



SARDAR PATEL UNIVERSITY, BALAGHAT

School of Engineering and Technology

Syllabus

Course: B.Tech

Semester: III

Branch: Computer Science and Engineering (AI & ML)

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

AIML301 Probability and Statistics

Course Objectives:

1. Understand basic probability concepts, including Bayes' theorem and random variables.
2. Learn key probability distributions and sampling methods.
3. Gain skills in hypothesis testing and estimation for large samples.
4. Apply hypothesis testing for proportions and small samples using t and F tests.
5. Analyze data using regression and correlation techniques.

Unit I: Probability:

Sample space and events - Probability -The axioms of probability - Some Elementary theorems - Conditional probability- Baye's theorem, Random variables -Discrete and continuous, probability density function; probability distribution function for discrete and continuous random variable joint distributions. Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

Unit II: Distributions:

Binomial, Poisson & normal distributions related properties. Sampling distributions –Sampling distribution of means (known and Unknown)

Unit III: Testing of Hypothesis I:

Tests of hypothesis point estimations – interval estimations Bayesian estimation. Large samples, Null hypothesis – Alternate hypothesis type I, & type II errors – critical region confidential interval for mean testing of single variance. Difference between the mean.

Unit IV: Testing of Hypothesis II:

Confidential interval for the proportions. Tests of hypothesis for the proportions single and difference between the proportions. Small samples, confidence interval for the t- distribution - Tests of hypothesis - t- distributions, F- distributions distribution. Test of Hypothesis.

Unit V: Regression and Correlation Analysis:

Introduction, Bi-Variate Normal distribution and the associated marginal and conditional distributions, estimation and analysis of simple regression models, correlation coefficients, analysis of correlation coefficients, Hypothesis tests associated with regression and correlation coefficients, curvilinear regression models, Multiple regression models, multiple and partial correlation coefficients.

Reference Books/ Text Book:

1. D. K. Murugesan & P. Guru Swamy, "Probability & Statistics", Anuradha Publications.



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2. G. S. S. Bhisma Rao, “Probability & Statistics for Engineers”, Scitech Publications.
3. Spiegel, Murray, “Probability and Statistics”, Schaum’s series.
4. K.V. Iyengar & B. Krishna Gandhi , “Probability & Statistics”, S.Chand.
5. William Mendenhall & Others, “ Probability & Statistics”, Cengage Publications.
6. P. Billingsley, “Probability and Measure”, John Wiley & Sons (SEA) Pvt. Ltd.
7. W. Feller ,“An introduction to probability theory and its applications”, John Wiley and Sons.

Course Outcome:

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

1. Apply probability rules and compute expectations and variances.
2. Use Binomial, Poisson, and Normal distributions effectively.
3. Perform large-sample hypothesis testing and confidence interval estimation.
4. Conduct small-sample tests using t and F distributions.
5. Interpret and analyze regression models and correlation coefficients.



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AIML302 Database Management System

Course Objectives:

1. Understand fundamental concepts of database systems, data models, and database architecture.
2. Learn relational database theory, relational algebra, and SQL query language.
3. Study normalization techniques to design efficient database schemas.
4. Understand transaction processing, concurrency control, and recovery mechanisms.
5. Explore file organization, indexing, query processing, and optimization techniques.

Unit I: Introduction to DBMS:

Data base System Applications, Purpose of Database Systems, View of Data – Data Abstraction, Instances & Schemas, Data Models: ER Model, Relational Model, Other Models, Database Languages: DDL, DML, database Access for applications Programs– data base Users & Administrator – Transaction Management – data base Architecture – Storage Manager – the Query Processor. Data base design & ER diagrams – ER Model - Entities, Attributes & Entity sets, Relationships & Relationship sets, ER Design Issues, Concept Design, Conceptual Design for University Enterprise. Introduction to Relational Model, Structure, Database Schema, Keys, Schema Diagrams.

Unit II: Relational Database:

Relational Query Languages, Relational Operations. Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus. Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY – HAVING, Nested Sub queries, Views, Triggers.

Unit III: Normalization:

Introduction, Non-loss decomposition and functional dependencies, First, Second, and third normal forms - dependency preservation, Boyce/Codd normal form.

Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form.

Unit IV: Transaction Processing Concepts:

Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions –Serializability -Recoverability –Implementation of Isolation –Testing for Serializability -Lock –Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity. Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.



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Unit V: File Organization:

File organization – various kinds of indexes. Query Processing – Measures of query cost - Selection operation – Projection operation, - Join operation – set operation and aggregate operation – Relational Query Optimization – Transacting SQL queries – Estimating the cost – Equivalence Rules.

Reference Books:

1. Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition.
3. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
4. An Introduction to Database systems, C.J. Date, A. Kannan, S.Swami Nadhan, Pearson, Eight Edition.
5. Atul Kahate , “ Introduction to Database Management System”, Pearson Educations.

Course Outcome:

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

1. Explain database concepts, ER modeling, and relational schema design.
2. Write and optimize queries using relational algebra and SQL.
3. Apply normalization principles to eliminate redundancy and ensure data integrity.
4. Analyze transaction management techniques and implement concurrency control.
5. Design efficient file organizations and optimize query execution for better performance.



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AIML303 Analysis & Design of Algorithm

Course Objectives:

1. Understand algorithm design and analysis techniques.
2. Learn greedy methods for optimization problems.
3. Apply dynamic programming to complex problems.
4. Use backtracking and branch & bound strategies.
5. Explore tree structures and graph algorithms.

Unit I: Algorithms:

Algorithms, Designing algorithms, analyzing algorithms, asymptotic notations, heap and heap sort. Introduction to divide and conquer technique, analysis, design and comparison of various algorithms based on this technique, example binary search, merge sort, quick sort, strassen's matrix multiplication.

Unit II: Study of Greedy Strategy:

Study of Greedy strategy, examples of greedy method like optimal merge patterns, Huffman coding, minimum spanning trees, knapsack problem, job sequencing with deadlines, single source shortest path algorithm.

Unit III: Concept of Dynamic Programming:

Concept of dynamic programming, problems based on this approach such as 0/1 knapsack, multistage graph, reliability design, Floyd-Warshall algorithm.

Unit IV: Concept of Backtracking:

Backtracking concept and its examples like 8 queen's problem, Hamiltonian cycle, Graph coloring problem etc.. Introduction to branch & bound method, examples of branch and bound method like traveling salesman problem etc. Meaning of lower bound theory and its use in solving algebraic problem, introduction to parallel algorithms.

Unit V: Tree:

Binary search trees, height balanced trees, 2-3 trees, B-trees, basic search and traversal techniques for trees and graphs (In-order, pre-order, post-order, DFS, BFS), NP-completeness.

Reference Books/ Text Book:

1. Cormen Thomas, Leiserson CE, Rivest RL; Introduction to Algorithms; PHI.
2. Horowitz & Sahani; Analysis & Design of Algorithm
3. Dasgupta; algorithms; TMH
4. Ullmann; Analysis & Design of Algorithm;
5. Michael T Goodrich, Roberto Tamassia, Algorithm Design, Wiley India
6. Rajesh K Shukla: Analysis and Design of Algorithms: A Beginner's Approach; Wiley.



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List of Experiments:

1. Write a program for Iterative and Recursive Binary Search.
2. Write a program for Merge Sort.
3. Write a program for Quick Sort.
4. Write a program for Strassen's Matrix Multiplication.
5. Write a program for optimal merge patterns.
6. Write a program for Huffman coding.
7. Write a program for minimum spanning trees using Kruskal's algorithm.
8. Write a program for minimum spanning trees using Prim's algorithm.
9. Write a program for single sources shortest path algorithm.
10. Write a program for Floyd-Warshall algorithm.
11. Write a program for traveling salesman problem.
12. Write a program for Hamiltonian cycle problem.

Course Outcome:

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

1. Analyze and design efficient algorithms.
2. Solve problems using greedy and dynamic techniques.
3. Implement backtracking and branch & bound solutions.
4. Work with advanced trees and graph traversals.
5. Understand NP-completeness and algorithm limits.



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AIML304 Artificial Intelligence

Course Objectives:

1. Understand the fundamentals, history, and applications of Artificial Intelligence.
2. Learn and apply various search techniques for problem-solving in AI.
3. Explore knowledge representation methods including logic, semantic networks, and ontologies.
4. Handle uncertainty using probabilistic reasoning, Bayesian networks, and fuzzy logic.
5. Understand intelligent agents, learning models, and expert systems for real-world applications.

Unit I: Introduction:

What is AI ? History & Applications, Artificial intelligence as representation & Search, Production System.

Basics of problem solving: Problem representation paradigms, defining problem as a state space representation, Characteristics.

Unit II: Search Techniques:

Uniformed Search techniques, Informed Heuristic Based search. Generate and test, Hill-climbing, Best-First Search, Problem Reduction and Constraint Satisfaction.

Unit III: Knowledge Representation:

Knowledge representation Issues, First order logic, Predicate Logic, Structured Knowledge Representation, Backward Chaining, Backward Chaining Resolution, Semantic Nets, Frames and Scripts, Ontology.

Unit IV: Uncertainty:

Handling uncertain knowledge, rational decisions, basics of probability, axioms of probability, Baye's Rule and conditional independence, Bayesian networks. Exact and Approximate inference in Bayesian Networks, Fuzzy Logic.

Intelligent Agents: Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

Unit V: Learning:

What is learning? Knowledge and learning, Learning in Problem Solving, Learning from example, learning probabilistic models, Formal Learning theory.

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

Reference Books/ Text Book:

1. E. Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008.
2. Artificial Intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers.



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3. Artificial Intelligence – A Practical Approach: Patterson, Tata McGraw Hill, 3rd Edition.
4. Introduction of Artificial Intelligence – Charniak (Pearson Education).

Course Outcome:

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

1. Explain the basic concepts, problem-solving methods, and state space representation in AI.
2. Apply uninformed and informed search algorithms to solve AI problems efficiently.
3. Represent and reason with knowledge using first-order logic, semantic nets, and structured models.
4. Use probabilistic and fuzzy logic approaches to manage uncertain information in intelligent systems.
5. Describe intelligent agents, machine learning approaches, and the components of expert systems.



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AIML305 Operating System

Course Objectives:

1. Understand OS functions, types, and services.
2. Learn file systems and disk management.
3. Study process scheduling and memory management.
4. Understand I/O systems and concurrency.
5. Explore real-world OS through case studies.

Unit I: Introduction to Operating Systems:

Function, Evolution, Different Types, Desirable Characteristics and features of an O/S, Operating Systems Services: Types of Services, Different ways of providing these Services – Utility Programs, System Calls.

Unit II: File Systems:

File Concept, User's and System Programmer's view of File System, Disk Organization, Tape Organization, Different Modules of a File System, Disk Space Allocation Methods – Contiguous, Linked, Indexed. Directory Structures, File Protection, System Calls for File Management, Disk Scheduling Algorithms.

Unit III: CPU Scheduling:

Process Concept, Scheduling Concepts, Types of Schedulers, Process State Diagram, Scheduling Algorithms, Algorithms Evaluation, System calls for Process Management, Multiple Processor Scheduling, Concept of Threads. Memory Management Different Memory Management Techniques – Partitioning, Swapping, Segmentation, Paging, Paged Segmentation, Comparison of these techniques, Techniques for supporting the execution of large programs: Overlay, Dynamic Linking and Loading, Virtual Memory – Concept, Implementation by Demand Paging etc.

Unit IV: Input / Output:

Principles and Programming, Input/ Output Problems, Asynchronous Operations, Speed gap Format conversion, I/O Interfaces, Programme Controlled I/O, Interrupt Driven I/O, Concurrent I/O. Concurrent Processes, Real and Virtual Concurrency, Mutual Exclusion, Synchronization, Inter-Process Communication, Critical Section Problem, Solution to Critical Section Problem : Semaphores – Binary and Counting Semaphores, WAIT & SIGNAL Operations and their implementation. Deadlocks: Deadlock Problems, Characterization, Prevention, Avoidance, Recovery.

Unit V: Case Studies of Operating Systems:

Distributed and Multiprocessor Operating Systems. Case Studies: Unix/Linux, WINDOWS and other Contemporary Operating Systems.



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Text/Reference Books:

1. Silberschatz, Galvin, Gagne, “Operating System Concepts”, Wiley, 9/E
2. William Stalling, “Operating Systems”, Pearson Education
3. Andrew S. Tanenbaum, “Modern Operating Systems”, 3/e, Prentice Hall
4. Maurice J. Bach, “ The Design of Unix Operating System”, Prentice Hall of India, Bovet & Cesati, “Understanding the Linux Kernel”, O’Reily, 2/E.

List of Experiments:

1. Write a program to implement FCFS CPU scheduling algorithm.
2. Write a program to implement SJF CPU scheduling algorithm.
3. Write a program to implement Priority CPU Scheduling algorithm.
4. Write a program to implement Round Robin CPU scheduling algorithm.
5. Write a program to compare various CPU Scheduling Algorithms over different Scheduling Criteria.
6. Write a program to implement classical inter process communication problem (producer consumer).
7. Write a program to implement classical inter process communication problem (Reader Writers).
8. Write a program to implement classical inter process communication Problem (Dining Philosophers).
9. Write a program to implement & Compare various page replacement algorithms.
10. Write a program to implement & Compare various Disk & Drum scheduling Algorithms
11. Write a program to implement Banker’s algorithms.
12. Write a program to implement Remote Procedure Call (RPC).
13. Write a Devices Drivers for any Device or peripheral.

Course Outcome:

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

1. Explain basic OS concepts and services.
2. Describe file organization and management.
3. Apply scheduling and memory techniques.
4. Solve concurrency and deadlock problems.
5. Compare features of Unix/Linux, Windows, etc.



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CSE306P Linux Lab

Course Objectives:

1. Introduce students to the basic concepts of operating systems, focusing on Unix/Linux architecture and commands.
2. Develop proficiency in using the Unix/Linux command line for file management, process control, and system navigation.
3. Teach students to write and execute shell scripts to automate tasks and improve productivity.
4. Introduce networking commands and tools for network configuration and troubleshooting in a Unix/Linux environment.

Unit I: Overview of Unix/Linux:

Concepts, Unix/Linux Installation Process, Hardware Requirements for Unix/Linux, Advantages of Unix/Linux, Reasons for Popularity and Success of Linux/Unix Operating System, Features of Linux/Unix Operating System, Kernel, Kernel Functions, The Shell Basic Commands, Shell Programming:-Shell Variables, Branching Control Structures, Loop-Control Structure, Continue and break Statements, Sleep Command, Debugging Script. Use of Linux as web- server, file server, directory server, application server, DNS server, SMTP server, Firewall, Proxy server.

Unit II: File System:

Definition of File System, Defining Geometry, Disk Controller, Solaris File System, Disk Based File Systems, Network-Based File Systems, Virtual File systems, UFS File System, The Boot Block, The Super Block, The Inode, Tuning File System, Repairing File System.

Process Control: - Viewing a Process, Command to display Process, Process Attributes, Process States, Process Fields, PS Commands options, PGREP, PRSTAT, CDE Process Manager, Scheduling Process, Scheduling Priorities, Changing the Priority of a time-sharing process, Killing Process.

Unit III: System Security:

Physical Security, Controlling System Access, Restricted Shells Controlling File Access, File Access Commands, Access Control List(ACLs), Setting ACL Entries, Modifying ACL entries on a file, Deleting ACL entries on a file, Restricting FTP, Securing Super User Access, Restricting Root Access, Monitoring super user Access, TCP Wrappers.

Dynamic Host Configuration Protocol: - Introduction, DHCP Leased Time, DHCP Scopes, DHCP IP Address, Allocation Types, Planning DHCP Deployment, DHCP Configuration files, Automatic Startup of DHCP Server, Configuration of DHCP Clients, Manually Configuring the DHCP.

Unit IV: Case Study:

Installation of Linux, Customization of Linux, Installation of SAMBA, APACHE, TOMCAT, Send MAIL, Postfix, Implementation of DNS, LDAP services, Firewall, Proxy server.



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Text/Reference Books:

1. Sumitab Das, "Unix Concept & Application", TMH
2. Forouzan, "Unix & Shell Programming", Cengage Learning
3. Venkatesh Murthy, "Introduction to Unix & Shell", PearsonEdu
4. Gopalan, Shivaselvan, "Beginners Guide to Unix" PHI Learning
5. Venkateshwavle, "Linux Programming Tools Unveil'ed", BS Publication.
6. Richard Peterson, "Linux Complete Reference", TMH
7. Richard Peterson, "Unix Complete Reference", TMH

Course Outcome:

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

1. Demonstrate proficiency in using essential Unix/Linux commands for file and directory manipulation, process management, and system monitoring.
2. Write, debug, and execute shell scripts to automate routine tasks and manage system operations efficiently.
3. Manage file permissions and ownership effectively, understanding the implications of security and access control.
4. Apply logical reasoning and problem-solving skills to diagnose and resolve issues encountered in a Unix/Linux system.