SCHEME OF INSTRUCTION & EXAMINATION
B.E CSE(AI&ML)
SEMESTER-III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	BS 207 MT	Probability & Statistics	3	1	-	4	30	70	3	4
2	PC 304 CS	Logic and Switching Theory	3	-	-	3	30	70	3	3
3	PC 301 CS	Data Structures	3	-	-	3	30	70	3	3
4	PC 302 CS	Discrete Mathematics	3	-	-	3	30	70	3	3
5	PC 303 CS	OOP using JAVA	3	-	-	3	30	70	3	3
6	PC 301 DS	Introduction to Data Science	3	-	-	3	30	70	3	3
7	HS 201 EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
8	PC 351 CS	Data Structures Lab	-	-	2	2	25	50	3	1
9	PC 351 DS	Data Science Lab	-	-	2	2	25	50	3	1
10	PC 352 CS	OOP using JAVA Lab			2	2	25	50	3	1
Total			**21**	**1**	**6**	**28**	**285**	**640**	**30**	**25**

SEMESTER-IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	ES 301 EC	Basic Electronics	3	-	-	3	30	70	3	3
2	HS 406 CM	Managerial Economics and Accountancy	3	-	-	3	30	70	3	3
3	ES301ME	Applied Operations Research	3	-	-	3	30	70	3	3
4	PC 402 CS	Operating Systems	3	-	-	3	30	70	3	3
5	PC 401 AI	Artificial Intelligence	3	-	-	3	30	70	3	3
6	PC 503 CS	Computer Networks	3	-	-	3	30	70	3	3
7	PC 404 CS	Database Management Systems	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
8	PC 451 AI	Artificial Intelligence Lab	-	-	2	2	25	50	3	1
9	PC 452 AI	CN & OS Lab	-	-	2	2	25	50	3	1
10	PC 453 CS	Database Management Systems Lab	-	-	2	2	25	50	3	1
Total			**21**	**-**	**6**	**27**	**285**	**640**	**30**	**24**

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PC304CS	Logic and Switching Theory					
Prerequisites			**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Objectives

1. To impart knowledge on the fundamentals of digital computers, number systems, arithmetic operations, and information representation using digital codes.
2. To develop the ability to simplify Boolean expressions using algebraic and Karnaugh Map (K-Map) techniques and implement logic functions using universal gates.
3. To introduce combinational logic design, including standard building blocks such as adders, multiplexers, encoders, and decoders, and foster hierarchical design using hardware description languages.
4. To provide insights into sequential circuits through the design and analysis of flip-flops, latches, and synchronous state machines.
5. To explain the concepts of counters, registers, and symmetric networks and their synthesis in practical digital systems.

Course Outcomes:

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

1. Represent numerical and character data using various number systems and codes, and perform basic arithmetic operations using digital methods.
2. Simplify and implement Boolean expressions using K-Maps, tabulation methods, and universal gates such as NAND and NOR.
3. Design combinational logic circuits such as multiplexers, decoders, and arithmetic comparators using gate-level dataflow.
4. Distinguish between combinational and Sequential circuit operations.
5. Simulate and implement sequential circuits using latches and flip-flops.

UNIT-I

Digital Computers and Information: Information Representation, Computer Structure.
Number Systems: Binary Numbers, Octal and Hexadecimal Numbers, Number Ranges.
Arithmetic Operations: Conversion from Decimal to other bases.
Decimal Codes: BCD Addition and Subtraction. Alphanumeric Codes: ASCII Character Code, Parity Bit.
Binary Logic and Gates: Binary Logic, Logic Gates. Boolean Algebra: Basic Identifiers, Algebraic Manipulation, Complement of a Function.
Standard Forms: Minterms and Maxterms, Sum of Product and Products of Sums.

UNIT-II

Minimization of Boolean Functions: Introduction, the map methods (Karnaugh Map) and Minimal Functions and their Properties, the tabulation procedure (Quine McCluskey Method),
NAND and NOR Gates: Nand Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. Exclusive OR Gates: Odd Function, Parity Generation and Checking.

UNIT-III

Combination Logic Design: Combinational Circuits, Design Topics: Design Hierarchy, Top-Down design, Computer Aided Design, Hardware Description Languages, Logic Synthesis. Analysis Procedure: Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation, Design Procedure, Decoders, Encoders, Multiplexers, Binary Adders, Binary Subtraction, Binary Multipliers,

UNIT-IV

Sequential Circuits: Sequential Circuit definitions, latches, Flip-Flops, Sequential circuit analysis,

Sequential circuit design, design with SR Flip-Flop, D Flip-Flop, and T Flip-Flop, design with JK Flip-Flops, Registers and Counters: registers, Shift registers, Synchronous Binary counters, Ripple Counter.

UNIT-V

Design of Sequential Circuits: Basic Design Steps, Finite State Machine representation using Moore and Mealy State Models, State Minimization, Design of FSM for Sequence generation and Algorithmic State Machine Charts, Symmetrical functions and their representations

Suggested Reading:

1. M. Moris Mano, Charles R. Kime, Logic and Computer Design Fundamentals, 5th edition, Pearson Education Asia, 2001.
2. Zvi Kohavi, Switching and Finite Automata Theory, 2nd edition, Tata McGraw Hill, 1995.
3. Charles H. Roth, Jr Fundamentals of Logic Design, 5th edition, Thomson, Brook, Cole, 2005.
4. Ref: AICTE e-Kumbha portal (Digital Electronics and Systems by Dr. Abhisek Bhatt)

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PC301CS	DATA STRUCTURES					
Prerequisites			**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To discuss the linear and non-linear data structures and their applications
3. To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
4. To introduce various internal sorting, searching techniques and their time complexities

Course Outcomes:

1. Understand the fundamentals of algorithm analysis and evaluate performance using time and space complexity along with asymptotic notations.
2. Implement linear data structures such as arrays, stacks, and queues, including their applications in expression evaluation, pattern matching, and sparse matrix handling.
3. Apply various types of linked lists (singly, circular, doubly) and perform dynamic memory management and operations such as polynomial manipulation and sparse matrix representation.
4. Design hierarchical data structures like trees and perform operations on BSTs and AVL trees for efficient searching, insertion, and deletion.
5. Apply graph traversal algorithms and internal sorting/searching techniques to solve computational problems using suitable data structures and efficient algorithms.

UNIT I

Algorithms: Introduction, Algorithm Specifications, Recursive Algorithms, Performance Analysis of an algorithm- Time and Space Complexity, Asymptotic Notations.

Arrays: Arrays ADT, Polynomials, Sparse matrices, Strings-ADT, Pattern Matching.

UNIT-II

Stacks and Queues: Stacks, Stacks using Arrays, Stacks using dynamic arrays, Evaluation of Expressions Evaluating Postfix Expression, Infix to Postfix. Queues: Queues ADT, operations, Circular Queues, Applications.

UNIT-III

Linked Lists: Singly Linked Lists and Chains, Linked Stacks and Queues, Polynomials, Operations for Circularly linked lists, Equivalence Classes, Sparse matrices, Doubly Linked Lists.

Hashing: Static Hashing, Hash Tables, Hash Functions, Overflow Handling, Theoretical Evaluation of Overflow Techniques.

UNIT - IV

Trees: Introduction, Binary Trees, Binary Tree Traversals, Heaps, Binary Search trees (BST): Definition, Searching an element, Insertion into a BST, Deletion from a BST.

Efficient Binary Search Trees: AVL Trees: Definition, Searching an element, Insertion into a AVL.

UNIT-V

Graphs: Graph Abstract Data Type, Elementary Graph operations (DFS and BFS), Minimum Cost

Spanning Trees (Prim's and Kruskal's Algorithms).
Sorting and Searching: Insertion sort, Quick sort, Best computing time for Sorting, Merge sort, Heap sort, shell sort, Sorting on Several Keys, List and Table Sorts, Summary of Internal Sorting, Linear and Binary Search algorithms.

Suggested Books:

1. Horowitz E, Sahni S and Susan Anderson-Freed, Fundamentals of Data structures in C, 2nd Edition (Reprint 2024), Universities Press.

Reference Books:

1. Mark A Weiss, Data Structures and Algorithm Analysis In C, Second Edition (2002), Pearson.
2. Kushwaha D. S and Misra A.K, Data structures A Programming Approach with C, Second Edition (2014), PHI.
3. Gilberg R. F and Forouzan B. A, Data structures: A Pseudocode Approach with C, Second Edition (2007), Cengage Leaming
4. Tanenbaum A. M, Langsam Y. Augenstein M. J, Data Structures using C, Second Edition (2008), Pearson.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, Introduction to Algorithms, Fourth Edition (2022), MIT Press
6. YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Data Structures Using C and C++, Second Edition (2009), PHI.

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PC302CS	DISCRETE MATHEMATICS					
Prerequisites			**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Objectives:

1. To understand the concepts of propositional and predicate logic and their applications in theorem proving.
2. To explore the properties of relations, functions, and algebraic structures such as groups and lattices.
3. To develop skills in combinatorics and counting principles for solving real-world problems.
4. To solve recurrence relations using generating functions and other algebraic techniques.
5. To apply graph theory concepts to solve problems in networks, trees, and coloring using traversal and optimization algorithms.

Course Outcomes:

1. Analyze logical arguments using truth tables, normal forms, quantifiers, and perform proof strategies such as contradiction and consistency.
2. Apply properties of binary relations and functions, including partial orders, equivalence relations, lattices, and algebraic structures.
3. Solve counting problems using combinations, permutations, binomial/multinomial theorems, and the principle of inclusion-exclusion.
4. Apply recurrence relations and generating functions to model and solve discrete problems
5. Analyse graphs using DFS and BFS and identify spanning trees and graph isomorphism.

UNIT-1

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers. Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving

UNIT-II

Relations: Properties of Binary Relations, equivalence, transitive closure, compatibility and partial ordering relations, Lattices, Hasse diagram. Functions: Inverse Function Composition of functions, recursive Functions, Lattice and its Properties, Algebraic structures: Algebraic systems Examples and general properties, Semi groups and monads, groups sub groups' homomorphism, Isomorphism.

UNIT-III

Elementary Combinatorics: Basis of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, the principles of Inclusion - Exclusion. Pigeon hole principles and its application.

UNIT-IV

Recurrence Relation: Generating Functions, Function of Sequences Calculating Coefficient of generating function, Recurrence relations, Solving recurrence relation by substitution and Generating. funds. Characteristics solution of in homogeneous Recurrence Relation.

UNIT-V

Graph Theory: Representation of Graph, DFS, BFS, Spanning Trees, planar Graphs. Graph Theory and Applications, Basic Concepts Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Suggested Readings:

1. Elements of Discrete Mathematics- A Computer Oriented Approach- CL Liu, D P Mohapatra. Third Edition, Tata McGrawHill.
2. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker, PHI.
3. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition. TMH.
4. Discrete Mathematical Structures Theory and Application-Malik & Sen, Cengage.
5. Discrete Mathematics with Applications, Thomas Koshy, Elsevier
6. Logic and Discrete Mathematics, Grass Man & Trembley, Pearson Education.

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PC303CS	**OOP using JAVA**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Objectives:

1. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using class libraries
2. To create Java application programs using sound OOP practices such as interfaces, exception handling, multi threading.
3. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using class libraries
4. Use Collection framework, AWT and event handling to solve real world problems.
5. Exploring Swing, and implementing Servlets.

Outcomes:

1. CO1: Apply object-oriented programming principles such as encapsulation, inheritance, and polymorphism to solve basic problems using Java.
2. CO2: Develop and debug Java programs using classes, methods, constructors, arrays, exception handling, and interfaces.
3. CO3: Use multithreading and exception handling mechanisms to enhance performance and robustness of Java applications.
4. CO4: Employ Java Collection Framework and utility classes to manage and manipulate data efficiently.
5. CO5: Design and implement GUI-based applications using AWT and handle user events through event-driven programming.

UNIT-I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming.

Introduction to Java: Java buzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring string class, using command-linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final. Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT-II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive() and join(), thread priorities, synchronization, inter thread communication, deadlock

UNIT-III

Collections: Overview of Java Collection frame work, commonly used Collection classes Array List, Linked List, Hash Set, Tree Set, Collection Interfaces Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces Vector, Hashtable, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, ScannerJava Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT-IV

GUI Programming with java: The AWT class hierarchy, MVC architecture. Applet Revisited: Basics, architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT V

Exploring Swing: JLabel, Imagelcon, JTextField, the Swing buttons, JTabbedpane, JScrollPane, JList, JComboBox.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servletparameters, javax.servlet.http package, handling HTTP requests and responses

Suggested Readings:

1. Herbert Scheldt, "The Complete Reference Java, 13th th Edition, Tata McGraw Hill, 2023.
2. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning, 2002.
3. C Thomas Wu, An Introduction to Object Oriented Programming with Java 5th Edition, McGraw Hill Publishing, 2010.
4. H. M. Dietel and P. J. Dietel, Java How to Program, Sixth Edition, Pearson Education /PHI.

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Course Code	Course Title						Core/Elective
PC301DS	**Introduction to Data Science**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To learn the core concepts, processes, technologies, and applications of data science along with data types and collection techniques.
- To differentiate among types of data analytics and statistical attributes, and analyze data using measures of central tendency and dispersion.
- To apply data cleaning techniques, detect outliers, and analyze relationships in data through correlation and sampling methods.
- To perform hypothesis testing and ANOVA to evaluate the significance of data-driven assumptions.
- To implement supervised and unsupervised learning algorithms and develop predictive models through real-world case studies.

Course Outcomes

After completing this course, the student will be able to:

1. Understand core concepts of Data Science and data management techniques.
2. Apply statistical and analytical techniques for data summarization and interpretation.
3. Analyze and preprocess data using cleaning, outlier detection, and transformation methods.
4. Evaluate hypotheses using statistical methods including hypothesis testing and ANOVA.
5. Build predictive models using supervised and unsupervised machine learning techniques.

Unit-I

Introduction to Data Science: Introduction, core concepts and technologies, data science process and toolkits, data science applications. Data: Data and Information, Data and its importance, Data Types. Data Collection and Management: Data Sources, Data Collection Techniques, Data Storage.

Unit-II

Data Analytics: Importance of Data Analytics, Types of Data Analytics-Descriptive, Diagnostics, Predictive and Prescriptive. Statistics: Understanding attributes, Types of Attributes- Discrete and Continuous Attributes. Measure of Central Tendency: Mean, Median, Mode. Measure of Dispersion: Skewness and Kurtosis.

Unit-III

Data Cleaning and Preparation: Exploring Data, Handling Missing Data, Discretization and Binning. Outliers: Introduction, Detecting and Filtering Outliers. Correlation Analysis: Correlation Coefficients, Sampling: Random Vs. Non Random .

Unit-IV

Hypothesis Testing: Introduction, Developing Hypothesis, Null and Alternate Hypothesis, Type-I, Type-II error, Approaches to Hypothesis Testing. Analysis of Variance (ANOVA): Introduction to ANOVA, One Way ANOVA, Two Way ANOVA.

Unit-V

Supervised Vs. Unsupervised Learning - Supervised Learning: Regression-Simple and Multiple Linear Regression, Case Study: House Price Prediction.
Classification: Logistic Regression, CART, Case Study: Credit Card Approval.
Unsupervised Learning: Clustering: KMeans Clustering, Case Study: Customer Segmentation.

Suggested Reading:

1. A Hands-on introduction to data science by chirag shah, Cambridge University Press.
2. Python Data Analysis: Perform data collection, data processing, wrangling, visualization, and model building using Python, Avinash Navlani, Armando Fandango, Ivan Idris, 3rd Edition.
3. Hands-On Exploratory Data Analysis with Python: Suresh Kumar Mukhiya, Usman Ahmed.
4. Python for Data Analysis, 3E, Wes McKinney.

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PC351CS	Data Structures Lab					
Prerequisites			**L**	**T**	**P**	**C**
			-	**-**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Objectives:

1. To develop skills to design and analyse simple linear and nonlinear data structures.
2. To gain programming skills to implement sorting and searching algorithms
3. To Strengthen the ability to identify and apply the suitable data structures for the given real world problem
4. To Gain knowledge in practical applications of data structures

Outcomes:

Essential Outcomes:

After completing this course, the student will be able to:

1. Implement linear data structures such as arrays, stacks, queues, and their variations to perform basic operations like insertion, deletion, and traversal.
2. Apply linked lists (singly, doubly, and circular) for dynamic memory management and use them to implement linear data structures such as stacks and queues.
3. Use standard searching (linear and binary) and sorting techniques (selection, insertion, merge, quick, heap) to process and organize data efficiently.
4. Construct tree structures such as binary trees, binary search trees, and AVL trees, and apply recursive traversal techniques.
5. Apply graph traversal (DFS and BFS), hashing techniques, and minimum spanning tree algorithms (Prim's and Kruskal's) for solving computing problems.

List of Experiments:

1. Write a program to represent arrays for the following:
    a. To check whether the given matrix is sparse or not and display triplet representation.
    b. To add two given polynomials.
2. Write a program to apply arrays to perform operations on the following linear data structures:
    a. Stacks
    b. Queues
    c. Circular Queue
3. Write a program to implement following stack applications:
    a. String Reversal.
    b. Infix to Postfix Conversion.
    c. Postfix Expression Evaluation.
    d. Balanced Parenthesis
4. Write a program to implement the operations of Singly Linked List
5. Write a program to implement the operations of Doubly Linked List.
6. Write a program to implement the operations of Circular Linked List.
7. Write a program to apply linked list to perform operations on the following data structures:
    a. Stacks
    b. Queues

8. Write a program to search for a an element given in an array using following search techniques:
    a. Linear search
    b. Binary search
9. Write a program to build a hash table using linear probing and search for a given element.
10. Write a program to construct a Binary Tree and implement display in-order, pre-order and post-order traversal.
11. Write a program to construct a Binary Search Tree and implement insertion, deletion and search operations on it.
12. Write a program to construct a AVL tree and implement insertion, deletion and search operations on it.
13. Write a program to connect a graph and traverse the graph using DFS and BFS.
14. Write a program to design a minimum spanning tree from a given graph using Prims and Kruskals Algorithm.
15. Write a program to sort given set of elements using following sorting techniques:
    a. Selection sort
    b. Insertion sort
    c. Merge sort
    d. Quick sort
    e. Heap sort

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PC352CS	**OOP using JAVA Lab**					
Prerequisites			**L**	**T**	**P**	**C**
			-	**-**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Objectives:

The objectives of the course are to impart knowledge of:
1. To build software development skills using java programming for real world applications.
2. To implement frontend and backend of an application
3. To implement classical problems using java programming.

Outcomes:
After the completion of the course, the student will be able to:

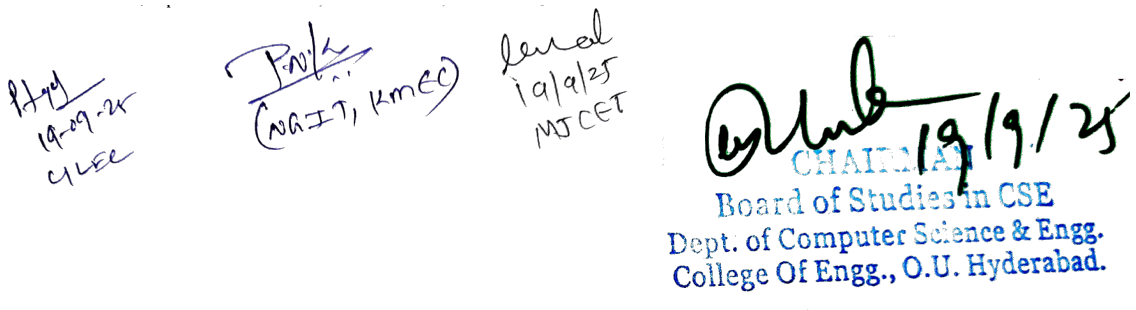
1. Develop Java applications using the concepts of Inheritance, interfaces, packages, access control specifiers.
2. Implement the concepts of Exception Handling in java Applications.
3. Read and write data using different Java I/O streams.
4. Create graphical user interfaces and Applets by applying the knowledge of Event Handling.
5. Create robust applications using Java standard class libraries and retrieve data from a database with JDBC.
6. Ability to solve real-world problems by designing user friendly GUI with befitting backend through the APIs of Java.

List of Experiments:

1. Write a Java program to illustrate the concept of class with method overloading
2. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)
3. Write a Java program to illustrate the concept of Single level and Multi level Inheritance.
4. Write a Java program to demonstrate the Interfaces & Abstract Classes.
5. Write a Java program to implement the concept of exception handling.
6. Write a Java program to illustrate the concept of threading using Thread Class and runnable Interface.
7. Write a Java program to illustrate the concept of Thread synchronization.
8. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
9. Write a Java program to illustrate collection classes like Array List, LinkedList, Treemap and Hash map.
10. Write a Java program to illustrate Legacy classes like Vector, Hash table, Dictionary & Enumeration interface.
11. Write a Java program to implement iteration over Collection using Iterator interface and List Iterator interface.
12. Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
13. Write a Java program to illustrate the concept of I/O Streams

14. Write a Java program to implement serialization concept
15. Write a Java applet program to implement Colour and Graphics class
16. Write a Java applet program for handling mouse & key events
17. Write a Java applet program to implement Adapter classes
18. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for

the digits and for the +, -, *, % operations. Add a text field to display the result.
19. Write an example for JDBC prepared statement with ResultSet
20. Write a Java Program to get primary key value (auto-generated keys) from inserted queries using JDBC
21. Write a Java Program to create a simple JList
22. Write a Java Program to create a simple checkbox using JCheckBox
23. Write a Java Program to create a checkbox and Item Listener toit.
24. 1. Write Servlet application to print current date &time
2. Html & Servlet Communication
3. Auto refresh a page
4. Demonstrate session tracking
5. Select record from database
6. Application for login page
7. Insert record into database
8. Count the visits on webpage
9. Insert teacher record in Database.



PC351DS	**DATA SCIENCE LAB**					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives:

1 To provide students with a comprehensive understanding of Python/R programming, covering fundamental concepts, control structures, functions, data manipulation, object-oriented programming, GUI development, data analysis, and practical application of various libraries.

Course Outcomes: On completion of this course, the student will be able to

CO1: Show the installation of Python/R Programming Environment.
CO2: Utilize and Python/ R Data types for developing programs.
CO3: Make use of different Python/R Data Structures.
CO4: Develop programming logic using Pyhton/R Packages.
CO5: Apply Python/R programming for reading, cleaning, visualizing and analyzing data
CO6: Engage in multivariate analysis, exploratory data analysis, and statistical analysis on complex datasets
CO7:Analyze the datasets using Python/ R programming capabilities

List of Experiments

1. Introduction to Python/R Programming
2. Download and install R-Programming environment and install basic packages in Python/ R.
3. Learn all the basics of Python/R-Programming (Data types, Variables, Operators etc.)
4. Implement Python/R-Loops with different examples.
5. Learn the basics of functions in Python/R and implement with examples.
6. Implement different String Manipulation functions in Python/ R.
7. Implement different data structures in Python/ R
8. Implement various Data Visualization Techniques
9. Demonstrate various operations on Toyota Corolla dataset (Kaggle) Reading files Exploratory data analysis Data preparation and pre-processing
10. Write a Program to apply multivariate analysis with Titanic data set.
11. Write a Program to perform time series analysis with Open Power System data.
12. Write a Program to predict price of pre-owned cars using Regression –

Kaggle data set

13. Demonstrate Customer Segmentation. using Clustering Technique
14. Program to Wine quality data analysis: loading, applying descriptive statistics, finding correlated columns, analysing columns, adding new attributes, grouping columns, concatenating data frames, univariate analysis, multivariate analysis.

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SEMESTER-IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	ES 301 EC	Basic Electronics	3	-	-	3	30	70	3	3
2	HS 406 CM	Managerial Economics and Accountancy	3	-	-	3	30	70	3	3
3	ES301ME	Applied Operations Research	3	-	-	3	30	70	3	3
4	PC 402 CS	Operating Systems	3	-	-	3	30	70	3	3
5	PC 401 AI	Artificial Intelligence	3	-	-	3	30	70	3	3
6	PC 503 CS	Computer Networks	3	-	-	3	30	70	3	3
7	PC 404 CS	Database Management Systems	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
8	PC 451 AI	Artificial Intelligence Lab	-	-	2	2	25	50	3	1
9	PC 452 AI	CN & OS Lab	-	-	2	2	25	50	3	1
10	PC 453 CS	Database Management Systems Lab	-	-	2	2	25	50	3	1
Total			**21**	**-**	**6**	**27**	**285**	**640**	**30**	**24**

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Course Code	Course Title						Core/PE/OE
ES301EC	BASIC ELECTRONICS						Core
	Contact Hours per Week				CIE	SEE	Credits
Prerequisite	L	T	D	P/D			
BS202PH	3	-	-	-	30	70	3

Course Objectives: The course is taught with the objectives of enabling the student to:

1. Understand the characteristics of diodes and its applications.
2. Understand the design concepts of biasing of BJT and FET
3. Understand the design concepts of feedback amplifiers and oscillators
4. Study the design concepts of OPAmp.
5. Understand the concepts of Data Acquisition Systems and data converters

Course Outcomes: On completion of this course, the student will be able to:

1. Study and analyze the rectifiers and regulator circuits.
2. Study and analyze the performance of BJTs, FETs on the basis of their operation And working.
3. Study&designoscillatorcircuits.
4. Study and analyze different Opamps and its applications.
5. Study and analyze different data acquisition systems

UNITI

PN Junction Diode: Characteristics, Half wav erectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications.

UNITII

Transistors: BJT construction and working, modes of operation, configurations of BJT (CB,CE,CC),small signal h-parameter model of CE, CE amplifier analysis. Construction and working of JFET, V-I characteristics of JFET.

UNITIII

Feedback concepts: Types of negative feedback– modification of gain, bandwidth, input and output impedances, applications.
Oscillators: RC Phase shift, Weinbridge, LC and crystal Oscillators (Qualitative treatment only).

UNITIV

Operational Amplifier: OP-AMP Blockdiagram, Ideal OP-AMP, DC and AC Characteristics, Inverting and Non-Inverting Amplifiers, Adder/Subtractor, Integrator, Differentiator, Precision rectifier , Schmit trigger and its applications.

UNITV

Data Acquisition Systems: Construction and Operation of transducers-Strain guage LVDT, Thermocouple, Instrumentation systems.
Data Converters: R-2R Ladder DAC, Successive approximation and Flash ADC.

Suggested TextBooks:
1.Robert BoylestadL. And Louis Nashelsky, Electronic Devices and Circuit Theory, PHI,2007.2st Edition, Prentice HallofIndia,2006.
2.Helfrick Dand David Cooper, Modern Electronic Instrumentation and MeasurementsTechniques,1st edition
3.Salivahanan, Suresh Kumar and Vallavaraj, Electronic Devices and Circuits,2nd Edition, TataMcGraw-Hill,2010.
Reference TextBooks:
1.David A. Bell, *Electronic Devices and Circuits*,5th ed., Oxford University Press, 2009
2.JBGupta, Electronic Devices and Circuits, S. K Kataria & sons,5thEdition,2012
3.The Art of Electronics, Horowitz,3rdEditionCambridgeUniversityPress
4.Electronic Devices and Circuits, A. P Godse, U. A Bakshi, Technical Publications

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MANAGERIAL ECONOMICS AND ACCOUNTANCY

HS406CM

Instruction: 3 periods per week — Duration of SEE:3 hours

CIE:30marks — SEE:70 marks Credits:3

Course Objectives:

To understand responsibilities of a manager of a business undertaking.

To analyze various factors influencing demand elasticity

To Forecast & compute the future sales level.

To understand the features, steps, merits, uses & limitations of Pay Back, ARR, NPV, PI & IRR methods of Capital Budgeting

To understand the principles of accounting and prepare Journal, Ledger, Trial Balance, Manufacturing A/c, Trading A/c., Profit & LossA/c. and Balance Sheet of an enterprise.

Course Outcomes:

Upon successful completion of this course, the student will be able to

Understand the responsibilities of a manager of a business undertaking

Able to Forecast & compute the future sales level

Outline the features, steps, merits, uses & limitations of Pay Back, ARR, NPV, PI& IRR methods of Capital Budgeting

Assess various factors influencing demand elasticity and determine Break Even Point (BEP) of an enterprise.

Understands the principles of accounting and prepare Journal, Ledger, Trial Balance, Manufacturing A/c, Trading A/c., Profit & LossA/c. and Balance Sheet of an enterprise.

UNIT-I

Introduction to economics and its evolution: Managerial Economics its Scope, Importance and relation to other sciences, its usefulness to engineers-Basic concepts of Managerial Economics.

UNIT-II

Demands: Analysis-concept of demand, determinants, law of demand, its assumptions, elasticity of demand, price, income and cross elasticity, demand forecasting-markets competitive structure, price- output determination under perfect competition and Monopoly.

UNIT-III

Theory of Production: Firm and industry-production function-input-output relations-laws of returns- internal and external economics of scale. Cost analysis-Cost concepts-fixed and variable costs-explicitly and implicitly costs-out pocket of costs and imputed costs-opportunity cost-cost output relation- ship-break even analysis.

UNIT-IV

Capital management: Significance, determinates and estimation of fixed and working capital requirements, sources of capital. Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems.

UNIT-V

Book-keeping: Principles and significance of double entry book keeping, journal, subsidiary books,

ledger accounts, trial balance concepts and preparation of final accounts with simple adjustments- analysis and interpretation of financial statements through ratios.

SuggestedReadings:

1. Varshney, R. L., and K. L. Maheshwari. Managerial Economics. Sultan Chand& Sons. 2010.
2. Eugene F. Brigham, James L. Pappas, Managerial economics, DrydenPress,1979
3. Grawal T.S.S C Gupta, Introduction to Accountancy, S Chand Publications,1978
4. I. M. Panday I.M., Financial Management, Vikas Publishing House Pvt Limited, 11th Ed. 2015
5. S K Maheshwari S N Maheshwari, An Introduction to Accountancy, 8th Ed.Vikas Publishing House Pvt Limited, 2006

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APPLIED OPERATIONS RESEARCH

ES301ME	**Instruction: 3 periods per week**	**Duration of SEE: 3 hours**
CIE: 30 marks	**SEE: 70 marks**	**Credits: 3**

Objectives:

Use variables for formulating complex mathematical models in management science, industrial engineering and transportation models

Use the basic methodology for the solution of linear programming problems

UnderstandthemathematicaltoolsthatareneededtosolveoptimizationproblemslikeTransportationmodels andAssignmentmodels

Understandthereplacementmodelswithchangeinmoneyvalueconsideringwithtimeand without time

Modelasystemasaqueuingmodelandcomputeimportantperformancemeasures

Course Outcomes: at the end of the course student will be able to:

Understand the basics of Operations Research and solve linear programming problems using graphical, simplex method and dual simplex methods.

Use PERT and CPM techniques for project planning

Solve transportation and assignment problems using methods like MODI and Hungarian, including special cases like unbalanced and maximization problems

Understand how to plan for replacing equipment and use game theory to make decisions in competitive situations

Use sequencing methods to plan jobs on machines and study queuing models to understand and improve waiting line systems.

UNIT–I

Introduction: Definition and Scope of Operations Research. Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions

UNIT–II

Duality: Definition, Relationship between primal and dual solutions, Dual Simplex Method. Network Analysis in Project Planning: PERT&CPM–Cost Analysis and Crashing the network

UNIT–III

Transportation Models: Finding an initial feasible solution-North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution by MODI methods, Unbalanced Transportation problem. Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, travelling salesman problems.

UNIT–IV

Replacement Models: Introduction, Replacement Policy for Items Whose Running Cost Increases with Time and Value of Money Remains Constant During a Period, Running Cost Increases with Time but Value of Money Changes with Constant Rate During a Period, Individual replacement policy, Group replacement policy.

Game Theory: Introduction, person zero sum games, Maximin -Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2xn and mx2 games.

UNIT–V

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through 3 machines, Processing 2 jobs through m machines. Queuing Theory: Introduction, single channel-Poisson arrivals with Exponential Service Time -Infinite Population and

Service in Random Order, Generalization of Model(Birth and Death Process).

Suggested Readings:

1. Hamdy, A. Taha, "Operations Research-An Introduction", Sixth Edition, Prentice Hall of India Pvt. Ltd.,1997
2. J.B.Gupta, "Utilization of Electric Power and Electric Traction"S.K.Kataria & Sons Publications, 2010
3. V.K.Kapoor, Operations Research,S.ChandPublishers,NewDelhi,2004
4. Hrvey M.Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd., 1980.
R.Paneer Selvam, Operations Research, Second Edition, PHIL earning Pvt. Ltd., New Delhi, 2008.

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PC402CS	OPERATING SYSTEMS					
Prerequisites			**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Objectives:

1. To Understand the fundamental components and structures of operating systems
2. To Comprehend the concept of processes, threads, and CPU scheduling techniques.
3.To learn the inter-process communication and synchronization techniques to avoid concurrency issues.
4. To gain knowledge to apply concepts of memory and virtual memory management for efficient process execution..
5. To know the I/O systems, file systems, and storage management techniques

Course Outcomes:

On completion of this course, the student will be able to

CO1. Describe the evolution, types, and structure of operating systems including system calls and Virtual Machine.

CO2. Identify and explain the lifecycle of processes and threads along with scheduling techniques

CO3. Apply various synchronization mechanisms to resolve concurrency problems in operating systems and Deadlock conditions

CO4. Demonstrate different memory management schemes including paging and virtual memory concepts.

CO5. Analyze and compare different file systems and I/O management techniques.

UNIT-1

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.

UNIT-II

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling.

UNIT-III

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson's Solution, classical problems of synchronization: The Bounded buffer problem, Producer Consumer Problem, reader's & writer problem, Dinning philosopher's problem. Semaphores, Event Counters, Monitors, Message Passing, Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks: Deadlock prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT-IV

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation, and Compaction; Paging: Principle of operation - Page allocation - Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory - Hardware and control structures - Locality of reference, Page fault, Working Set, Dirty page/Dirty bit - Demand paging, Page Replacement

algorithms, Trashing.

UNIT - V

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software,

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency, and performance.

Secondary-Storage Structure: Disk structure, Disk scheduling algorithms, Disk Management, RAID structure.

Suggested Readings:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts Essentials, 9th Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India, 2016.
3. Maurice Bach, Design of the Unix Operating Systems, 8th Edition, Prentice-Hall of India, 2009.
4. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition,, O'Reilly and Associates.

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PC401AI	ARTIFICAL INTELLIGENCE					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1 To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.

2 To Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

3 Explore the current scope, potential, limitations, and implications of intelligent systems

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe the historical background, scope, and applications of AI and intelligent agents.
2. Apply uninformed and informed search algorithms to solve problem-solving tasks.
3. Explain the fundamentals of propositional and predicate logic, and demonstrate basic logic programming.
4. Represent knowledge using semantic networks and frames for reasoning tasks.
5. Compare different uncertainty handling mechanisms including Bayesian belief networks and fuzzy logic.

UNIT – I

Introduction to Artificial Intelligence: Introduction, Brief History, Intelligent Systems, foundations of AI, Sub-Areas of AI, Applications, Tic-Tac Game Playing, Development of AI Languages, Current Trends in AI.

Agents: Agents and Environments, Good Behavior: The concept of Rationality, Performance measures, The nature of Environments, The Structure of Agents, Simple agents, Rational agents, problem solving agents, intelligent agents.

UNIT – II

Solving Problem by Searching: Problem-Solving Agents, Searching for Solutions, Uninformed search strategies.

Informed Search and Exploration: Informed Search Strategies, Heuristic Functions, Local-Search Algorithms and Optimization Problems.

Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Iterative Deepening.

UNIT – III

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Knowledge Representation using Frames.

UNIT – IV

Probabilistic Reasoning

Expert System: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert System versus Traditional Systems, Rule-Based Expert Systems.

Uncertainty Measures: Introduction, Probability Theory, Bayesian Belief Networks.

Fuggy Logic Systems: Introduction, Crisp Sets, Fuzzy Sets, Fuzzy Terminology, Fuggy Logic Control, Neuro Fuzzy Systems.

UNIT – V

Connectionist Models: Introduction: Hopfield Networks, learning in Neural Networks, Applications of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI and Symbolic AI.

Suggested Reading:

1 "Artificial Intelligence" by Saroj Kaushik, Cengage Learning.

2 "Artificial Intelligence" Third Edition by Elaine Rich, Kevin Knight, Shivashankar B Nair, tatamcgrawhill.

3 "Artificial Intelligence-A Modern Approach" Second Edition by Stuart Russell, Peter Norvig.

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PC 503 CS	Computer Networks					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To develop an understanding of communication in modern network architectures from a design and performance perspective.
2. To understand Data Transmission standards and MAC protocols.
3. To introduce the protocols functionalities in Network Layer and Transport Layer.
4. To understand DNS and supportive application protocols.
5. To provide basic concepts of cryptography.

Course Outcomes:

After completing this course, the student will be able to:

1. Explain the functions of the different layer of the OSI and TCP/IP Protocol.
2. Understand wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. Illustrate network layer and transport layer protocols. For a given problem related TCP/IP protocol developed the network programming.
4. Identify the communication protocols and QoS
5. Identify the types of encryption techniques.

UNIT-I

Data communication Components: Representation of data communication, flow of Networks, Layered architecture, OSI and TCP/IP model, Transmission Media. (William stalling)

Techniques for Bandwidth utilization: Line configuration, Multiplexing - Frequency division, Time division and Wave division, Asynchronous and Synchronous transmission, XDSL , Introduction to Wired and Wireless LAN

UNIT-II

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC;

Flow Control and Error control protocols: Stop and Wait, Go back - N ARQ, Selective Repeat ARQ, Sliding Window, and Piggybacking.

Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

UNIT-III

Network Layer: Switching techniques (Circuit and Packet) concept,

Logical addressing: IPV4(Header), IPV6(Header), NAT, Sub-Netting concepts.

Inter-Networking: Tunneling, Fragmentation, congestion control (Leaky Bucket and Token Bucket algorithm), Internet control protocols: ARP, RARP, BOOTP and DHCP.

Network Routing Algorithms: Delivery, Forwarding and Unicast Routing protocol, Gateway protocols.

UNIT-IV

Transport Layer: Process to Process Communication, Elements of transport protocol, Internet Transport Protocols: UDP, TCP. Congestion and Quality of Service, QoS improving techniques.

UNIT-V

Application Layer: Domain Name Space (DNS), EMAIL, SNMP, Bluetooth. Basic concepts of Cryptography: Network Security Attacks, firewalls, symmetric encryption, Data encryption Standards, public key Encryption (RSA), Hash function, Message authentication, Digital Signature.

Suggested books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. W. Richard Stevens, Unix Network Programming, Prentice Hall/ Pearson Education, 2009.

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PC404CS	**Database Management Systems**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. Understand core database concepts, including file organization methods, database architecture, schema levels, and relational algebra operations.
2. Model real-world scenarios using E-R diagrams and convert them into normalized relational schemas following Codd's rules.
3. Construct advanced SQL queries using joins, subqueries, set operations, and aggregation to retrieve and manipulate data effectively.
4. Apply normalization techniques to refine database design, eliminate redundancy, and maintain data consistency and integrity.
5. Develop PL/SQL programs using control structures, triggers, procedures, and indexing to enhance database functionality and performance.

Course Outcomes:

CO1: Understand database systems fundamentals for file organization, database environment, schemas, and relational algebra operations.
CO2: Design E-R models and convert them into normalized relational schemas using E.F. Codd's rules and solve complex SQL queries.
CO3: Analyze the need for and apply normalization techniques to remove data redundancy and ensure data integrity.
CO4:. Develop PL/SQL programs using control structures, cursors, triggers, procedures, and functions; apply indexing techniques to optimize database performance and enforce complex integrity constraints
CO5: Understand the concepts of transactions and develop an overview of diverse databases.

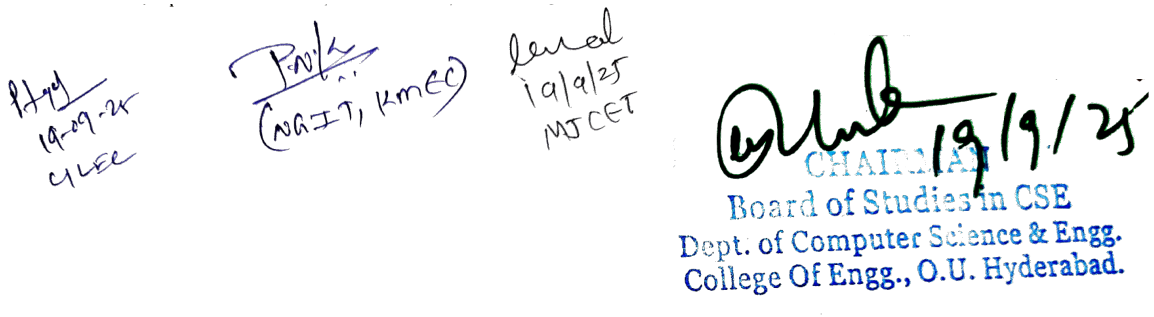
UNIT – I
Introduction to Database: File System Organization: Sequential - Pointer - Indexed – Direct, Purpose of Database System, Database Characteristics, Users of Database System, Advantages of DBMS Approach, Schemas and Instances - Three Schema Architecture and Data Independence, Database System Environment. Relational Algebra – Selection and projection, Renaming, Set operations Joins, Expressive Power of Algebra and calculus
UNIT – II
Logical Database Design: Design of Relational Database – E.F. Codd's Rule - Entity-Relationship model, Weak Entity, Strong Entity, Attributes, Extended ER Diagrams. Structured Query Language: Structured Query Language (SQL): Form of Basic SQL Query, Examples of Basic SQL Queries, Introduction to Sub-Queries and Nested Queries, Set operations in SQL , Comparison Operators and Single row & Multi-row operators,, Aggregative Operators, NULL value, , Disallowing NULL values, Logical connectivity's – AND, OR and NOT, Logical Operators - ALL, ANY, IN, BETWEEN, EXISTS, LIKE, NOT, SOME , Joins – LEFT, RIGHT, OUTER, NATURAL
UNIT – III
Integrity constraints: Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical database Design – Introduction to Views – Destroying /altering Tables and Views, User-level and System-level privileges. Normalization: Introduction to Lossless and Lossy decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyee/Codd normal form, and other normal forms examples. (4th and 5th Normal forms).

UNIT – IV
Introduction to PL/SQL: Control Structures, Cursors, SQL Triggers, Procedures, and Functions, Complex Integrity Constraints in SQL Triggers and Active Data bases. Indexing:Types of Single Level Ordered Indexes - Multilevel Indexes - Dynamic Multilevel Indexes
UNIT – V
Transaction Processing and Concurrency Control: Transaction Concepts - ACID Properties – Transaction States - Concurrency Control Problems - Serializability - Recoverability - Pessimistic and Optimistic Concurrency Control Schemes. Advanced Topics: Overview: Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Data Warehouse - OLTP Vs OLAP - NoSQL Database.

Suggested Reading:

1. Abraham Silberschatz, Henry F Korth, S. Sudarshan, Database System Concepts, Sixth Edition, McGrah-Hill International Edition, 2010.
2. Ramakrishnan, Gehrke, Database Management Systems, Third Edition, McGrah-Hill International Edition, 2003.
3. Elmasri Navathe, Somayajulu, Fundamentals of Database System, Fourth Edition, Pearson Education, 2006.
4. Patric O'Neil, Elizabeth O'Neil, Database--principles, programming, and performance, Morgan Kaufmann Publishers, 2001.

Reference Book from ekumb-AICTE :
1. Dr. Madhu Bala Myneni , Introduction to DBMS: Theory & Practicals, Language- English & Telugu url link: https://ekumbh.aicte-india.org/allbook.php#



PC451AI	ARTIFICAL INTELLIEGENCE LAB					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives:

1 Develop the ability to design and implement solutions for both informed and uninformed search problems in Artificial Intelligence (AI)

2 Acquire proficiency in using Prolog to express and reason about knowledge in first-order logic

3 Utilize the Natural Language Toolkit (NLTK) and advanced techniques to implement Natural Language Processing (NLP) solutions

4 Select and apply relevant Python libraries to synthesize information and construct supervised learning models

5 Develop a comprehensive case study in a multidisciplinary domain, showcasing the integration of AI techniques to solve complex problems.

Course Outcomes: On completion of this course, the student will be able to

CO1 Design and develop solutions for informed and uninformed search problems in Al

CO2 Demonstrate reasoning in first order logic using Prolog.

CO3 Utilize advanced package like NLTK for implementing natural language processing

CO4 Demonstrate and enrich knowledge to select and apply python libraries to synthesize information and develop supervised learning models

CO5 Develop a case study in multidisciplinary areas to demonstrate use of AI

List of Programs

1. Write a program to implement Uninformed search techniques:

a. BFS

b. DFS

2. Write a program to implement Informed search techniques

a. Greedy Best first search

b. A algorithm

3. Study of Prolog its facts, and rules.

a. Write simple facts for the statements and querying it.

b. Write a program for Family-tree.

4. Write a program to train and validate the following classifiers for given data (scikit-learn):

a. Decision Tree

b. Multi-layer Feed Forward neural network

5. Text processing using NLTK

a. Remove stop words

b. implement stemming

c. POS (Parts of Speech) tagging

6. In addition to the above programs, students should be encouraged to study implementations of one of the following

Game bot (Tic Tac toe, 7 puzzle)

Expert system (Simple Medical Diagnosis)

Text classification

Chat bot

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PC 452 AI	Computer Networks & Operating Systems LAB					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives:

1. Learn to communicate between two desktop computers.
2. Learn to implement the different protocols
3. Be familiar with socket programming.
4. Be familiar with the various routing algorithms Be familiar with simulation tools.
5. To use simulation tools to analyze the performance of various network protocols
6. Learn different types of CPU scheduling algorithms
7. Demonstrate the usage of semaphores for solving synchronization problem
8. Understand memory management techniques and different types of fragmentation that occur in them and various page replacement policies Learn various disk scheduling algorithms.

Course Outcomes: After completing this course, the student will be able to:

1. Implement various protocols using TCP and UDP. Program musing sockets.
2. Use simulation tools to analyze the performance of various network protocols.
3. Implement and Analyze various routing algorithms.
4. Evaluate the performance of different types of CPU scheduling algorithms.
5. Implement producer-consumer problem, reader-writers problem, Dining philosopher's problem.
6. Implement paging replacement and disk scheduling techniquesUse different system calls for
7. writing application programs.

Part – A

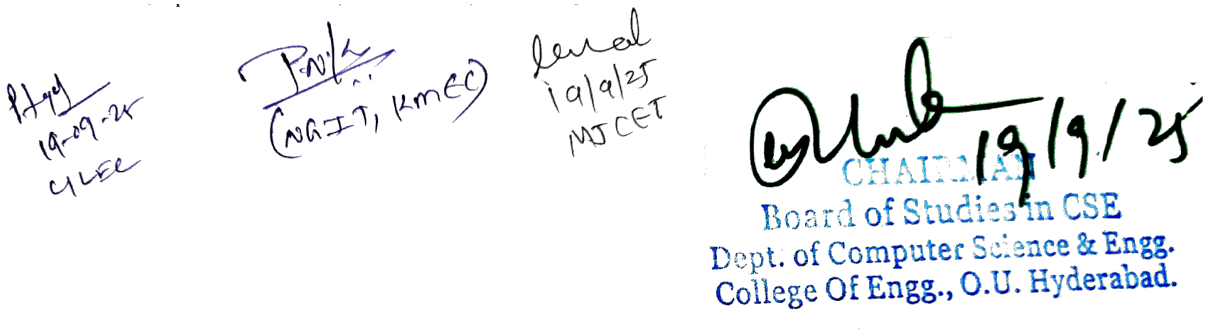
Computer Networks Lab

1. Configuration of router, hub, switch etc. (using real devices or simulators)
2. Running and using services/commands like ping, traceroute, nslookup, arp, telnet, ftp, etc.
3. Network packet analysis using tools like Wireshark, tcpdump, etc.
4. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
5. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)
6. Programming using raw sockets
7. Programming using RPC

Part -B

Operating Systems Lab:

1. Write C programs to Simulate the following CPU scheduling algorithms
   a) FCFS b) SJF c)Round Robin d) Priority
2. Write C programs to Simulate IPC techniques
   a) Pipes b) Message Queues c) Shared Memory
3. Write C Programs to Simulate Classical Problems of Synchronization
   a) Readers-Writers b) Producers-Consumers C) Dining Philosophers
4. Write C Program to simulate Bankers Algorithm for Dead Lock Avoidance
5. Write C Programs to Simulate all page replacement algorithms
   a) FIFO b) LRU c) Optimal etc.
6. Write C program to Simulate Disk Scheduling Algorithms
   a) FCFS b) SSTF etc.
7. Write Unix Shell Programs



PC453CS	**Database Management Systems Lab**					
Prerequisites			**L**	**T**	**P**	**C**
			-	**-**	**2**	**1**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Objectives:
The objectives of the course are to impart knowledge of:
1. To practice various DDL commands in SQL
2. To write simple and Complex queries in SQL
3. To familiarize PL/SQL

Outcomes:
After the completion of the course, the student will be able to:
1. Design and implement a database schema for a given problem
2. Develop the query statements with the help of structured query language.
3. Populate and query a database using SQL and PL/SQL
4. Develop multi-user database application

Design GUI using forms and implement database connectivity:

List of Programs
1. Creation of database (exercising the commands for creation)
2. Simple condition query creation using SQL Plus
3. Complex condition query creation using SQL Plus
4. Usage of Triggers and Stored Procedures.
5. Creation of Forms for student Information, library information, Pay roll etc.
6. Writing PL/SQL procedures for data validation
7. Generation using SQL reports
8. Creating Password and Security features for applications.
9. Usage of File locking table locking, facilities in applications.
10. Creation of small full pledged database application spreading over to 3sessions.

Suggested Readings:
1. Nilesh Shah, Database System Using Oracle, PHI, 2007.
2. Rick F Vander Lans, Introduction to SQL, Fourth edition, Pearson Education, 2007.
3. Benjamin Rosenzweig, Elena Silvestrova, Oracle PL/SQL by Example, Third edition, Pearson Education, 2004.
4. Albert Lulushi, Oracle Forms Developer's Handbook, Pearson Education, 2006.

19-09-25 CLEE

(NGIT, KMEC)

19/9/25 MJCET

19/9/25
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Dept. of Computer Science & Engg.
College Of Engg., O.U. Hyderabad.