-ary relations and their applications, Representing relations, Closures of relations, Equivalence relations, Partial orderings, Partitions, Hasse diagram, Lattices, Chains and Anti-Chains, Transitive closure and Warshall's algorithm. Functions – Surjective, Injective and Bijective functions, Identity function, Partial function, Invertible function, Constant function, Inverse functions and Compositions of functions, The Pigeonhole Principle. |
| | Practical/Tutorial |
| Unit-III | Counting Principles |
| | The Basics of Counting , rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Algorithms for generating Permutations and Combinations. |
| | Practical/Tutorial |
| Unit-IV | Graph Theory |
| | Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, the handshaking lemma, Single source shortest path-Dijkstra's Algorithm, Planar Graphs, Graph Colouring. |
| | Practical/Tutorial |
| Unit- V | Trees |
| | Introduction , properties of trees, Binary search tree, tree traversal, decision tree, prefix codes and Huffman coding, cut sets, Spanning Trees and Minimum Spanning Tree, Kruskal's and Prim's algorithms, The Max flow- Min Cut Theorem (Transport network). |
| | Practical/Tutorial |
| Unit-VI | Algebraic Structures and Coding Theory |

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| | 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, Galois Theory –Field Theory and Group Theory. | | |
| | Practical/Tutorial | | |
| | | | |
| Text Books | Author | Title of Book | Publication |
| T1 | Kenneth H. Rosen | Discrete Mathematics and its Application | Tata McGraw-Hill |
| T2 | C.L.Liu | Elements of Discrete Mathematics | Tata McGraw-Hill |
| | | | |
| Reference Books | | | |
| R1 | B. Kolman, R. Busby and S. Ross | Discrete Mathematical Structures | Pearson Education |
| R2 | N.Biggs | Discrete Mathematics | Oxford University Press |
| R3 | Narsingh Deo | Graph with application to engineering and Computer Science | Prentice Hall of India |
| R4 | Dr.K.D.Joshi | Foundation of Discrete Mathematics | New Age International Ltd |
| R5 | Eric Gossett | Discrete Mathematical Structures with Proofsll, | Wiley India Ltd, |
| R6 | Sriram P. and Steven S. | Computational Discrete Mathematics | Cambridge University Press |
| Self-Learning Facilities, Web Resources, Research papers for reference | e-Books <ul style="list-style-type: none"> • https://www.ebookphp.com/discrete-mathematical-structures-6th-edition-epub-pdf/ • http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf • http://home.iitk.ac.in/~aralal/book/mth202.pdf • https://web.stanford.edu/class/cs103x/cs103x-notes.pdf • http://home.iitk.ac.in/~aralal/book/mth202.pdf MOOC/ Video Lectures available at: <ul style="list-style-type: none"> • https://www.nptel.ac.in/courses/106/106/106106094/ • https://nptel.ac.in/courses/106/106/106106183/ • https://nptel.ac.in/courses/106/103/106103205/ • https://nptel.ac.in/courses/106/105/106105192/ • https://nptel.ac.in/courses/111/106/111106050/ • https://nptel.ac.in/courses/111/106/111106102/ | | |
| Tutorials | | | |
| Presentations | - | | |

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Fundamentals of Data Structures

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| Course Title: Fundamentals of Data Structures | | Course Number: | Course Code : 210242 |
| Year: 2022-23 | | Semester: I | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial / Practical : - 4Hrs/ Week | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments, Presentations | Quiz, Q&A session, Group Discussion |
| Prerequisites | 110005: Programming and Problem Solving | | |
| Course Objectives | | | |
| 1 | To understand the standard and abstract data representation methods. | | |
| 2 | To acquaint with the structural constraints and advantages in usage of the data. | | |
| 3 | To understand various data structures, operations on it and the memory requirements | | |
| 4 | To understand various data searching and sorting methods. | | |
| 5 | To understand various algorithmic strategies to approach the problem solution. | | |
| 6 | To understand the standard and abstract data representation methods. | | |
| Course Outcomes | | | |
| CO1 | Design the algorithms to solve the programming problems, identify appropriate algorithmic strategy for specific application, and analyze the time and space complexity. | | |
| CO2 | Discriminate the usage of various structures, Design/Program/Implement the appropriate data structures; use them in implementations of abstract data types and Identity the appropriate data structure in approaching the problem solution. | | |
| CO3 | Demonstrate use of sequential data structures- Array and Linked lists to store and process data. | | |
| CO4 | Understand the computational efficiency of the principal algorithms for searching and sorting and choose the most efficient one for the application. | | |
| CO5 | Compare and contrast different implementations of data structures (dynamic and static). | | |
| CO6 | Understand, Implement and apply principles of data structures-stack and queue to solve computational problems. | | |
| Course Contents | | | |
| Unit-I | Introduction to Algorithm and Data Structures (07 Hours) Introduction: | | |

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| | <p>From Problem to Program (Problem, Solution, Algorithm, Data Structure and Program). Data Structures: Data, Information, Knowledge, and Data structure, Abstract Data Types (ADT), Data Structure Classification (Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral data structures).</p> <p>Algorithms: Problem Solving, Introduction to algorithm, Characteristics of algorithm, Algorithm design tools: Pseudo-code and flowchart. Complexity of algorithm: Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, finding complexity using step count method, Analysis of programming constructs-Linear, Quadratic, Cubic, Logarithmic. Algorithmic Strategies: Introduction to algorithm design strategies- Divide and Conquer, and Greedy strategy.</p> |
| | Practical/Tutorial |
| | <ol style="list-style-type: none"> In second year computer engineering class, group A student's play cricket, group B students play badminton and group C students play football. Write a Python program using functions to compute following: <ol style="list-style-type: none"> List of students who play both cricket and badminton List of students who play either cricket or badminton but not both Number of students who play neither cricket nor badminton Number of students who play cricket and football but not badminton. Write a Python program to compute following operations on String: <ol style="list-style-type: none"> To display word with the longest length To determine the frequency of occurrence of particular character in the string To check whether given string is palindrome or not To display index of first appearance of the substring To count the occurrences of each word in a given string |
| Unit-II | Linear Data Structure Using Sequential Organization |
| | <p>Concept of Sequential Organization, Overview of Array, Array as an Abstract Data Type, Operations on Array, Merging of two arrays, Storage Representation and their Address Calculation: Row major and Column Major, Multidimensional Arrays: Two-dimensional arrays, n-dimensional arrays. Concept of Ordered List, Single Variable Polynomial: Representation using arrays, Polynomial as array of structure, Polynomial addition, Polynomial multiplication. Sparse Matrix: Sparse matrix representation using array, Sparse matrix addition, Transpose of sparse matrix- Simple and Fast Transpose, Time and Space tradeoff.</p> |
| | Practical/Tutorial |
| | <p>Write a Python program to compute following computation on matrix:</p> <ol style="list-style-type: none"> Addition of two matrices Subtraction of two matrices Multiplication of two matrices Transpose of a matrix |

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| Unit-III | Searching and Sorting |
| | <p>Searching: Search Techniques-Sequential Search/Linear Search, Variant of Sequential Search- Sentinel Search, Binary Search, Fibonacci Search, and Indexed Sequential Search.</p> <p>Sorting: Types of Sorting-Internal and External Sorting, General Sort Concepts-Sort Order, Stability, Efficiency, and Number of Passes, Comparison Based Sorting Methods-Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Shell Sort, Non-comparison Based Sorting Methods-Radix Sort, Counting Sort, and Bucket Sort, Comparison of All Sorting Methods and their complexities</p> |
| | Practical/Tutorial |
| | <p>1.</p> <p>a) Write a Python program to store roll numbers of student in array who attended training program in random order. Write function for searching whether particular student attended training program or not, using Linear search and Sentinel search.</p> <p>b) Write a Python program to store roll numbers of student array who attended training program in sorted order. Write function for searching whether particular student attended training program or not, using Binary search and Fibonacci search</p> <p>2.</p> <p>Write a Python program to store first year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using</p> <p style="padding-left: 40px;">a) Selection Sort</p> <p style="padding-left: 40px;">b) Bubble sort and display top five scores</p> <p>3.</p> <p>Write a Python program to store first year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using quick sort and display top five scores.</p> |
| Unit-IV | Linked Lists |
| | <p>Introduction to Static and Dynamic Memory Allocation,</p> <p>Linked List: Introduction, of Linked Lists, Realization of linked list using dynamic memory management, operations, Linked List as ADT, Types of Linked List: singly linked, linear and Circular Linked Lists, Doubly Linked List, Doubly Circular Linked List, Primitive Operations on Linked List-Create, Traverse, Search, Insert, Delete, Sort, Concatenate. Polynomial Manipulations- Polynomial addition. Generalized Linked List (GLL) concept, Representation of Polynomial using GLL.</p> |
| | Practical/Tutorial |
| | <p>1. Department of Computer Engineering has student's club named 'Pinnacle Club'. Students of second, third and final year of department can be granted membership on request. Similarly one may cancel the membership of club. First node is reserved for president of club and last node is reserved for secretary of club. Write C++</p> |

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| | <p>program to maintain club member's information using singly linked list. Store student PRN and Name. Write functions to:</p> <ol style="list-style-type: none"> Add and delete the members as well as president or even secretary. Compute total number of members of club Display members Two linked lists exists for two divisions. Concatenate two lists. <p>2. Write C++ program for storing binary number using doubly linked lists. Write functions-</p> <ol style="list-style-type: none"> To compute 1's and 2's complement Add two binary numbers |
| Unit- V | Stack |
| | <p>Basic concept, stack Abstract Data Type, Representation of Stacks Using Sequential Organization, stack operations, Multiple Stacks, Applications of Stack- Expression Evaluation and Conversion, Polish notation and expression conversion, Need for prefix and postfix expressions, Postfix expression evaluation, Linked Stack and Operations.</p> <p>Recursion- concept, variants of recursion- direct, indirect, tail and tree, backtracking algorithmic strategy, use of stack in backtracking..</p> |
| | Practical/Tutorial |
| | <ol style="list-style-type: none"> A palindrome is a string of character that's the same forward and backward. Typically, punctuation, capitalization, and spaces are ignored. For example, "Poor Dan is in a droop" is a palindrome, as can be seen by examining the characters "poor danisina droop" and observing that they are the same forward and backward. One way to check for a palindrome is to reverse the characters in the string and then compare with them the original-in a palindrome, the sequence will be identical. Write C++ program with functions- <ol style="list-style-type: none"> To print original string followed by reversed string using stack To check whether given string is palindrome or not Implement C++ program for expression conversion as infix to postfix and its evaluation using stack based on given conditions: <ol style="list-style-type: none"> Operands and operator, both must be single character. Input Postfix expression must be in a desired format. Only '+', '-', '*' and '/' operators are expected. |
| Unit-VI | Queue |
| | <p>Basic concept, Queue as Abstract Data Type, Representation of Queue using Sequential organization, Queue Operations, Circular Queue and its advantages, Multi-queues, Linked Queue and Operations. Deque- Basic concept, types (Input restricted</p> |

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| | and Output restricted), Priority Queue- Basic concept, types (Ascending and Descending). | | |
| | Practical/Tutorial | | |
| | <ol style="list-style-type: none"> Queues are frequently used in computer programming, and a typical example is the creation of a job queue by an operating system. If the operating system does not use priorities, then the jobs are processed in the order they enter the system. Write C++ program for simulating job queue. Write functions to add job and delete job from queue. Pizza parlor accepting maximum M orders. Orders are served in first come first served basis. Order once placed cannot be cancelled. Write C++ program to simulate the system using circular queue using array. | | |
| Text Books | Author | Title of Book | Publication |
| T1 | Horowitz, Sahani, Dinesh Mehata, | “Fundamentals of Data Structures in C++”, | Galgotia Publisher, ISBN: 8175152788, 9788175152786. |
| T2 | Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser | “Data Structures and Algorithms in Python”, | Wiley Publication, ISBN: 978-1-118-29027-9 |
| Reference Books | | | |
| R1 | Steven S S. Skiena, | “The Algorithm Design Manual” | Springer, 2nd ed. 2008 Edition, ISBN-13: 978-1849967204, ISBN-10: 1849967202. |
| R2 | Allen Downey, Jeffery Elkner, Chris Meyers | , “How to think like a Computer Scientist: Learning with Python”, | Dreamtech Press, ISBN: 9789351198147 Pearson, Education, ISBN 978-81-317-6092-5 |
| R3 | M. Weiss, | “Data Structures and Algorithm Analysis in C++”, | 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0. |
| R4 | Brassard and Bratley, | “Fundamentals of Algorithmic”, | Prentice Hall India/Pearson Education, ISBN 13-9788120311312. |
| R5 | Yashwant Kanetkar & A. Kanetkar, | “Let us Python”, | BPB Publisher, ISBN: 9789389845006 |
| Self-Learning Facilities, Web Resources, Research papers for reference | e-Books: <ul style="list-style-type: none"> https://www.ebooks.com/en-us/book/95777110/Python-data-structures-and-algorithms/benjamin-baka/ https://www.ebookphp.com/advanced-data-structures-epub-pdf/ | | |

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| | <ul style="list-style-type: none">• https://www.ebookphp.com/data-structures-and-algorithms-professional-edition-beginners-guide-epub-pdf/ MOOC/ Video Lectures available at: <ul style="list-style-type: none">• https://nptel.ac.in/courses/106/102/106102064/• https://nptel.ac.in/courses/106/105/106105085• https://nptel.ac.in/courses/106/106/106106127 |
| Tutorials | - |
| Presentations | - |

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Object Oriented Programming

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|---|--|-----------------------------------|-------------------------------------|
| Course Title: Object Oriented Programming | | Course Number: | Course Code: 210243 |
| Year: 2022-23 | | Semester: I | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial: - | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments, Presentations | Quiz, Q&A session, Group Discussion |
| Prerequisites | 110005: Programming and Problem Solving | | |
| Course Objectives | | | |
| 1 | To learn the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. | | |
| 2 | To learn the syntax and semantics of the C++ programming language. | | |
| 3 | To understand the concept of data abstraction and encapsulation, how to design C++ classes for code reuse, how to implement copy constructors and class member functions, to overload functions and operators in C++. | | |
| 4 | To learn how inheritance and virtual functions implement dynamic binding with polymorphism. | | |
| 5 | To learn how to design and implement generic classes with C++ templates and how to use exception handling in C++ programs. | | |
| Course Outcomes | | | |
| CO1 | Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software. | | |
| CO2 | Design object-oriented solutions for small systems involving multiple objects. | | |
| CO3 | Use virtual and pure virtual function and complex programming situations. | | |
| CO4 | Apply object-oriented software principles in problem solving. | | |
| CO5 | Analyze the strengths of object-oriented programming. | | |
| CO6 | Develop the application using object oriented programming language(C++). | | |
| Course Contents | | | |
| Unit-I | Fundamentals of Object Oriented Programming | | |
| | Introduction to object-oriented programming , Need of object-oriented programming, Fundamentals of object-oriented programming: Namespaces, objects, classes, data members, methods, messages, data encapsulation, data | | |

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| | <p>abstraction and information hiding, inheritance, polymorphism. Benefits of OOP, C++ as object oriented programming language.</p> <p>C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, Access specifiers, separating interface from implementation.</p> <p>Functions- Function, function prototype, accessing function and utility function, Constructors and destructor, Types of constructor, Objects and Memory requirements, Static members: variable and functions, inline function, friend function.</p> |
| | Practical/Tutorial |
| | <p>Develop a program in C++ to create a database of student's information system containing the following information: Name, Roll number, Class, Division, Date of Birth, Blood group, Contact address, Telephone number, Driving license no. and other. Construct the database with suitable member functions. Make use of constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete as well as exception handling.</p> |
| Unit-II | Inheritance and Pointers |
| | <p>Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Public and Private Inheritance, Types of Inheritance, Ambiguity in Multiple Inheritance, Virtual Base Class, Abstract class, Friend Class, Nested Class.</p> <p>Pointers: declaring and initializing pointers, indirection Operators, Memory Management: new and delete, Pointers to Objects, this pointer, Pointers Vs Arrays, accessing Arrays using pointers, Arrays of Pointers, Function pointers, Pointers to Pointers, Pointers to Derived classes, Passing pointers to functions, Return pointers from functions, Null pointer, void pointer.</p> |
| | Practical/Tutorial |
| | <p>Imagine a publishing company which does marketing for book and audio cassette versions. Create a class publication that stores the title (a string) and price (type float) of publications. From this class derive two classes: book which adds a page count (type int) and tape which adds a playing time in minutes (type float).</p> <p>Write a program that instantiates the book and tape class, allows user to enter data and displays the data members. If an exception is caught, replace all the data member values with zero values.</p> |
| Unit-III | Polymorphism |
| | <p>Polymorphism- Introduction to Polymorphism, Types of Polymorphism, Operator Overloading- concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and</p> |

Curriculum Book of SE (AI&DS)

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| | mutable. Function overloading, Run Time Polymorphism - Pointers to Base class, virtual function and its significance in C++, pure virtual function and virtual table, virtual destructor, abstract base class. |
| | Practical/Tutorial |
| | Implement a class Complex which represents the Complex Number data type. Implement the following 1. Constructor (including a default constructor which creates the complex number 0+0i). 2. Overload operator+ to add two complex numbers. 3. Overload operator* to multiply two complex numbers. 4. Overload operators << and >> to print and read Complex Numbers. |
| Unit-IV | Files and Streams |
| | Data hierarchy , Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output. |
| | Practical/Tutorial |
| | Write a C++ program that creates an output file, writes information to it, closes the file, open it again as an input file and read the information from the file. |
| Unit- V | Exception Handling and Templates |
| | Exception Handling - Fundamentals, other error handling techniques, simple exception handling- Divide by Zero, Multiple catching, re-throwing an exception, exception specifications, user defined exceptions, processing unexpected exceptions, constructor, destructor and exception handling, exception and inheritance. Templates - The Power of Templates, Function template, overloading Function templates, and class template, class template and Nontype parameters, template and friends Generic Functions, The type name and export keywords. |
| | Practical/Tutorial |
| | Write a function template for selection sort that inputs, sorts and outputs an integer array and a float array. |
| Unit-VI | Standard Template Library (STL) |
| | Introduction to STL, STL Components, Containers- Sequence container and associative containers, container adapters, Application of Container classes: vector, list, Algorithms - basic searching and sorting algorithms, min-max algorithm, set operations, heap sort, Iterators - input, output, forward, bidirectional and random access. Object Oriented Programming – a road map to future |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Write C++ program using STL for sorting and searching user defined |

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| | <p>records such as personal records (Name, DOB, Telephone number etc) using vector container.</p> <p>OR</p> <ul style="list-style-type: none">• Write C++ program using STL for sorting and searching user defined records such as Item records (Item code, name, cost, quantity etc) using vector container.• Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks in the map, using the state name as an index and returns the population of the state | | |
| Text Books | | | |
| T1 | Deitel | C++ How to Program | Eighth Edition, McGraw Hill Professional, 2011, ISBN: 978-00-72226805 |
| T2 | Robert Lafore | Object-Oriented Programming in C++ | fourth edition, Sams Publishing, ISBN: 0672323087 (ISBN 13: 9780672323089) |
| Reference Books | | | |
| R1 | Herbert Schildt | C++-The complete reference | Eighth Edition, McGraw Hill Professional, 2011, ISBN: 978-00-72226805 |
| R2 | E. Balagurusamy | Object-Oriented Programming with C++ | 7 th edition, Graw-Hill Publication, ISBN 10: 9352607996 ISBN 13: 9789352607990 |
| Self-Learning Facilities, Web Resources, Research papers for reference | <p>e-Books</p> <ul style="list-style-type: none">• https://www.springer.com/gp/book/9781852334505• https://www.ebookphp.com/object-oriented-programming-in-c-epub-pdf/• https://www.springer.com/gp/book/9781447133780 <p>MOOC/ Video Lectures available at:</p> <ul style="list-style-type: none">• https://nptel.ac.in/courses/106/105/106105151/• https://swayam.gov.in/nd1_noc20_cs07/preview• https://www.classcentral.com/course/swayam-programming-in-c-6704 | | |

Curriculum Book of SE (AI&DS)

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| | <ul style="list-style-type: none">• https://nptel.ac.in/courses/106/105/106105151/• https://swayam.gov.in/nd1_noc20_cs07/preview• https://www.classcentral.com/course/swayam-programming-in-c-6704 |
| Tutorials | |
| Presentations | - |

Curriculum Book of SE (AI&DS)

Computer Graphics

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|---|--|---|--|
| Course Title: Computer Graphics | | Course Number: | Course Code: 210244 |
| Year: 2022-23 | | Semester: III | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial/Practical: - 2 Hrs/Week | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical: 25 Marks Term Work: 25 Marks |
| | Indirect Methods | Assignments, Presentations | Quiz, Q&A session, Group Discussion |
| Prerequisites | Basic Mathematics | | |
| Course Objectives | | | |
| 1 | Remembering: To acquaint the learner with the basic concepts of Computer Graphics. | | |
| 2 | Understanding: To learn the various algorithms for generating and rendering graphical figures.. | | |
| 3 | Applying: To get familiar with mathematics behind the graphical transformations. | | |
| 4 | Understanding: To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting.. | | |
| 5 | Creating: To generate Interactive graphics using OpenGL | | |
| Course Outcomes | | | |
| CO1 | Identify the basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of computer graphics. | | |
| CO2 | Apply mathematics to develop Computer programs for elementary graphic operations. | | |
| CO3 | Illustrate the concepts of windowing and clipping and apply various algorithms to fill and clip polygons | | |
| CO4 | Understand and apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection | | |
| CO5 | Understand the concepts of color models, lighting, shading models and hidden surface elimination.. | | |
| CO6 | Create effective programs using concepts of curves, fractals, animation and gaming | | |
| Course Contents | | | |
| Unit-I | Graphics Primitives and Scan Conversion Algorithms | | |
| | Introduction, graphics primitives - pixel, resolution, aspect ratio, frame buffer. Display devices, applications of computer graphics. Introduction to OpenGL | | |

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| | <p>- OpenGL architecture, primitives and attributes, simple modelling and rendering of two- and three-dimensional geometric objects, GLUT, interaction, events and call-backs picking. (Simple Interaction with the Mouse and Keyboard) Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: DDA, Bresenham, and Midpoint.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> • Write C++ program to draw the following pattern. Use DDA line and Bresenham's circle drawing algorithm. Apply the concept of encapsulation. • Write C++ program to draw the following pattern. Use DDA line and Bresenham's circle drawing algorithm. Apply the concept of encapsulation. • Design and simulate any data structure like stack or queue visualization using graphics. Simulation should include all operations performed on designed data structure. Implement the same using OpenGL • Write OpenGL program to draw Sun Rise and Sunset. • Write C++ program to draw 3-D cube and perform following transformations on it using OpenGL i) Scaling ii) Translation iii) Rotation about an axis (X/Y/Z). |
| Unit-II | Polygon, Windowing and Clipping |
| | <p>Polygons: Introduction to polygon, types: convex, concave and complex. Inside test. Polygon Filling: flood fill, seed fill, scan line fill. Windowing and clipping: viewing transformations, 2-D clipping: Cohen – Sutherland algorithm line Clipping algorithm, Sutherland Hodgeman Polygon clipping algorithm, Weiler Atherton Polygon Clipping algorithm.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> • Write C++ program to draw a concave polygon and fill it with desired color using scan fill algorithm • Write C++ program to implement Cohen Southerland line clipping algorithm. • Write C++ program to draw 3-D cube and perform following transformations on it using OpenGL i) Scaling ii) Translation iii) Rotation about an axis (X/Y/Z). |
| Unit-III | 2D, 3D Transformations and Projections |
| | <p>2-D transformations: introduction, homogeneous coordinates, 2-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary point. 3-D transformations: introduction, 3-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary axis. Projections : Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric,</p> |

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| | diametric, trimetric) and Perspective (Vanishing Points – 1 point, 2 point and 3 point) | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none"> Write C++ program to draw 2-D object and perform following basic transformations: 1. Scaling 2. Translation 3. Rotation. Apply the concept of operator overloading. | | |
| Unit-IV | Light, Colour, Shading and Hidden Surfaces | | |
| | Colour models: Properties of Light, CIE chromaticity Diagram, RGB, HSV, CMY. Illumination Models: Ambient Light, Diffuse reflection, Specular Reflection, and the Phong model, Combined diffuse and Specular reflections with multiple light sources, warn model, Shading Algorithms: Halftone, Gauraud and Phong Shading. Hidden Surfaces Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock) | | |
| | Practical/Tutorial | | |
| | | | |
| Unit- V | Curves and Fractals | | |
| | Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, Fractals: Introduction, Classification, Fractal generation: snowflake, Triadic curve, Hilbert curve, Applications | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none"> Write C++ program to generate snowflake using concept of fractals. C++ program to generate Hilbert curve using concept of fractals. Write C++ program to generate fractal patterns by using Koch curves. | | |
| Unit-VI | Introduction to Animation and Gaming | | |
| | Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility. Animation: Introduction, Conventional and computer based animation, Design of animation sequences, Animation languages, Key-frame, Morphing, Motion specification. Gaming: Introduction, Gaming platform (NVIDIA, i8060), Advances in Gaming | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none"> Design and implement game / animation clip / Graphics Editor using open source graphicslibrary. Make use of maximum features of Object Oriented Programming. | | |
| Text Books | Author | Title of Book | Publication |

Curriculum Book of SE (AI&DS)

| | | | |
|---|---|---|--|
| T1 | S. Harrington | “Computer Graphics” | McGraw-Hill Publications, , ISBN 0 07 – 100472 – 6. |
| T2 | Donald D. Hearn and Baker | “Computer Graphics And OpenGL” | Pearson Educaion.ISBN-13: 9780136053583. |
| T3 | D. Rogers | “Procedural Elements for Computer Graphics” | Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4. |
| Reference Books | | | |
| R1 | J. Foley, V. Dam, S. Feiner, J. Hughes | “Computer Graphics Principles and Practice” | 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9 |
| R2 | D. Rogers, J. Adams, | “Mathematical Elements for Computer Graphics” | Tata McGraw Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8. |
| Self-Learning Facilities, Web Resources, Research papers for reference | www.tutorialspoint.com https://open.umn.edu/opentextbooks/textbooks/introduction-to-computer-graphics | | |
| Tutorials | https://nptel.ac.in/courses/106/106/106106090/ https://nptel.ac.in/courses/106/102/106102065/ | | |
| Presentations | - | | |

Curriculum Book of SE (AI&DS)

Operating Systems

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|---|--|---|------------------------------------|
| Course Title: Operating Systems | | Course Number: | Course Code: 217521 |
| Year: 2022-23 | | Semester: III | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs. /Week | | Tutorial/ Practical: - 2 Hrs. / Week | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments, Presentations | Quiz, |
| Prerequisites | Programming and Problem solving (110005) | | |
| Course Objectives | | | |
| 1 | To understand functions of operating system | | |
| 2 | To learn and understand process, resource and memory management. | | |
| 3 | To learn and understand file and I/O management. | | |
| Course Outcomes | | | |
| CO1 | Enlist functions of OS and types of system calls. | | |
| CO2 | Apply process scheduling algorithms to solve a given problem. | | |
| CO3 | Illustrate deadlock prevention, avoidance and recovery. | | |
| CO4 | Explain memory management technique. | | |
| CO5 | Illustrate I/O and file management policies. | | |
| CO6 | Describe Linux process management. | | |
| Course Contents | | | |
| Unit-I | Fundamental Concepts of Operating system | | |
| | Operating system functions and characteristics, historical evolution of operating systems, issues in operating system design, User's view of the OS, Types of OS: Batch, time sharing, multiprogramming, distributed, network and real-time systems, Operating-System Services, Types of System Calls, System Programs. BASH Shell scripting: Basic shell commands, shell as a scripting language. | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none">Implement UNIX system calls like ps, fork, join, exec family, and wait for process management (use shell script/ Java/ C programming)Shell programmingCreate a shell program to do mathematical operations.Create a shell program to find string in a file using grep system call. | | |
| Unit-II | Process Management | | |

Curriculum Book of SE (AI&DS)

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| | Process concept, Process Control Block (PCB), Process Operations, Process Scheduling : Types of process schedulers, Types of scheduling: Preemptive, Non preemptive. Scheduling algorithms: FCFS, SJF, RR, Priority, Inter process Communication (IPC). Threads : multithreaded model, implicit threads, threading issues |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Given the list of processes, their CPU burst times. Display/print the Gantt chart for FCFS, SJF, Priority and Round Robin scheduling algorithm. Compute and print the average waiting time and average turnaround time |
| Unit-III | Process Coordination |
| | Synchronization : Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors). Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, shared memory: system V) Deadlock : Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Implement producer-consumer problem with counting semaphores and mutex. Demonstrate Reader-Writer problem with reader priority or writer Write a program to implement the Bankers Algorithm. Inter process communication in Linux using Pipes <p>Pipes: Full duplex communication between parent and child processes. Parent process writes a pathname of a file (the contents of the file are desired) on one pipe to be read by child process and child process writes the contents of the file on second pipe to be read by parent process and displays on standard output.</p> |
| Unit-IV | Memory Management |
| | Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. Virtual Memory: Hardware and Control Structures, Operating System Software. |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Write a program to implement page Replacement strategies (FIFO, LRU, Optimal) Write a Program to implement paging simulation using Least Recently Used (LRU) and Optimal algorithm |

Curriculum Book of SE (AI&DS)

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| Unit- V | I/O and File Management | | |
| | I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Disk Scheduling Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN. File Management: Concept, Access methods, Directory Structure, Protection, File System implementation, Directory Implementation, Allocation methods, Free Space management. | | |
| | Practical/Tutorial | | |
| | | | |
| Unit-VI | Linux | | |
| | History Of Unix and Linux, Overview Of Linux - Linux Goals, Interfaces to Linux, The Shell, Linux Utility Programs, Kernel structure, Processes in Linux – Process management system calls in Linux, Implementation of process and threads in Linux, Process scheduling Linux, Booting. | | |
| | Practical/Tutorial | | |
| | | | |
| Text Books | Author | Title of Book | Publication |
| T1 | Das, Sumitabha | UNIX Concepts and Applications | TMH, ISBN-10: 0070635463, ISBN-13: 978-0070635463, 4 th Edition. |
| T2 | Kay Robbins and Steve Robbins | UNIX Systems Programming | Prentice Hall, ISBN-13:9780134424071, ISBN-10: 0134424077, 2 nd Edition. |
| Reference Books | | | |
| R1 | Abraham Silberschatz, Peter Baer Galvin and Greg Gagne | Operating System Concepts | WILEY, ISBN978-1-118-06333-0, 8 th Edition |
| R2 | William Stallings | Operating System: Internals and Design Principles | Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 9 th Edition. |

Curriculum Book of SE (AI&DS)

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| Self-Learning Facilities, Web Resources, Research papers for reference | www.tutorialspoint.com www.geeksforgeeks.org www.scaler.com https://repository.dinus.ac.id/docs/ajar/Operating_System.pdf https://nptel.ac.in/courses/106/105/106105214/ |
| Tutorials | - |
| Presentations | - |

Curriculum Book of SE (AI&DS)

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| 1. | SE AI&DS Course Structure | |
| | Semester 2 | 31 |
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| Savitribai Phule Pune University | | | | | | | | | | | | | | |
|---|---|--|-----------|----------|------------------------------|---------|------|-----------|------|-------|---------------|-----------|----------|-------|
| Second Year of Artificial Intelligence and Data Science (2020 Course) | | | | | | | | | | | | | | |
| (With effect from Academic Year 2021-22) | | | | | | | | | | | | | | |
| Semester-IV | | | | | | | | | | | | | | |
| Course Code | Course Name | Teaching Scheme | | | Examination Scheme and Marks | | | | | | Credit Scheme | | | |
| | | (Hours/Week) | | | | | | | | | | | | |
| | | Lecture | Practical | Tutorial | Mid-Sem | End-Sem | work | Practical | Oral | Total | Lecture | Practical | Tutorial | Total |
| 217528 | Statistics | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | -- | - | 03 |
| 217529 | Internet of Things | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 210252 | Data Structures and Algorithms | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 210253 | Software Engineering | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 217530 | Management Information System | 03 | - | - | 30 | 70 | - | - | - | 100 | 03 | - | - | 03 |
| 217531 | Internet of Things Laboratory | - | 04 | - | - | - | 50 | 25 | - | 75 | - | 02 | - | 02 |
| 217532 | Data Structures and Algorithms Laboratory | - | 04 | - | - | - | 25 | 25 | - | 50 | - | 02 | - | 02 |
| 217533 | Project Based Learning II | - | 04 | - | - | - | 50 | - | - | 50 | - | 02 | - | 02 |
| 217534 | Code of Conduct | - | - | 01 | - | - | 25 | - | - | 25 | - | - | 01 | 01 |
| 217535 | Audit Course 4 | Grade | | | | | | | | | | | | |
| Total | | 15 | 12 | 01 | 150 | 350 | 150 | 50 | - | 700 | - | - | - | - |
| Total Credit | | | | | | | | | | | 15 | 06 | 01 | 22 |
| 217535: Options for Audit Course 4 | | | | | | | | | | | | | | |
| Audit Course Code | | Audit Course Title | | | | | | | | | | | | |
| 217535-I | | Water Management | | | | | | | | | | | | |
| 217535-II | | Intellectual Property Rights and Patents | | | | | | | | | | | | |
| 217535-III | | The Science of Happiness | | | | | | | | | | | | |
| 217535-IV | | Stress Relief: Yoga and Meditation | | | | | | | | | | | | |
| 217535-V | | Foreign Language (one of Japanese/Spanish/French/German) Course contents for Japanese(Module 2) are provided. For other languages institute may design suitably. | | | | | | | | | | | | |

Curriculum Book of SE (AI&DS)

Curriculum Book Semester II

Curriculum Book of SE (AI&DS)

Statistics

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|---------------------------------------|--|-----------------------------------|-------------------------------------|
| Course Title: Statistics | | Course Number: | Course Code: 217528 |
| Year: 2022-23 | | Semester: II | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial: - | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments, Presentations | Quiz, Q&A session, Group Discussion |
| Prerequisites | 210241: Discrete Mathematics | | |
| Course Objectives | | | |
| 1 | Demonstrate knowledge of probability and the standard statistical distributions. | | |
| Course Outcomes | | | |
| CO1 | Identify the use of appropriate statistical terms to describe data. | | |
| CO2 | Use appropriate statistical methods to collect, organize, display, and analyze relevant data. | | |
| CO3 | Use distribution functions for random variables | | |
| CO4 | Distinguish between correlation coefficient and regression | | |
| CO5 | Understand tests for hypothesis and its significance | | |
| Course Contents | | | |
| Unit-I | Introduction To Statistics And Sampling Theory | | |
| | Statistics: Introduction, Origin and Development of Statistics, Definition, Importance and Scope, Limitations, Distrust of Statistics Population and Sample: Sampling –Introduction, Types of Sampling, Purposive Sampling, Random Sampling, Simple Sampling, Stratified Sampling, Parameter and Statistic, Sampling Distribution, Statistical Inference, Sampling With and Without Replacement, Random Samples: Random Numbers, Population Parameters, Sample Statistics, Sampling Distributions | | |
| | Practical/Tutorial | | |
| | | | |
| Unit-II | Descriptive Statistics: Measures Of Central Tendency | | |

Curriculum Book of SE (AI&DS)

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| | Frequency Distributions and Measures of central Tendency: Frequency Distribution, Continuous Frequency Distribution, Graphic Representation of a Frequency Distribution, Histogram, Frequency Polygon, Averages or Measures of Central Tendency or Measures of Location, Requisites for an Ideal Measure of Central Tendency, Arithmetic Mean, Properties of Arithmetic Mean, Merits and Demerits of Arithmetic Mean, Weighted Mean, Median, Merits and Demerits of Median, Mode, Merits and Demerits of Mode, Geometric Mean, Merits and Demerits of Geometric Mean, Harmonic Mean, Merits and Demerits of Harmonic Mean, Selection of an Average |
| | Practical/Tutorial |
| | |
| Unit-III | Descriptive Statistics: Measures of Dispersion |
| | Measures of Dispersion, Skewness and Kurtosis: Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis Correlation and Regression : Bivariate Distribution, Scatter diagrams, Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Lines of Regression, Regression Coefficients, Binomial and multinomial distributions, Poisson distribution, Uniform distribution, Exponential distribution, Gaussian distribution, Log-normal distribution, Chi-square distribution |
| | Practical/Tutorial |
| | |
| Unit-IV | Random Variables And Probability Distributions |
| | Random Variables and Distribution Functions: Random Variable, Distribution Function, Properties of Distribution Function, Discrete Random Variable, Probability Mass Function, Discrete Distribution Function, Continuous Random Variable, Probability Density Function Theoretical Discrete Distributions : Bernoulli Distribution, Binomial Distribution, Mean Deviation about Mean of Binomial Distribution, Mode of Binomial Distribution, Additive Property of Binomial Distribution, , Characteristic Function of Binomial Distribution, Cumulants of Binomial Distribution , Poisson Distribution, The Poisson Process, Geometric Distribution... |
| | Practical/Tutorial |
| | |
| Unit- V | Inferential Statistics: Hypothesis |
| | Statistical Inference - Testing of Hypothesis, Non-parametric Methods and Sequential Analysis: Introduction, Statistical Hypothesis (Simple and -Composite), Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis, Critical Region, Two Types of Errors, level of Significance, Power of the Test |

Curriculum Book of SE (AI&DS)

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|---|--|---|--|
| | Practical/Tutorial | | |
| | | | |
| Unit-VI | Inferential Statistics: Tests For Hypothesis | | |
| | Steps in Solving Testing of Hypothesis Problem, Optimum Tests Under Different Situations, Most Powerful Test (MP Test), Uniformly Most Powerful Test, likelihood Ratio Test, Properties of Likelihood Ratio Test, Test for the Mean of a Normal Population, Test for the Equality of Means of Two Normal Populations, Test for the Equality of -Means of Several Normal Populations, Test for the Variance of a Normal Population, Test for Equality of Variances of two Normal Populations, Non-parametric Methods, Advantages and Disadvantages of Non-parametric Methods | | |
| | Practical/Tutorial | | |
| | | | |
| Text Books | Author | Title of Book | Publication |
| T1 | S. C. Gupta, V. K. Kapoor | Fundamentals of Mathematical Statistics (A Modern Approach) | Sultan Chand & Sons Educational Publishers, Tenth revised edition, ISBN: 81-7014-791-3 |
| T2 | J. Medhi | Statistical Methods: An Introductory Text | Second Edition, New Age International Ltd, ISBN: 8122419577 |
| | | | |
| Reference Books | | | |
| R1 | Glen Cowan | Statistical Data Analysis | University Of Siegen, Clarendon Press, Oxford, 1998, ISBN: 0198501552 |
| R2 | Ken Black | Applied Business Statistics | Wiley, 7th Edition, ISBN: 9788126537075 |
| Self-Learning Facilities, Web Resources, Research papers for reference | e-Books <ul style="list-style-type: none"> • https://www.itl.nist.gov/div898/handbook/ • https://web.stanford.edu/~hastie/ElemStatLearn/index.html MOOC/ Video Lectures available at: <ol style="list-style-type: none"> 1. Introduction to Probability and statistics https://onlinecourses.nptel.ac.in/noc20_ma22/p_review 2. Introduction to Data Analytics https://nptel.ac.in/courses/110/106/110106072/ | | |
| Tutorials | | | |
| Presentations | - | | |

Curriculum Book of SE (AI&DS)

Internet of Things

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|--|---|--|--|-------------------------------------|--|
| Course Title: Internet Of Things | | Course Number: | | Course Code: 217529 | |
| Year: 2022-23 | | Semester: IV | | | |
| Designation of Course | | Professional Core | | | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial/Practical: - 4Hrs/Week | | | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | | End Semester Examination: 70 Marks | |
| | | | | Practical/Term Work | |
| | Indirect Methods | Assignments, Presentations | | Quiz, Q&A session, Group Discussion | |
| Prerequisites | Programming and Problem Solving | | | | |
| Course Objectives | | | | | |
| 1 | Understand the Basic Digital Electronics and microprocessors. | | | | |
| 2 | To introduce students with the architecture and operation of typical microprocessors and microcontrollers and its interfacing | | | | |
| 3 | Understand the definition and significance of the Internet of Things. | | | | |
| 4 | Interface and deploy analog and digital sensors. | | | | |
| 5 | To learn real world application scenarios of IoT along with its societal and economic impact using case studies. | | | | |
| Course Outcomes | | | | | |
| CO1 | Have a thorough understanding of the structure, function and characteristics of computer systems and Understand the structure of various number systems and its application in digital design. | | | | |
| CO2 | Develop the skill set to build IoT systems and sensor interfacing. | | | | |
| CO3 | Explain the concept of Internet of Things and identify the technologies that make up the internet of things | | | | |
| CO4 | Analyze trade-offs in interconnected wireless embedded device networks. Select Appropriate Protocols for IoT Solutions | | | | |
| CO5 | Design a simple IoT system comprising sensors by analyzing the requirements of IoT Application | | | | |
| CO6 | Identify the Application of IoT in automation of Commercial and Real World examples | | | | |
| Course Contents | | | | | |
| Unit-I | Fundamentals of Computer Organization & Digital Electronics | | | | |

Curriculum Book of SE (AI&DS)

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|-----------------|--|
| | <p>Basic Organization of Computers, Classification Micro, Mini, Mainframe and Super Computer. System Bus and Interconnection, PCI, Computer Function, I-Cycle, Interrupt and Class of Interrupts.</p> <p>Number systems, Decimal Number system, Binary number system, Octal & Hexadecimal number system, 1's & 2's complement, Binary Fixed Point Representation.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> • Study of different GATES (AND, OR, XOR), Sensors and basic binary operations.. • Study of different operating systems for Raspberry-Pi /Beagle board/Arduino. Understanding the process of OS installation |
| Unit-II | Communication Interface |
| | <p>Basic Peripherals & their interfacing with 8086/8088, Semiconductor Memory Interfacing-Dynamic RAM</p> <p>Interfacing-Interfacing I/O ports-PIO-8255, Modes of operation-interfacing Analog-Digital Data converter-stepper motor interfacing.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> • Study of Connectivity and configuration of Raspberry-Pi /Beagle board/Arduino circuit with basic peripherals like LEDs. Understanding GPIO and its use in the program |
| Unit-III | Introduction & IOT Technologies behind smart and intelligent devices |
| | <p>IoT Concepts, Introduction to IOT Communications, Telemetry vs IOT, Applications of IOT Communications, People, Processes and Devices.</p> <p>Automation, asset management, telemetry, transportation, telematics. Telemetry and Telemetric; Report location, logistics, tracking and remote assistance; Next generation kiosks, self-service technology; Cellular IOT connectivity services.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> • Write an application to control the operation of hardware simulated traffic signals. (Mini Project: Same can be done parallel with PBL) • Write a program using piezo element and use it to play a tune after someone knocks |
| Unit-IV | IoT Systems, Network and Protocols |
| | <p>Study of RF Wireless Sensors; Wireless networks; Wireless Sensor Networking (WSN); Cellular Machine-to-Machine (M2M) application networks; Computer Connected to Internet; Network Devices; Device configuration and management; Exchange information in real time without human intervention; IoT Protocols.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> • Write a program to show the temperature and shows a graph of the recent measurements |

Curriculum Book of SE (AI&DS)

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| | <ul style="list-style-type: none"> Write a program using piezo element and use it to play a tune after someone knocks Understanding the connectivity of Raspberry-Pi /Beagle board circuit / Arduino with IR sensor. Write an application to detect obstacle and notify user using LEDs | | |
| Unit- V | IOT Design and System Engineering | | |
| | Discuss IOT Requirements; Hardware & Software; Study of IOT Sensors; Tagging and Tracking; Embedded Products; IOT Design; SIM Card Technology; IOT Connectivity and Management; IOT Security & IOT Communication. | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none"> Study of Raspberry-Pi/ Beagle board/ Arduino and other microcontroller (History & Evolution) Study of different operating systems for Raspberry-Pi /Beagle board/Arduino. Understanding the process of OS installation. | | |
| Unit-VI | IOT Applications | | |
| | IOT Verticals; IOT Hosted Services; IOT Application development, IOT Connectivity; IOT Software providers; Review of various IoT application domains including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communication and wearable computing devices. | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none"> Write a program read the temperature sensor and send the values to the serial monitor on the computer. Create a program so that when the user enters 'b' the green light blinks, 'g' the green light is illuminated 'y' the yellow light is illuminated and 'r' the red light is illuminated Create a program that illuminates the green LED if the counter is less than 100, illuminates the yellow LED if the counter is between 101 and 200 and illuminates the red LED if the counter is greater than 200 Write a program to control the color of the LED by turning 3 different potentiometers. One will be read for the value of Red, one for the value of Green, and one for the value of Blue. | | |
| Text Books | Author | Title of Book | Publication |
| T1 | Arshdeep Bahga, Vijay Madisetti, | Internet of Things: A hands-on approach | Universities Press, ISBN:0: 0996025510, 13: 978-0996025515. |

Curriculum Book of SE (AI&DS)

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|---|---|---|---|
| T2 | Olivier Hersent, David Boswarthick, Omar Elloumi | The Internet of Things: Key applications and Protocols” | Wiley, 2012, ISBN:978- 1-119-99435-0 |
| Reference Books | | | |
| R1 | David Hanes | “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things” | Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456- 5, 2017 |
| R2 | Olivier Hersent, Omar Elloumi and David Boswarthick | “The Internet of Things: Applications to the Smart Grid and Building Automation” | Wiley, 2012, 9781119958345 |
| R3 | Adrian McEwen, Hakim Cassimally | “Designing the Internet of Things” | Wiley, 2014, ISBN: 978-1-118-43063-7 |
| Self-Learning Facilities, Web Resources, Research papers for reference | www.tutorialspoint.com https://open.umn.edu/opentextbooks/textbooks/introduction-to-computer-graphics 8255 Programmable Peripheral Interface-Microprocessor-by ekeeda Internet of Things and Access Control: Sensing, Monitoring and Controlling Access in IoT-Enabled Healthcare Systems -1st Edition, Kindle Edition | | |
| Tutorials | Introduction to IoT (NPTEL) by Prof. Sudip Mishra, IITKGP. | | |
| Presentations | - | | |

Curriculum Book of SE (AI&DS)

Data Structures and Algorithms

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| Course Title: Data Structures and Algorithms | | Course Number: | | Course Code: 210252 | |
| Year: 2022-23 | | Semester: IV | | | |
| Designation of Course | | Professional Core | | | |
| Teaching Scheme: 3 Hrs. /Week | | Tutorial/Practical: - 4 Hrs. / Week | | | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | | End Semester Examination: 70 Marks | |
| | | | | Practical/Term Work | |
| | Indirect Methods | Assignments, Presentations | | Quiz, Presentation | |
| Prerequisites | 110005: Programming and Problem Solving 210242: Fundamentals of Data Structures | | | | |
| Course Objectives | | | | | |
| 1 | To develop a logic for graphical modeling of the real-life problems. | | | | |
| 2 | To suggest appropriate data structure and algorithm for graphical solutions of the problems. | | | | |
| 3 | To understand advanced data structures to solve complex problems in various domains. | | | | |
| 4 | To operate on the various structured data | | | | |
| 5 | To build the logic to use appropriate data structure in logical and computational solutions. | | | | |
| 6 | To understand various algorithmic strategies to approach the problem solution. | | | | |
| Course Outcomes | | | | | |
| CO1 | Identify and articulate the complexity goals and benefits of a good hashing scheme for real- world applications. | | | | |
| CO2 | Apply non-linear data structures for solving problems of various domain. | | | | |
| CO3 | Design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language. | | | | |
| CO4 | Analyze the algorithmic solutions for resource requirements and optimization | | | | |
| CO5 | Use efficient indexing methods and multiway search techniques to store and maintain data. | | | | |
| CO6 | Use appropriate modern tools to understand and analyze the functionalities confined to the secondary storage. | | | | |
| Course Contents | | | | | |
| Unit-I | Hashing | | | | |

Curriculum Book of SE (AI&DS)

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| | <p>Hash Table- Concepts-hash table, hash function, basic operations, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions-properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing, closed addressing and separate chaining.</p> <p>Skip List- representation, searching and operations- insertion, removal</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client's telephone number. Make use of two collision handling techniques and compare them using number of comparisons required to find a set of telephone number Implement all the functions of a dictionary (ADT) using hashing and handle collisions using chaining with / without replacement. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique. Standard Operations: Insert (key, value), Find(key), Delete(key) |
| Unit-II | Trees |
| | <p>Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals (recursive and non-recursive)- inorder, preorder, post order, depth first and breadth first, Operations on binary tree. Huffman Tree (Concept and Use), Binary Search Tree (BST), BST operations, Threaded binary search tree- concepts, threading, insertion and deletion of nodes in in- order threaded binary search tree, in order traversal of in-order threaded binary search tree.</p> |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> A book consists of chapters, chapters consist of sections and sections consist of subsections. Construct a tree and print the nodes. Find the time and space requirements of your method. Beginning with an empty binary search tree, construct binary search tree by inserting the values in the order given. After constructing a binary tree - i. Insert new node, ii. Find number of nodes in longest path from root, iii. Minimum data value found in the tree, iv. Change a tree so that the roles of the left and right pointers are swapped at every node, v. Search a value. Construct an expression tree from the given prefix expression eg. ++a*bc/def and traverse it using post order traversal (non recursive) and then delete the entire tree. |
| Unit-III | Graphs |
| | <p>Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prim's and Kruskal Algorithms, Dijkstra's Single</p> |

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| | source shortest path, All pairs shortest paths- Floyd-Warshall Algorithm Topological ordering. |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight take to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Check whether the graph is connected or not. Justify the storage representation used. You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures. |
| Unit-IV | Search Trees |
| | Symbol Table-Representation of Symbol Tables- Static tree table and Dynamic tree table, Weight balanced tree - Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming, Height Balanced Tree- AVL tree. Red-Black Tree, AA tree, K-dimensional tree, Splay Tree. |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Given sequence $k = k_1 < k_2 < \dots < k_n$ of n sorted keys, with a search probability p_i for each key k_i. Build the Binary search tree that has the least search cost given the access probability for each key? A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword |
| Unit- V | Indexing and Multiway Trees |
| | Indexing and Multiway Trees- Indexing, indexing techniques-primary, secondary, dense, sparse, Multiway search trees, B-Tree- insertion, deletion, B+Tree - insertion, deletion, use of B+ tree in Indexing, Trie Tree. |
| | Practical/Tutorial |
| | <ul style="list-style-type: none"> Implement the Heap/Shell sort algorithm implemented in Java demonstrating heap/shell data structure with modularity of programming language. |
| Unit-VI | File Organization |
| | Files: concept, need, primitive operations. Sequential file organization- concept and primitive operations, Direct Access File- Concepts and Primitive operations, indexed sequential file organization-concept, types of indices, |

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| | structure of index sequential file, Linked Organization- multi list files, coral rings, inverted files and cellular partitions. | | |
| | Practical/Tutorial | | |
| | <ul style="list-style-type: none"> Department maintains a student information. The file contains roll number, name, division and address. Allow user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If it is, then the system displays the student details. Use sequential file to main the data. Company maintains employee information as employee ID, name, designation and salary. Allow user to add, delete information of employee. Display information of particular employee. If employee does not exist an appropriate message is displayed. If it is, then the system displays the employee details. Use index sequential file to maintain the data. | | |
| Text Books | Author | Title of Book | Publication |
| T1 | Horowitz, Sahani, Dinesh Mehata | Fundamentals of Data Structures in C++ | Galgotia Publisher, ISBN: 8175152788, 9788175152786. |
| T2 | M Folk, B Zoellick, G. Riccardi, | File Structures | Pearson Education", ISBN:81-7758-37-5 |
| Reference Books | | | |
| R1 | A. Aho, J. Hopcroft, J. Ulman, | Data Structures and Algorithms | Pearson Education, 1998, ISBN-0-201- 43578-0. |
| R2 | Michael J Folk, | File Structures an Object Oriented Approach with C++ | Pearson Education, ISBN: 81-7758-373-5. |
| Self-Learning Facilities, Web Resources, Research papers for reference | www.tutorialspoint.com www.geeksforgeeks.org https://www.ebookphp.com/advanced-data-structures-epub-pdf/ https://nptel.ac.in/courses/106/102/106102064/ | | |
| Tutorials | - | | |
| Presentations | - | | |

Curriculum Book of SE (AI&DS)

Software Engineering

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|--|--|------------------------------------|-------------------------------------|
| Course Title: Software Engineering | | Course Number: | Course Code: 210253 |
| Year: 2022-23 | | Semester: II | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial: - | |
| Course Assessment Methods | Direct methods | In-semester Examination : 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments , Presentations | Quiz, Q&A session, Group Discussion |
| Prerequisites | 110005: Programming and Problem Solving | | |
| Course Objectives | | | |
| 1 | To learn and understand the principles of Software Engineering. | | |
| 2 | To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements. | | |
| 3 | To apply design and testing principles to software project development. | | |
| 4 | To understand project management through life cycle of the project. | | |
| Course Outcomes | | | |
| CO1 | Analyze software requirements and formulate design solution for a software. | | |
| CO2 | Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns. | | |
| CO3 | Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development. | | |
| CO4 | Model and design User interface and component-level. | | |
| CO5 | Identify and handle risk management and software configuration management. | | |
| CO6 | Utilize knowledge of software testing approaches, approaches to verification and validation. | | |
| CO7 | Construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain efficient, reliable, robust and cost-effective software solutions. | | |
| Course Contents | | | |
| Unit-I | Introduction to Software Engineering and Software Process Models | | |

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| | <p>Software Engineering Fundamentals: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice.</p> <p>Software Process: A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, A Final Word on Evolutionary Processes. Unified Process, Agile software development: Agile methods, plan driven and agile development.</p> |
| | Practical/Tutorial |
| | |
| Unit-II | Software Requirements Engineering and Analysis |
| | <p>Modeling: Requirements Engineering, Establishing the Groundwork, Identifying Stakeholders, Recognizing Multiple Viewpoints, working toward Collaboration, Asking the First Questions, Eliciting Requirements, Collaborative Requirements Gathering, Usage Scenarios, Elicitation Work Products, Developing Use Cases, Building the Requirements Model, Elements of the Requirements Model, Negotiating Requirements, Validating Requirements.</p> <p>Suggested Free Open Source tools: StarUML, Modelio, SmartDraw.</p> |
| | Practical/Tutorial |
| | |
| Unit-III | Estimation and Scheduling |
| | <p>Estimation for Software Projects: The Project Planning Process, Defining Software Scope and Checking Feasibility, Resources management, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition Techniques, Software Sizing, Problem-Based Estimation, LOC-Based Estimation, FP-Based Estimation, Object Point (OP)-based estimation, Process-Based Estimation, Process-Based Estimation, Estimation with Use Cases, Use-Case-Based Estimation, Reconciling Estimates, Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Mode, Preparing Requirement Traceability Matrix</p> <p>Project Scheduling: Project Scheduling, Defining a Task for the Software Project, Scheduling.</p> <p>Suggested Free Open Source Tools: Gantt Project, Agantty, Project Libre.</p> |
| | Practical/Tutorial |
| | |
| Unit-IV | Design Engineering |
| | <p>Design Concepts: Design within the Context of Software Engineering, The Design Process, Software Quality Guidelines and Attributes, Design Concepts - Abstraction, Architecture, design Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object-Oriented Design Concept, Design Classes, The Design Model, Data Design Elements, Architectural Design Elements, Interface Design Elements, Component-Level Design Elements, Component Level Design for Web Apps, Content Design at the Component Level,</p> |

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| | Functional Design at the Component Level, Deployment-Level Design Elements. Architectural Design: Software Architecture, What is Architecture, Why is Architecture Important, Architectural Styles, A brief Taxonomy of Architectural Styles. Suggested Free Open Source Tool: Smart Draw | | |
| | Practical/Tutorial | | |
| | | | |
| Unit- V | Risks and Configuration Management | | |
| | Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan. Software Configuration Management: Software Configuration Management, The SCM Repository The SCM Process, Configuration Management for any suitable software system. Suggested Free Open Source Tools: CF Engine Configuration Tool, Puppet Configuration Tool. | | |
| | Practical/Tutorial | | |
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| Unit-VI | Software Testing | | |
| | A Strategic Approach to Software Testing, Verification and Validation, Organizing for Software Testing, Software Testing Strategy—The Big Picture, Criteria for Completion of Testing, Strategic Issues, Test Strategies for Conventional Software, Unit Testing, Integration Testing, Test Strategies for Object-Oriented Software, Unit Testing in the OO Context, Integration Testing in the OO Context, Test Strategies for Web Apps, Validation Testing, Validation-Test Criteria, Configuration Review. Suggested Free Open Source Tools: Selenium, JUnit. | | |
| | Practical/Tutorial | | |
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| Text Books | Author | Title of Book | Publication |
| T1 | Roger Pressman | Software Engineering: A Practitioner's Approach", | McGraw Hill, ISBN 0-07-337597-7 |
| T2 | Ian Sommerville | Software Engineering | Addison and Wesley, ISBN 0-13-703515-2 |
| | | | |
| Reference Books | | | |
| R1 | Carlo Ghezzi | Fundamentals of Software Engineering | PHI, ISBN-10: 0133056996 |
| R2 | Rajib Mall | Fundamentals of Software Engineering | PHI, ISBN-13: 978-8120348981 |
| R3 | Pankaj Jalote | An Integrated Approach to Software Engineering | Springer, ISBN 13: 9788173192715. |

Curriculum Book of SE (AI&DS)

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| R4 | S K Chang | Handbook of Software Engineering and Knowledge Engineering | WorldScientific, Vol I, II, ISBN: 978-981-02-4973-1 |
| R5 | Tom Halt | Handbook of Software Engineering | Clanye International, ISBN- 10: 1632402939 |
| R6 | | | |
| Self-Learning Facilities, Web Resources, Research papers for reference | e-Books <ul style="list-style-type: none"> https://ebookpdf.com/roger-s-pressman-software-engineering MOOC/ Video Lectures available at: <ul style="list-style-type: none"> https://swayam.gov.in/nd1_noc19_cs69/preview https://swayam.gov.in/nd2_cec20_cs07/preview | | |
| Tutorials | | | |
| Presentations | - | | |

Curriculum Book of SE (AI&DS)

Management Information Systems

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|--|---|-----------------------------------|-------------------------------------|
| Course Title: Management Information Systems | | Course Number: | Course Code : 217530: |
| Year: 2022-23 | | Semester: II | |
| Designation of Course | | Professional Core | |
| Teaching Scheme: 3 Hrs/Week | | Tutorial / Practical : - | |
| Course Assessment Methods | Direct methods | In-semester Examination: 30 Marks | End Semester Examination: 70 Marks |
| | | | Practical/Term Work |
| | Indirect Methods | Assignments, Presentations | Quiz, Q&A session, Group Discussion |
| Prerequisites | | | |
| Course Objectives | | | |
| 1 | To understand concepts of Management Information System and Business intelligence forMIS. | | |
| 2 | To recognize the need of an information system in today’s global business with tools andtechnologies. | | |
| 3 | To identify IT infrastructure components and to study security in the Information System. | | |
| 4 | To understand the importance of project management and the international information system. | | |
| 5 | To understand the concepts of decision support systems for business applications. | | |
| 6 | To understand artificial intelligence and data science for Management Information System | | |
| Course Outcomes | | | |
| CO1 | Explain the concepts of Management Information System and Business intelligence for MIS. | | |
| CO2 | CO2 : Illustrate the need of information systems in global business and ethical issues. | | |
| CO3 | CO3 : List the IT infrastructure components and explain security in the Information System. | | |
| CO4 | CO4 : Demonstrate the importance of project management and extend its use in the internationalinformation system. | | |
| CO5 | CO5 : Illustrate the concepts of decision support systems for business applications. | | |
| CO6 | CO6 : Relate artificial intelligence and data science for Management Information System. | | |
| Course Contents | | | |

Curriculum Book of SE (AI&DS)

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| Unit-I | An Overview of Management Information System |
| | Management information system: Concept, MIS: Definition, Role of MIS, Impact of MIS, MIS & the User, Management as a Control System: The functions of Management, Managerial Roles, The Levelsof Management[R3]. MIS: A Support to the Management, Management effectiveness and MIS, Organization as a System. Decision Making, Information, Knowledge and Business intelligence, Business intelligence for MIS. |
| | Practical/Tutorial |
| | |
| Unit-II | Organization, Management and NetworkEnterprise |
| | Information systems in today's global business: The Role of information system, Perspective's on Information System. Global E-business and collaboration: Business Processes, Types of Information Systems. System for Collaboration and Team Work: Tools and technologies for collaboration andteam work, E-mail and Instant Messaging, Social Networking, Virtual worlds, Internet based Collaboration Environments. Information system organization and strategy, Ethical and social issues in information system. |
| | Practical/Tutorial |
| | |
| Unit-III | Information Technology Infrastructure |
| | IT infrastructure and Emerging Technologies: IT infrastructure and its components, Hardware and software platform trends, Management issues. Foundation of Business intelligence: Databases and information management. Telecommunication, The Internet and Wireless technology, Securing information systems: system vulnerability, Business value of security and control. |
| | Practical/Tutorial |
| | |
| Unit-IV | Key System Applications for Digital Age |
| | Achieving operational Excellence and customer intimacy : Enterprise Applications, E-Commerce : Digital Markets and Digital Goods , Managing knowledge, Enhancing Decision Making , Building information Systems, Managing project : The importance of project Management, the business valueof information systems, Managing project risk, Managing Global Systems: The growth of international information systems, organizing international information systems, Technology issues and opportunities |

Curriculum Book of SE (AI&DS)

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| | for global value chain. | | |
| | Practical/Tutorial | | |
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| Unit- V | Business Applications | | |
| | Introduction to e-business systems: Functional Business systems, cross functional Enterprise systems. Customer Relationship Management: The Business focus, Enterprise Resource Planning: The business backbone, Supply chain Management: Business Network. Electronic Commerce Systems: Fundamentals, e-commerce applications and issues. Decision support systems: Decision support in Business, DSS Components, Decision Supports Trends, OLTP, Data Mining for Decision Support, Knowledge Management System. | | |
| | Practical/Tutorial | | |
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| Unit-VI | Artificial Intelligence & Data Science for MIS | | |
| | Business and AI, An overview of Artificial Intelligence, Neural Network, Fuzzy Logic System, Genetic Algorithms, Virtual Reality, Intelligent Agents, Expert Systems: Components, Applications, Developing Expert Systems, The Value of Expert Systems: Benefits & Limitations. MIS in Data Science: Transition into data science for a Business Intelligence (BI) MIS professional: performing detective analytics and generate insights from reports, statistics to support your insights about reports, present your findings to the right group, explore an open-source tool to generate reports OR to perform detective analysis, the model building / predictive modeling steps, Methods to evaluate your model's performance. | | |
| | Practical/Tutorial | | |
| | | | |
| Text Books | Author | Title of Book | Publication |
| T1 | 1. Waman S. Javadekar | Management Information System: A Global Digital Enterprise Perspective | McGraw Hill Education Pvt. Ltd. 5 th Edition, ISBN – 13:978-1-25-902669-0. |
| T2 | James A. O'Brien, George M Marakas | Management Information Systems | The McGraw-Hill Companies, 7 th Edition, ISBN-0-07-062-003-2. |
| Reference Books | | | |

Curriculum Book of SE (AI&DS)

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|---|--|---|--|
| R1 | 1.Kenneth C. Laudon, Jane P. Laudon, Perason,. | Management information Systems: Managing the DigitalFirm | 12 th Edition, ISBN-978-81-317-8746-5 |
| R2 | James A. O'Brien | Management Information Systems: Managing information Technology in theBusiness Enterprise | Tata McGraw Hill Edition, 6 th Edition, ISBN- 0-07-058739-6. |
| R3 | Robert Schultheis, Marry sumner, | Management information system: The Manager's View | TataMcGraw Hill Edition, 4 th Edition, ISBN-0-07-463879-3 |
| R4 | Gordon B.Davis, Margrethe H. Olson | Management Information Systems : Conceptual Foundations, Structure and Development | Tata McGraw Hill Edition, 2 nd Editon,ISBN-13:978-0-07-040267-6 |
| Self-Learning Facilities, Web Resources, Research papers for reference | e-Books: 1. https://repository.dinus.ac.id/docs/ajar/Kenneth_C.Laudon,Jane_P_.Laudon_-_Management_Information_Sysrem_13th_Edition_.pdf 2. https://www.sohailuniversity.edu.pk/wp-content/uploads/2018/12/Management-Information-Systems-OBrien.pdf 3. https://sctevtservices.nic.in/docs/website/pdf/140304.pdf MOOC Courses: https://nptel.ac.in/courses/110/105/110105148/ https://nptel.ac.in/courses/122/105/122105022/ https://onlinecourses.swayam2.ac.in/cec21_ge05/preview | | |
| Tutorials | - | | |
| Presentations | - | | |