



SARDAR PATEL UNIVERSITY, BALAGHAT

School of Engineering and Technology

Syllabus

Course: B.Tech

Semester: II

Branch: CSE (Artificial Intelligence & Machine Learning)

w.e.f. Academic Session: 2024-25

AIML201 Fundamental of Calculus

Course Objectives:

1. Understand the core principles of limits, derivatives, and integrals.
2. Equip students with techniques to differentiate functions and apply these techniques to solve real-world problems.
3. Connect calculus concepts to data science and artificial intelligence applications, including optimization, modeling, and analyzing trends.

Unit I: Sequences and Series:

Sequences of real numbers, Series, ratio and root test.

Unit II: Calculus of Functions of Single Variable:

Review of limits, continuity, and differentiability. Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's theorem with remainders, indeterminate forms, curvature, curve tracing. Fundamental theorem of Integral calculus, mean value theorems of integral calculus, evaluation of definite integrals, applications in area, length, volumes and surface of solids of revolutions, Improper integrals: Beta and Gamma functions, differentiation under integral sign.

Unit III: Calculus of Functions of Several Variables:

Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation, Tangent plane and normal line. Total differentiation, chain rules, Taylor's formula, maxima and minima, Lagrange's method of undetermined multipliers. Double and triple integrals, Jacobian, change of order of integration, change of variables, application to area, volumes, Mass, Centre of gravity.

Unit IV: Differential Equation and its Modeling with Curve Fitting:

Modeling with Differential Equations, Direction Fields and Euler's Method, Linear and Bernoulli's differential equations, Nonlinear differential equations, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems Center and circle of curvature, evolutes and involutes.

Reference Books:

1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons.
2. Piskunov, N., Differential and Integral calculus, Mir publishers Moscow (Vol. 1, Vol. 2).
3. Methods for Data Science III - Data Visualization and R by James Godfre.



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Course Outcome:

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

1. Demonstrate a clear understanding of limits, continuity, derivatives, and integrals.
2. Apply differentiation rules to compute derivatives of various functions and interpret their meanings in context.
3. Utilize calculus to formulate and solve real-world problems, particularly in optimization and data analysis contexts.



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AIML202 Introduction to Problem Solving and Programming

Course Objectives:

1. To introduce students to the fundamental concepts of problem-solving and programming, including algorithms, data types, control structures, and basic syntax
2. To teach students the basics of programming using a high-level programming language (e.g., Python, Java) and to familiarize them with development environments and tools

Unit I: Introduction:

Computer systems - Python Programming Language Computational Thinking - Python Data Types: Expressions, Operator, Variables, and Assignments - Strings -Lists - Objects & Classes - Python standard library.

Unit II: Imperative programming:

Imperative programming: Python modules – Built-in-function: print() function –eval() function – user-defined function & assignments -parameter passing.

Unit III: Exceptions:

Text Data, Files & Exceptions: Strings, revisited - formatted output -files -errors & Exceptions - Execution control Structures: decision control & the IF statement.

Unit IV: Iteration Patterns:

‘For’- LOOP & Iteration Patterns – two-dimensional list - while loop – more loop patterns – additional iteration control statements – Container and Randomness: Dictionaries – other built-in container types - character encodings & strings – module random.

Unit V: Namespaces:

Namespaces - encapsulation in functions - global vs local namespaces exceptional flow control - modules as namespaces.

Reference Books:

1. Ljubomir Periodic, “Introduction to Computing Using Python : An Application Development Focus”, John Wiley & Sons,2012.
2. Sheetal Taneja & Naveen kumar, Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications, Pearson, 2017.
3. Martin C. Brown, Python: The Complete Reference, Osborne/McHraw Hill, 2001.
4. Wesley J. Chun, “Core Python Programming”, Pearson Education, Second Edition, 2007.



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Course Outcome:

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

1. Understand fundamental programming concepts such as variables, data types, operators, and control structures.
2. Utilize programming constructs such as loops, conditionals, and functions to implement algorithms
3. Design algorithms for solving a range of problems, demonstrating an understanding of efficiency and complexity.



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AIML203 Data Structure & Algorithms

Course Objectives:

1. To introduce the basic concepts of data structures and algorithms, emphasizing their importance in computer science and software development.
2. To develop practical skills in implementing various data structures (e.g., arrays, linked lists, stacks, queues, trees, graphs) using programming languages like Python, Java, or C++
3. To enhance problem-solving skills through algorithm design and analysis, including searching, sorting, and optimization techniques

Unit I: Introduction to Data Structure:

Introduction to Data Structure: Concepts of Data and Information, Classification of Data Structures, Abstract Data Types, Implementation aspects: Memory representation. Data structures operations and its cost estimation. Introduction to linear data structures- Arrays, Linked List: Representation of linked list in memory, different implementation of linked list. Circular linked list, doubly linked list, etc. Application of linked list: polynomial manipulation using linked list etc.

Unit II: Stacks & Queue:

Stacks: Stacks as ADT, Different implementation of stack, multiple stacks. Application of Stack: Conversion of infix to postfix notation using stack, evaluation of postfix expression, Recursion. Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dqueue and Priority Queue, Queue simulation, Application of queues.

Unit III: Tree:

Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree: Operations, Traversal, Search. AVL Tree, Heap, Applications and comparison of various types of tree; Introduction to forest, multi-way Tree, B tree, B+ tree, B* tree and red-black tree.

Unit IV: Graph:

Graphs: Introduction, Classification of graph: Directed and Undirected graphs etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST) - Kruskal, Prim's algorithms. Dijkstra's Shortest path algorithm, Comparison between different graph algorithms. Application of graphs.

Unit V: Sorting and Searching:

Sorting: Introduction, Sort methods like Bubble Sort, Quick sort, Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort and Radix sort; comparison of various sorting techniques. Searching:



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Basic Search Techniques: Sequential search, Binary search, Comparison of search methods. Hashing & Indexing. Case Study: Application of various data structures in operating system, DBMS etc.

Text Books:

1. A M Tanenbaum, Y Langsam & MJ Augustin, “Data structure using C and C++”, Prentice Hall India.
2. Robert Kruse, Bruce Leung, “Data structures & Program Design in C”, Pearson Education.

Reference Books:

1. Aho, Hopcroft, Ullman, “Data Structures and Algorithms”, Pearson Education.
2. N. Wirth, “Algorithms + Data Structure = Programs”, Prentice Hall.
3. Richard, GilbergBehrouz, Forouzan, “Data structure – A Pseudocode Approach with C”, Thomson Press.
4. Schaum’s Outlines, McGraw Hill Education, “Data Structures with C”.
5. Data Structures through C (A Practical Approach) by G.S. Baluja, Dhanpat Rai & Co (P) Limited.

Course Outcome:

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

1. Recognize and describe various data structures, their properties, and their applications.
2. Write efficient code to implement and manipulate basic data structures, ensuring data integrity and optimal performance.
3. Conduct complexity analysis to evaluate algorithm efficiency, applying Big O notation effectively.



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AIML204 Technical Communication

Course Objectives:

1. Introduce students to the fundamentals of effective communication in technical contexts, including clarity, conciseness, and audience awareness.
2. Equip students with the skills to write technical documents such as reports, proposals, thesis documentation, user manuals, and research papers.
3. Provide training in delivering technical presentations, including the use of visual aids and effective verbal communication techniques.

Unit I: Fundamentals of Technical Communication:

Technical Communication: Features; Distinction between General and Technical Communication. Language as a tool of Communication, Dimensions of Communication: Reading & comprehension. Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal.

Unit II: Forms of Technical Communication:

Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration, C.V./Resume writing; Technical Proposal: Types, Structure & Draft.

Unit III: Technical Presentation: Strategies & Techniques Presentation:

Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humor; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit IV: Technical Communication Skills:

Interview skills; Group Discussion: Objective & Method; Seminar/Conferences, Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.



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Unit V: Dimensions of Oral Communication & Voice Dynamics:

Code and Content; Stimulus & Response; Encoding process; Decoding process; Pronunciation Etiquette; Syllables; Vowel sounds; Consonant sounds; Tone: Rising tone; Falling Tone; Flow in Speaking; Speaking with a purpose; Speech & personality; Professional Personality Attributes: Empathy; Considerateness; Leadership; Competence.

Reference Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Personality Development and Soft Skills by Barun K. Mitra, OUP, 2012, New Delhi.
3. Spoken English- A Manual of Speech and Phonetics by R.K.Bansal & J.B.Harrison, Orient Blackswan, 2013, New Delhi.
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
6. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
7. Skills for Effective Business Communication by Michael Murphy, Harvard University, U.S.
8. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

Course Outcome:

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

1. Demonstrate the ability to communicate complex technical information clearly and effectively to diverse audiences.
2. Create a variety of professional technical documents, including project proposals, reports, and documentation that meet industry standards.
3. Present technical information in a structured and engaging manner, using appropriate visual aids and adapting to audience needs.



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AIML205 Fundamental of AI & ML

Course Objectives:

1. Provide a solid foundation in the core concepts, theories, and methodologies of Artificial Intelligence (AI) and Machine Learning (ML).
2. Develop students' abilities to preprocess, analyze, and visualize data effectively for AI and ML applications.
3. Foster an understanding of the ethical implications and responsibilities associated with AI and ML technologies.

Unit I: Introduction:

Introduction to AI: What is AI? History & Applications.

Intelligence System: What is Intelligence? Types of Intelligence, What is Intelligence composed of ? Artificial Intelligence vs. Human Intelligence.

Research Areas of AI: Speech and Voice Recognition, Working of Speech and Voice Recognition Systems, Real Life Applications of Research Areas, Task Classification of AI.

Unit II: Agents and Environments & Fuzzy Logic Systems:

What are Agent and Environment? The Structure of Intelligent Agents, The Nature and properties of Environments.

What is Fuzzy Logic? Why Fuzzy Logic? Fuzzy Logic Systems Architecture, Application Areas of Fuzzy Logic, Advantages and Disadvantages of FLS, Expert Systems: Characteristics of ES, Capabilities, Components, what is Knowledge? Inference Engine, User Interface, Limitations, benefits and Applications of Expert System, Development of Expert Systems: General Steps

Unit III: Introduction to Machine Learning:

Human learning & it's types, Machine learning and its categories (Supervised, unsupervised, reinforcement), Algorithms for Supervised Learning, k-Nearest Neighbors, Decision Trees, Naive Bayes, Logistic Regression, Support Vector Machines, Algorithms for Unsupervised Learning- k-means clustering, Cluster Identification, Comparison- Supervised, unsupervised, reinforcement.

Machine learning using Deep learning: Black box approach, duration of development, application of deep learning. Problems not to be solved using Machine Learning, Applications of Machine learning, Tools in Machine Learning, Issues in Machine Learning.

Unit IV: Preparing to Model:

Machine-learning activities, Basic types of data in machine Learning, exploring structure of data (Numerical data, Categorical data), Data quality and remediation, Data Preprocessing-Dimensionality



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Reduction, Feature Subset Selection.

Machine learning using Neural Networks: Introduction of ANN, architecture of ANN-Single layer feed forward network, Multi-layer feed forward ANN's, Competitive network, Recurrent Network, Learning Process in ANN-Number of layers, Direction of single flow, Number of nodes in layers.

Unit V: Robotics:

What is Robotics? Difference in Robot System and Other AI Program, Robot Locomotion, Components of a Robot, Computer Vision, Application Domains of Computer Vision, Applications of Robotics.

Expert Systems: Fundamental blocks, Knowledge Engineering, Knowledge Acquisition, Knowledge Based Systems, Automated Reasoning, Understanding Natural Language.

Text/Reference Books:

1. E. Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008,
2. Machine Learning by Subramanian Chandramouli, SaikalDutt, Amit Kumar Das.
3. S, Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
4. Introduction to Machine Learning by Dr. Nilesh Shelke, Dr. Narendra. V.Choudhary, Dr. Gopal Sakarkar, Das Ganu Publications.

Course Outcome:

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

1. Articulate key concepts and terminologies in AI and ML, including types of learning (supervised, unsupervised, reinforcement).
2. Perform data preprocessing tasks, including data cleaning, normalization, and feature engineering, to prepare datasets for analysis.
3. Assess the performance of machine learning models using various evaluation metrics and techniques, and apply model tuning strategies to optimize performance.



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AIML206P Computer Workshop (Python)

Course Objectives:

1. Learn the basic syntax, data types, and control structures of Python.
2. Enhance algorithmic thinking and problem-solving through Python programming.
3. Understand and apply OOP principles using Python.
4. Create simple applications and scripts that solve real-world problems.

Unit I: An Introduction to Python

Python Syntax compared to other programming languages, Python Installation, Beginning Python Basics: The print statement, Comments, Python Data Structures & Data Types, String Operations in Python, Simple Input & Output, Simple Output Formatting, Operators in python, Python Program Flow: Indentation, The If statement and its' related statement, An example with if and it's related statement, The while loop, The for loop, The range statement, Break &Continue, Examples for looping.

Unit II: Functions & Modules

Create your own functions, Functions Parameters, Variable Arguments, Scope of a Function, Function Documentations, Lambda Functions & map, N Exercise with functions, Create a Module, Standard Modules

Unit III: Exceptions Handling and File Handling

Errors, Exception handling with try, Handling Multiple Exceptions, Writing your own Exception, File handling Modes, Reading Files, Writing & Appending to Files, Handling File Exceptions, The with statement

Unit IV: Classes in Python

New Style Classes, Creating Classes, Instance, Methods, Inheritance, Polymorphism, Exception Classes & Custom Exceptions, Data Structures: List Comprehensions, Nested List Comprehensions, Dictionary Comprehensions, Functions , Default Parameters, Variable Arguments, Specialized Sorts

Unit V: Writing GUIs in Python (Tkinter)

Introduction, Components and Events, An Example GUI, The root component, Adding a Button, Entry Widgets, Text Widgets, Check buttons, Capstone Project in Python.

Reference Books:

1. "Python Crash Course" by Eric Matthes, A hands-on introduction to programming with Python, covering the basics and practical projects.



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2. "Automate the Boring Stuff with Python" by Al Sweigart, Focuses on practical programming tasks and automation.
3. "Fluent Python" by Luciano Ramalho, Delves into Python's features and libraries, with a focus on writing idiomatic and efficient code.

Course Outcome:

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

1. Demonstrate proficiency in writing and executing Python scripts for various tasks.
2. Effectively use Python libraries for tasks such as data manipulation, web scraping, or automation.
3. Create classes and objects, and apply inheritance and polymorphism in Python.
4. Build and deploy small-scale applications, demonstrating an understanding of software development practices.