SARDAR PAEL UNIVERSITY
M Sc – Artificial Intelligence & Machine Learning

w.e.f. June 2024
3 Lectures & 1 Seminar/Tutorial per week
Total Marks: 100

PT01FAIM51: Mathematical and Statistical Foundations

Unit 1 Matrices and Logic

- Row/Column operations
- Gaussian elimination
- Decomposition, Inverse
- Logic operators AND, OR etc., Truth tables
- Theory of inference and deduction
- Mathematical inductions
- Metrics and basics of graph theory

Unit 2 Differential Equations

- Differential equations of first order and first degree
- Homogeneous differential equations, Equations
- Linear differential equations
- Applications of first order
- Linear differential equations of higher order
- Homogeneous and non-homogeneous linear differential equations with constant coefficients

Unit 3 Basic Statistical Techniques – I

- Frequency distributions.
- Measures of central tendency & Measures of dispersion
- Least square fit
- Hypothesis testing and techniques such as chi square testing

Unit 4 Basic Statistical Techniques – II

- Axiomatic definition of probability and properties, conditional probability, multiplication rule. Theorem of total probability, Bayes' theorem and independence of events.
- Probability mass function, probability density function and cumulative distribution functions, distribution of a function of a random variable.
- Bivariate data: Definition, box plot, scatter diagram, simple, partial and multiple correlation

MAIN REFERENCE BOOKS:

1. Hans Schneider and George P Barker: Matrices and Linear algebra, Holt Rinehart, 1968.
2. Deo. N: Graph Theory with Application to Engineering, PHI, 1974.
3. Murray R Spiegel: Theory and Problem of Statistics McGraw-Hill Schaum's Outline Series, 1981.
4. Trembley J. P. and Manohar R. P. : Discrete Mathematical Structures with Applications to Computer Science. McGraw Hill, 1975.
5. Harary F. : Graph Theory , Addison-Wesley Publ. Comp. 1972.
6. Shanti Narayan, Integral Calculus, S. Chand & Co. Ltd., 1999.
7. Lectures on Probability Theory and Mathematical Statistics - 3rd Edition, by Marco Taboga,CreateSpace Independent Publishing Platform, 2017.

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PT01CAIM52: Artificial Intelligence

Unit 1 Introduction to Artificial Intelligence

- Natural and Artificial intelligence
- Narrow AI and General AI
- Testing intelligence with Turing test, and Chinese room experiment,
- Nature of AI solutions
- Application domains such as Expert, Mundane and Formal tasks
- DIKW chain and Evolution of AI based system
- Knowledge Based Systems, Knowledge Acquisition and representations
- Application areas of artificial intelligence

Unit 2 Production Systems

- Problem analysis
- Problem characteristics
- Production states of problem
- Search space
- Time and space efficiency
- Production system and its characteristics
- Applications of production system with examples

Unit 3 Weak Searches

- Weak and Blind Searches
- Breadth first search
- Depth first search
- Forward & backward chaining
- Heuristic search, Generate-and-test, Hill climbing, and Steepest ascent hill climbing
- A* algorithm application and uses

Unit 4 Agent Based Systems

- Definition of agent
- Characteristics of agent
- Typology
    - Collaborative agent
    - Interface agent
    - Mobile agent
    - Information agent
    - Intelligent agent
    - Hybrid agent
- Agent communication language
- Agents, objects and intelligent systems
- Multi agent system architectures and examples

MAIN REFERENCE BOOKS:

1. Rushell and Norvig, Modern Approach to Artificial Intelligence, Prentice Hall of India Ltd., 4th edition, 2020
2. Rich and Knight, Artificial Intelligence, Tata McGraw Hill Publishing Co. Ltd., 2010.
3. Akerkar RA and Sajja P S, Knowledge-Based Systems, Jones & Bartlett Publishers, Sudbury, MA, USA, 2009

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PT01CAIM53: Python Programming -1

Unit 1 Introduction

- History, Characteristics
- Applications
- Data types
- Operators
- Branching process
- Control structure
- String manipulation and iteration

Unit 2 Class, Objects, and Functions

- Abstract data types
- Inheritance, Encapsulation in python
- Functions, and Scoping, Recursions
- Global variables, Modules
- System functions, and Parameters

Unit 3 Functions &Exception Handling

- Syntax of function
- Inbuilt and User defined Exception
- Handling exception

Unit 4 Application Algorithms

- Searching and sorting algorithms
- Hash tables
- Neural networks
- Feed forward
- K-nearest neighbour
- Recurrent

MAIN REFERENCE BOOKS:

1. John V Guttagm, Introduction to Computer Programming using Python, 2nd Edition, PHI, 2017.
2. R. Nageswara Rao, Core Python Programming, Dreamtech Press; Second edition, 2018.
3. N. Karumanchi, Data Structures and Algorithmic Thinking with Python, Wiley; Reprint edition, 2016.

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PT01CAIM54: Oops and Java Programming

Unit 1 Introduction to Java

- The Java programming language: history, evolution, features
- Introduction to the Java programming environment, JDK, JRE
- Introduction to the IDE
- Data types and wrapper classes, operators
- Control structures**,** String handling, Scanner Class

Unit 2 Introduction to Object-oriented Programming

- Basic concepts of object-oriented programming
- Classes, instances, methods
- Static and non-static members
- Packages
- Inheritance and polymorphism, method overriding
- Final and abstract classes, abstract methods
- Interfaces

Unit 3 Other Features of the Java Platform

- Exception handling
- Input-output and file handling
- The collections framework
- Introduction to the java.util package
- Multithreading

Unit 4 Developing Graphical Programs and Accessing Database

- Introduction to AWT
- Writing graphical programs using AWT
- The Swing library
- Writing graphical programs using Swing
- Managing layout using Swing
- Event handling using Swing
- Introduction to JDBC
- Different types of JDBC drivers
- Developing database applications using JDBC

MAIN REFERENCE BOOKS:

1. Beginning Java Objects from Concepts to code, 2nd Edition, Jacquie Barker, Publication- A Press.
2. Programming with Java A Premier- E. Balaguruswamy, MC Graw Hill.
3. The Complete Reference, Java 2 (Fourth Edition) Herbert Schild- TMH.
4. Core Java Volume 1, Fundamentals Horstmann & Cornell, 8th Edition, Pearson Education.

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PT01CAIM55: Foundations of Software Development

Unit 1 Basics of Data Structures

- Introduction to Data Structures, Applications, Operations
- Primitive and Non-primitive Data Structures
- Linear and Non-linear Structures
- Introduction to Array, Stack, Queue, Linked List, Trees and Graphs

Unit 2 Basics of Operating Systems

- Operating System - definition, examples
- Services provided by an Operating System
- The concept of a process, process scheduling
- Queuing diagram representation of process scheduling
  Memory management : Paging, Virtual Memory

Unit 3 Basics of Computer Network

- Computer Networks – definition and advantages
- Transmission Technology in Broadcast Networks and Point-to-Point Networks
- Introduction to Local Area Networks, Metropolitan Area Networks, Wide Area Networks
- Transmission Media – Guided and Unguided
- The OSI Reference Model
- The TCP/IP Reference Model

Unit 4 Basics of DBMS

- Relational model concept
- E-R diagram and its conversion to relations
- Normalization
- Introduction to transactions
- Concurrent access to database and related problems
- Introduction of Locking techniques
- Data definition, queries, grouping and ordering
- Insert, Delete, Update
- Constraints: Primary key and Foreign key
- Built-in functions

MAIN REFERENCE BOOKS:

1. Singh Bhagat & Naps Thomas : Introduction to Data Structures, Tata McGraw-Hill Publishing Co. Ltd.,1985.

2. Tanenbaum A. S. : Modern Operating Systems, 3rd edition, Prentice-Hall, 2008.
3. Tanenbaum A. S.: Computer Networks, 5th Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2016.
4. Forouzan B. A.: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2017.
5. Elmasri And Navathe :Fundamentals of Database Systems, Addison-Wesley Publishing Co. 1994.
6. Ivan Bayross: SQL , PL/SQL BPB Publications.