A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18CS1004** | **Duration** | **3hrs** |
| **Course Title** | **PROGRAMMING FOR PROBLEM SOLVING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the number of bytes reserved for a float variable in windows 64-bit applications. | | CO1 | U | 1 |
| 2. | Specify the purpose of debugging in program development. | | CO1 | U | 1 |
| 3. | State any one unary operators with an example | | CO2 | R | 1 |
| 4. | List the two ways a string can be declared. | | CO2 | R | 1 |
| 5. | Recall the purpose of the if-else statement in C. | | CO3 | R | 1 |
| 6. | List any one conditional control statements used in C | | CO3 | R | 1 |
| 7. | Write how a string is initialized in C. | | CO4 | A | 1 |
| 8. | Identify the value of num[7] from the below line of code  int num[]={9,6,4,2,3,5,1,7,8}; | | CO4 | U | 1 |
| 9. | Define recursion in C. | | CO5 | U | 1 |
| 10. | Identify the error / output in the following program:  #include<stdio.h>  #include<string.h>  void main(){  char str1[]="abc", str2[]="def";  printf("%d", strcmp(str1,str2));  } | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List any three characteristics of computer. | | CO1 | R | 3 |
| 12. | Compare and contrast ‘keyword’ and ‘identifier’ in C with examples. | | CO2 | A | 3 |
| 13. | Develop a simple program to find whether a number is positive or negative. | | CO3 | A | 3 |
| 14. | Infer the use of a do-while loop to display a menu at least once. | | CO4 | A | 3 |
| 15. | Recall the use of the malloc() and free() functions. | | CO5 | R | 3 |
| 16. | Depict how pointers are used with structures. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Examine the steps involved in the program development and their importance. | CO1 | U | 6 |
|  | b. | Outline the skeleton of a program structure with a simple C program | CO1 | AU | 6 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate the expression c = (a > b) ? a : b; for different values of a and b and justify how the conditional operator works. | CO2 | An | 6 |
|  | b. | Distinguish between assignment operator (=) and comparison operator (= =) through examples code. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Develop a C program to calculate the sum of first n odd integers (i.e.,) using while loop and for loop. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Build a program to find the length of two strings, and compare and concatenate them without using in-built string functions using string functions. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate a program in C to add and multiply two matrices of MXN order. Read M and N from user. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | 1. Develop a C program to find the factorial of a given number using the recursion function. | CO5 | A | 6 |
|  | b | 1. Using functions, write a C program to find the even numbers from an integer array. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | A programmer wants to find the factorial of a number using recursion. Write a C function that implements this using recursive calls and explain the control flow. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Define a function to swap-two numbers using pointers. Demonstrate the concept of call- by- value and call-by- reference method using C | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the fundamentals of computer and software development process. |
| **CO2** | Identify the data type to represent the real time data representation and operators for computation. |
| **CO3** | Prepare innovative solutions for the problem using branching and looping statements. |
| **CO4** | Decompose a problem into functions and synthesize a complete program using divide and conquer approach. |
| **CO5** | Formulate algorithms and programs using arrays, pointers and structures. |
| **CO6** | Create a new application software to solve real world problems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19CS2015** | **Duration** | **3hrs** |
| **Course Title** | **ARTIFICIAL INTELLIGENCE FOR FOOD ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Indicate any two search techniques used in problem-solving. | | CO1 | U | 1 |
| 2. | Define an intelligent agent. | | CO1 | R | 1 |
| 3. | List any two challenges in knowledge representation. | | CO2 | R | 1 |
| 4. | Classify types of knowledge used in AI systems. | | CO2 | U | 1 |
| 5. | Identify two sensors used in electronic nose technology. | | CO3 | U | 1 |
| 6. | Define food pattern recognition. | | CO3 | R | 1 |
| 7. | State any two applications of AI in food manufacturing processes. | | CO4 | R | 1 |
| 8. | Name the AI technique commonly used for sorting food items. | | CO4 | R | 1 |
| 9. | Define feature extraction in image analysis. | | CO5 | R | 1 |
| 10. | Write one AI application for food market analysis. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare uninformed search techniques with informed search techniques. | | CO1 | U | 3 |
| 12. | Differentiate predicate logic from rule-based knowledge representation. | | CO2 | U | 3 |
| 13. | Apply AI methods to classify food based on sensory data. | | CO3 | A | 3 |
| 14. | Differentiate manual-based texture analysis from AI-based texture analysis. | | CO4 | U | 3 |
| 15. | Discuss the challenges of using AI for real-time image processing in food systems. | | CO5 | U | 3 |
| 16. | Propose an AI-based approach to enhance food market analysis. | | CO6 | C | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Analyze how AI problem formulation and heuristic search can be applied in developing intelligent traffic and logistics systems for efficient food distribution. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Evaluate how statistical reasoning supports intelligent decision-making in food quality assessment and contamination detection. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Illustrate with a labeled diagram how AI-integrated electronic nose technology functions in detecting aroma deviations and maintaining product consistency in food industries. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Examine how product quality and process optimization are achieved in food industries through Cleaning-in-Place (CIP), sorting, and texture analysis using AI. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the effectiveness of hyperspectral imaging in sensory analysis for assessing freshness and color uniformity in meat or fish processing plants. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. | a. | Examine how AI techniques such as pattern recognition and machine learning are used to predict microbial contamination in perishable food products. | CO3 | A | 6 |
|  | b. | Discuss how predictive maintenance and quality monitoring systems enhance efficiency in automated food manufacturing lines using AI. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain how image analysis and feature extraction are applied in detecting defects during raw material and processed food inspection using AI. | CO5 | U | 6 |
|  | b. | Assess the effectiveness of vision systems in package inspection for identifying labeling errors and ensuring sealing accuracy with AI. | CO5 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze how AI-based market forecasting models support food product development and enhance marketing strategies. | CO6 | An | 6 |
|  | b. | Examine the role of AI in optimizing food supply chain management through demand prediction, logistics planning, and waste reduction. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Define AI based problems and select appropriate search method for different search spaces. |
| **CO2** | Express knowledge representation techniques and problem-solving strategies to common AI applications. |
| **CO3** | Develop prediction models and extend for food processing applications. |
| **CO4** | Analyze the food industry operations and develop AI based solutions. |
| **CO5** | Inspect the challenges in quality management of food products through AI based image processing techniques. |
| **CO6** | Propose AI based solutions for food industry management. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS1001** | **Duration** | **3hrs** |
| **Course Title** | **PROGRAMMING FOR PROBLEM SOLVING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define an algorithm. | | CO1 | U | 1 |
| 2. | List out the steps involved in the software development life cycle. | | CO1 | R | 1 |
| 3. | Recall the importance of data types in C programming. | | CO2 | R | 1 |
| 4. | Write a C code to check whether a number is odd or even using ternary operator | | CO2 | A | 1 |
| 5. | List out the labelled conditional statements available in C. | | CO3 | U | 1 |
| 6. | State the purpose of break and continue statements. | | CO3 | R | 1 |
| 7. | Cite a code to initialize an array with 5 integers | | CO4 | U | 1 |
| 8. | List out any two string handling functions in C. | | CO4 | R | 1 |
| 9. | Define recursion. | | CO5 | U | 1 |
| 10. | Define a pointer and mention its significance. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between compiler and interpreter. | | CO1 | U | 3 |
| 12. | List out the different types of operators used in C with one example each. | | CO2 | U | 3 |
| 13. | Write a program to find the largest of three numbers using if-else statement. | | CO3 | A | 3 |
| 14. | Explain the concept of bubble sort algorithm. | | CO4 | U | 3 |
| 15. | Write a function in C to find the factorial of a number using recursion. | | CO5 | A | 3 |
| 16. | Explain the concept of dynamic memory allocation using malloc() and free(). | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | **Construct** a C program for a school fee management system that allows the user to enter student details, calculate the total fee based on the number of subjects opted, and display the final amount to be paid. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | **Write a program** to simulate a basic calculator that accepts two numbers and an operator (+, −, ×, ÷) and displays the result using appropriate arithmetic and relational operators. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | **Develop an application** to generate electricity bills based on units consumed using conditional and looping constructs. Include slab-based billing (e.g., 0–100, 101–200, etc.). | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | **Construct a program** that maintains inventory details of a store using arrays. Allow insertion, search, and display operations for product IDs and quantities. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | **Develop an application** to manage employee payroll using functions. Include separate functions for calculating gross salary, deductions, and net salary. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | **Write a program** to store and retrieve hospital patient details using structures and file handling. The program should allow adding, searching, and displaying patient records. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | **Construct** a banking system simulation using user-defined functions that supports deposit, withdrawal, and balance enquiry operations for multiple customers. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | **Develop an application** for a retail billing system that reads product name, price, and quantity from the user, computes the total and applicable discount, and displays the final bill using modular program design. Use appropriate program statements. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the fundamentals of computers and the software development process. |
| **CO2** | Identify the data type to represent real-time data and apply operators for computation. |
| **CO3** | Prepare innovative solutions using branching and looping statements. |
| **CO4** | Decompose problems into functions and synthesize complete programs using a divide-and-conquer approach. |
| **CO5** | Formulate algorithms and programs using arrays, pointers, and structures. |
| **CO6** | Create new application software to solve real-world problems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2013** | **Duration** | **3hrs** |
| **Course Title** | **DATA STRUCTURES AND ALGORITHMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define Abstract Data Type (ADT). | | CO1 | R | 1 |
| 2. | Write the asymptotic notation for the best case of linear search. | | CO4 | U | 1 |
| 3. | State any one example of a time-space trade-off. | | CO1 | R | 1 |
| 4. | State one real-world application of queue ADT | | CO2 | R | 1 |
| 5. | Cite the strategy which is adopted in merge sort algorithm. | | CO4 | U | 1 |
| 6. | Define a complete binary tree. | | CO6 | R | 1 |
| 7. | Identify the height of a tree with a single node. | | CO6 | U | 1 |
| 8. | Define the degree of a vertex in a graph. | | CO6 | R | 1 |
| 9. | When does a trww become a graph. | | CO6 | R | 1 |
| 10. | Name any two graph traversal algorithms. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Develop an algorithm to find the second largest number in an unsorted array and determine its time complexity. | | CO1 | A | 3 |
| 12. | Write an algorithm to implement queue operations using arrays. | | CO2 | A | 3 |
| 13. | Compare singly and doubly linked lists with examples. | | CO3 | U | 3 |
| 14. | Distinguish between merge sort and quick sort. | | CO5 | U | 3 |
| 15. | Develop a max-heap for {25, 14, 35, 8, 50, 12} and demonstrate the heapify process | | CO6 | A | 3 |
| 16. | Represent a simple graph using adjacency list and adjacency matrix. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | | |
| 17. |  | Explain the asymptotic notations Big-Oh, Big-Theta, and Big-Omega with the definition, graph representation, and an example. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Write pseudo code for enqueue and dequeue methods in a linear queue and perform the following operations in a queue of size 10 with the elements 25,100,45,80:  Enqueue(57)  Enqueue(89)  Dequeue()  Dequeue()  Display() | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Construct a binary search tree for the sequence {50, 30, 70, 20, 40, 60, 80} and display its inorder traversal. | CO5 | A | 6 |
|  | b. | Apply AVL tree rotations to balance a tree after inserting {10, 20, 30, 40}. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the merge sort algorithm by sorting the numbers {23, 20, 45, 67, 35, 99, 21, 41, 12} in descending order. Write the algorithm for merge sort. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Demonstate the concept of Topological Sorting in Directed Acyclic Graphs. Describe any two methods for performing topological sort and its applications. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Discuss the implementation of stack and queue using linked lists. Compare their efficiency with array-based implementations and mention scenarios where linked structures are preferred. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the step-by-step working principleof Dijkstra’s Algorithm. | CO6 | U | 6 |
|  | b. | Apply Dijkstra's Algorithm to find Shortest Paths from the Source to all other nodes in the following graph. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Describe the concept of a Minimum Spanning Tree (MST). Compare Kruskal’s and Prim’s algorithms with examples. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Articulate the basics of abstract data type and algorithm analysis. |
| **CO2** | Comprehend the stack and queue ADT and use them for real-time applications. |
| **CO3** | Represent various data structures by exploring the concepts of linked lists. |
| **CO4** | Explore different searching algorithms and hashing techniques. |
| **CO5** | Interpret and analyze the various sorting algorithms. |
| **CO6** | Describe the tree and graph data structures and demonstrate the methods for traversing |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2030** | **Duration** | **3hrs** |
| **Course Title** | **INTERNET OF THINGS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Differentiate radio frequency identification and near field communication. | | CO1 | U | 1 |
| 2. | List any two benefits of Internet of Things. | | CO1 | R | 1 |
| 3. | Compare Blynk app with IFTTT applet for controlling smart home devices. | | CO2 | U | 1 |
| 4. | Identify the function of relay board in a smart home automation system. | | CO2 | R | 1 |
| 5. | **Compare** optical heart rate monitoring with traditional heart rate monitoring methods based on their accuracy and usability. | | CO3 | U | 1 |
| 6. | Identify the type of sensor commonly used in fitness trackers to monitor physical activity. | | CO3 | R | 1 |
| 7. | Name the protocol used by Constrained Application Protocol for communication. | | CO4 | R | 1 |
| 8. | **Compare** **BCM** with **BOARD** pin numbering systems in Raspberry Pi. | | CO4 | U | 1 |
| 9. | **Define** AIoT. | | CO5 | R | 1 |
| 10. | Compare pitch with roll in unmanned aerial vehicles. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate authentication and authorization mechanisms in IoT security. | | CO1 | U | 3 |
| 12. | Compare Zigbee with Lora. | | CO2 | U | 3 |
| 13. | Differentiate between cloud computing and edge computing. | | CO3 | U | 3 |
| 14. | Differentiate between internal and external representation of sensor data. | | CO4 | U | 3 |
| 15. | State the role of **Arduino and NodeMCU** in agricultural automation systems. | | CO5 | R | 3 |
| 16. | Identify the steps needed for assembling a drone. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17 | a | Sketch the architecture of IoT and explain it. | CO1 | A | 6 |
|  | b | Illustrate the technology of connected devices in IoT. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | **Write the step by step process of transforming a traditional home into a smart home.** | CO2 | A | 8 |
|  | b. | List any four System Interconnection Kit (SIK) components. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | **Illustrate** the design and working principles of wearable internet of things enabled real time health monitoring system. | CO3 | U | 6 |
|  | b. | Explain the types of inertial sensors and their applications. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Compare and contrast CoAP, MQTT, and HTTP protocols based on communication model, performance, and suitability for IoT environments. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the role of automation and real-time monitoring in achieving efficient irrigation and improved crop productivity. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Write the process of integrating medical sensors with a mobile app for monitoring patient health. | CO3 | A | 6 |
|  | b. | Write an Arduino program to simulate a simple traffic light system using three LEDs:   * Red LED should be ON for 5 seconds. * Yellow LED should be ON for 2 seconds. * Green LED should be ON for 5 seconds. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Write the **process of setting up a local web server** using NodeMCU for agricultural automation. Include code structure, HTTP communication, and advantages of local control. | CO5 | A | 12 |
|  |  |  |  |  |  |
| COMPULSORY QUESTION | | | | | |
| 24. |  | Explain the components of drones and the steps involved in assembling a drone  using these components. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand internet of Things and its hardware and software components. |
| **CO2** | Interface I/O devices, sensors &amp; communication modules. |
| **CO3** | Remotely monitor data and control devices. |
| **CO4** | Compare the connectivity technologies and protocols in IOT. |
| **CO5** | Infer Security issues in IOT. |
| **CO6** | Develop real life IoT based projects. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2047** | **Duration** | **3hrs** |
| **Course Title** | **ROBOTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Summarize about robot according to ISO standards. | | CO1 | U | 1 |
| 2. | List two types of robots based on the configuration. | | CO1 | R | 1 |
| 3. | Identify one manipulator in robotics. | | CO2 | U | 1 |
| 4. | State any one application of the ROS platform.. | | CO2 | R | 1 |
| 5. | Show one function of the Proximity Sensor. | | CO3 | U | 1 |
| 6. | Define tactile sensor. | | CO3 | R | 1 |
| 7. | Give any two types of actuators used in robotic systems. | | CO4 | U | 1 |
| 8. | State one challenge in PID control in robotics. | | CO4 | R | 1 |
| 9. | Summarize about kinematic modelling. | | CO5 | U | 1 |
| 10. | Infer any one phase of robot safety in industrial environments. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the classification of robots based on control systems. | | CO1 | An | 3 |
| 12. | Illustrate about translation and rotation representation with an example. | | CO2 | U | 3 |
| 13. | Compare sensors and actuators in robotic systems with examples. | | CO3 | An | 3 |
| 14. | Analyze the differences between hydraulic and pneumatic actuators. | | CO4 | U | 3 |
| 15. | Describe about the tuning of PID controllers. | | CO5 | An | 3 |
| 16. | Summarize the integration of sensors with embedded control hardware. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the history, classification, and components of a robot. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the forward kinematic equations for a two-link manipulator. | CO2 | An | 6 |
|  | b. | Explain coordinate transformation with a neat sketch. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the various sensors used in robotics and its applications. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the types of actuators and the transmission systems used in robots. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Determine the basic control laws (P, PD, and PID) used in robotic systems. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Analyze the use of a camera calibration and its integration with real application. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the social and safety issues related to the deployment of robots in society. | CO4 | A | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Summarize the process of building and interfacing control hardware, software for an autonomous mobile robot using ROS. | CO6 | E | 12 |
|  |  |  |  |  |  |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL M – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Perform kinematic and dynamic analyses with simulation |
| **CO2** | Design control laws for a robot. |
| **CO3** | Integrate mechanical and electrical hardware for a real prototype of robotic devices. |
| **CO4** | Select a robotic system for a given application. |
| **CO5** | Describe the different physical forms of robot architectures. |
| **CO6** | Develop simple robot control systems integrating perception, planning, and action. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2058** | **Duration** | **3hrs** |
| **Course Title** | **BASICS OF DATA ANALYTICS – R PROGRAMMING AND TABLEAU** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Enumerate the options available for the position argument in geom\_bar(). | | CO1 | R | 1 |
| 2. | Predict the output of the following R code snippet:  x <-NA  is.na(x) | | CO1 | U | 1 |
| 3. | Label with an example to import a CSV file named New\_data.csv into R. | | CO2 | R | 1 |
| 4. | List any two principles of tidy data. | | CO2 | R | 1 |
| 5. | Define recursion. | | CO3 | R | 1 |
| 6. | Predict the output of the following R code snippet:  data <- c(5, 2, 9, 1, 7)  New\_data <- sort(data)  print(New\_data) | | CO3 | U | 1 |
| 7. | Identify the function in modelr package that is used to add predictions to a dataset. | | CO4 | R | 1 |
| 8. | Name a common type of model used in statistics. | | CO4 | R | 1 |
| 9. | State the purpose of flexdashboard. | | CO5 | R | 1 |
| 10. | Label the use of Tableau. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the process of installing and loading packages in R with an example. | | CO1 | U | 3 |
| 12. | Explain the context of factors with an example. | | CO2 | U | 3 |
| 13. | Write the R code to find the factorial of a number. | | CO3 | A | 3 |
| 14. | Paraphrase the linear regression model in statistical analysis. | | CO4 | U | 3 |
| 15. | Give an example to create a code chunk in an R Markdown file. | | CO5 | U | 3 |
| 16. | Differentiate between data dashboard and data visualization in the context of data analysis. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a program in R to check whether the given number is a palindrome or not. | CO1 | A | 6 |
|  | b. | Explain exploratory data analysis with an example. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the separate() and unite() functions used in data transformation with examples. | CO2 | A | 6 |
|  | b. | Describe the four main types of joins in R using the dplyr package with suitable examples. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the following methods of string with an example:   1. str\_length() ii) str\_c() | CO3 | A | 6 |
|  | b. | Examine the vector manipulation and arithmetic operations in R by performing the following tasks:   1. Create a numeric vector named sales containing five values representing sales figures. 2. Calculate the total sum and average of the sales vector. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Deduce the influence of transformation operations in the modelr package on the performance of linear models, with suitable examples. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Write a brief note on the use of ggrepel package with an example. | CO5 | A | 6 |
|  | b. | Prepare the legend layout of graphics for communication with an example. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Sketch the overview of Tableau interface with examples. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Discuss in detail the string manipulation functions in R and illustrate their usage with suitable examples. | CO2 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate the key principles of effective data visualization in an educational context and explain how Tableau can be used to enhance the understanding of course performance data. | CO6 | An | 6 |
|  | b. | Sketch the different types of charts used in Tableau and their roles in data visualization with suitable examples. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Apply the principles of data Wrangling to transform the datasets into a form convenient for analysis. |
| **CO2** | Demonstrate powerful R tools for solving data problems with greater clarity and ease |
| **CO3** | Perform data exploration, generate hypotheses, and quickly test them. |
| **CO4** | Provide a low-dimensional summary that captures true “signals” in your dataset. |
| **CO5** | Develop visualizations to communicate results using R Markdown. |
| **CO6** | Communicate the data analytics summary using tableau dashboards. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS2012** | **Duration** | **3hrs** |
| **Course Title** | **INTERNET OF THINGS SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State any one real-world application of the Internet of Things. | | CO1 | R | 1 |
| 2. | Identify two components of a typical IoT system. | | CO1 | R | 1 |
| 3. | Define cryptography in the context of IoT. | | CO2 | R | 1 |
| 4. | Explain why lightweight encryption is important for IoT devices. | | CO2 | U | 1 |
| 5. | List any two types of attacks that target IoT networks. | | CO3 | R | 1 |
| 6. | Describe one example of a physical-layer attack in IoT. | | CO3 | U | 1 |
| 7. | State the purpose of access control in IoT systems. | | CO4 | R | 1 |
| 8. | Explain the function of trust models in IoT security. | | CO4 | U | 1 |
| 9. | Identify one challenge in integrating IoT with cloud services. | | CO5 | R | 1 |
| 10. | Explain how blockchain can enhance IoT security. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate how IoT enables smart applications in transportation or agriculture. | | CO1 | A | 3 |
| 12. | Evaluate the strengths and limitations of lightweight cryptography for IoT devices. | | CO2 | E | 3 |
| 13. | Analyze how firmware updates can both improve and endanger IoT device security. | | CO3 | An | 3 |
| 14. | Justify the need for trust management frameworks in large-scale IoT deployments. | | CO4 | E | 3 |
| 15. | Design a simple security checklist for cloud-based IoT data protection. | | CO5 | C | 3 |
| 16. | Propose an IoT security model for remote patient monitoring devices. | | CO6 | C | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the IoT architecture of a system and classify the roles of devices, gateways and cloud services. | CO1 | U | 6 |
|  | b. | Analyze the advantages and limitations of using cloud connectivity for this setup. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Compare the security requirements of data at rest and data in transit. | CO2 | R | 6 |
|  | b. | Develop a lightweight encryption strategy suitable for low-power smart meters and justify your choice. | CO2 | C | 6 |
|  |  |  |  |  |  |
| 19. |  | Recommend a response plan including firmware hardening and network segmentation to reduce risk. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain how identity and access management can prevent misuse of medical data. | CO4 | U | 6 |
|  | b. | Construct a simple trust model linking patients, devices and administrators for secure operations. | CO4 | C | 6 |
|  |  |  |  |  |  |
| 21. |  | Design a risk-mitigation plan covering encryption, authentication, and backup strategies. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain any four emerging technologies that can enhance IoT data security. | CO2 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | Define authentication and name two common methods used in IoT systems. | CO3 | R | 6 |
|  | b. | Analyze the scenario and answer: A smart campus connects lighting, air conditioning, and surveillance systems through IoT. Identify the basic hardware and software components used to implement such IoT solutions. | CO3 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain privacy-preserving IoT architecture that limits third-party data access. | CO6 | R | 6 |
|  | b. | Analyze the scenario and answer: A home-automation startup faces privacy issues with third-party apps. Investigate the data-sharing risks involved in API integration. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate knowledge and understanding of the security in internet of things |
| **CO2** | Describe cryptographic primitives involved for securing IoT |
| **CO3** | Conceptually identify vulnerabilities, including recent attacks in securing the internet of things |
| **CO4** | Analyse the Identity and Access Management Solutions for IoT |
| **CO5** | Appraise the security challenges related to emerging technologies |
| **CO6** | Design security solutions for IoT applications |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOVE / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS2014** | **Duration** | **3hrs** |
| **Course Title** | **MLOps** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the key principles of DevOps method. | | CO1 | R | 1 |
| 2. | List the common middleware tools used in MLOps. | | CO1 | R | 1 |
| 3. | Identify the two training models used for forecasting future weather conditions. | | CO2 | U | 1 |
| 4. | Classify the types of data based on its size. | | CO2 | U | 1 |
| 5. | Identify the type of machine learning model used for the problem “Predicting whether an email is spam or not”. | | CO3 | U | 1 |
| 6. | Determine the open-source platform used for managing the ML lifecycle, including deployment process. | | CO3 | A | 1 |
| 7. | Write the main purpose of Continuous Integration (CI) in MLOps. | | CO4 | A | 1 |
| 8. | Analyze the ways Azure Kubernetes Service (AKS) simplifies containerized application management and evaluate its impact on operational efficiency in cloud environments. | | CO4 | An | 1 |
| 9. | List the factors affecting data quality. | | CO5 | R | 1 |
| 10. | Define data drift. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the key drivers used for the MLOps pipeline. | | CO1 | A | 3 |
| 12. | **Scenario:**  A cargo shipping company in Finland imports 90% of goods via cargo shipping. The goal is to save 20% of costs for cargo operations at the port of Turku.  **Objective:**  Develop an ML solution to predict weather conditions 4 hours in advance. Analyze the given scenario based on model type, data characteristics and team setup. | | CO2 | An | 3 |
| 13. | Identify the necessity of packaging ML models and explore the various methods available for packaging. | | CO3 | U | 3 |
| 14. | Infer different types of triggers used for pipeline execution. | | CO4 | U | 3 |
| 15. | State the usage of AZURE Machine Learning SDK toolkit. | | CO5 | R | 3 |
| 16. | Describe various types of model auditing. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Develop a MLOps workflow to efficiently manage and deploy machine learning models, and provide a detailed architecture to illustrate the workflow. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Analyze the steps and components involved in creating a machine learning pipeline, and discuss each stage contributes to the overall workflow. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the metrics and techniques involved in model evaluation and interpretation taxonomy that can be applied to any business problem. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Examine the transition from a monolithic system to a microservices-based architecture in the context of car repair facility use case. Include the functions of API and microservices to enhance reliability. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Classify the four main categories of attacks on ML systems and evaluate how each method can be used in machine learning models. | CO5 | An | 6 |
|  | b. | A healthcare organization is deploying a machine learning (ML) model to assist in diagnosing medical conditions based on patient data. Given the critical nature of healthcare decisions, ensuring the security and reliability of the ML system is essential. Concerns arise about potential threats such as adversarial attacks altering diagnosis results, data poisoning affecting model training, and model inversion attacks compromising patient confidentiality. The team must implement rigorous security measures to safeguard the ML system.  Illustrate various testing methodologies that can be applied to secure the ML solution in this scenario. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Distinguish the different types of hybrid models in machine learning and evaluate the multiple approaches to enhance performance in various applications. | CO1 | An | 6 |
|  | b. | Illustrate various containerization techniques applied for deploying and managing containerized applications. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Examine the role of continuous integration, delivery, and deployment pipelines in model development and evaluate their impact on efficiency, reliability, and automation. | CO4 | A | 6 |
|  | b. | Evaluate the key principles of monitoring an ML system and assess their significance in ensuring the model performance. | CO6 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Manipulate the concept of explainable monitoring framework with architecture. | CO6 | A | 6 |
|  | b. | Discriminate the impact of continual learning on machine learning operation and provide an example to support the analysis. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Examine the concept, workflow and structure of MLOps. |
| **CO2** | Operationalize ML models for pipeline deployment and for external business systems that are more complex and less standardized. |
| **CO3** | Design an ML production system end-to-end: project scoping, data needs, modeling strategies, and deployment requirements. |
| **CO4** | Establish a model baseline, address concept drift, and prototype how to develop, deploy, and continuously improve a productionized ML application. |
| **CO5** | Build data pipelines by gathering, cleaning, and validating datasets. Establish data lifecycle by using data lineage and provenance metadata tools. |
| **CO6** | Apply best practices and progressive delivery techniques to maintain and monitor a continuously operating production system. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS3003** | **Duration** | **3hrs** |
| **Course Title** | **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the role of the PAC learning framework in determining the learnability of a hypothesis class. | CO1 | An | 10 |
|  | b. | Compare Empirical Risk Minimization and Structural Risk Minimization with suitable examples. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Infer the influence of VC dimension on the generalization capability of a learning algorithm. | CO1 | An | 10 |
|  | b. | Illustrate the significance of Minimum Description Length and Occam’s Razor in model selection. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | **Construct a Decision Tree** for the given dataset and **compute the following**: i. Entropy for each attribute. ii. Information Gain for each attribute.  iii. Identify the **root node** based on maximum Information Gain.   | **A** | **B** | **C** | **Class** | | --- | --- | --- | --- | | 1 | 0 | 1 | X | | 1 | 1 | 1 | X | | 0 | 1 | 0 | Y | | 1 | 0 | 0 | Y | | 0 | 0 | 1 | X | | CO2 | A | 10 |
|  | b. | Grade the performance of Support Vector Machines using different kernel functions. | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | **Apply** the K-Means clustering algorithm on the given dataset consisting of points P₁(1,2), P₂(2,3), P₃(5,8), P₄(6,9), and P₅(7,10), by initializing two centroids C1(1,2) and C2(5,8). **Perform** one complete iteration to assign points to clusters, **recompute** the new centroid positions, and **justify** the choice of distance metric used in the clustering process. | CO2 | A | 10 |
|  | b. | Apply Principal Component Analysis to a sample dataset and analyze the resulting dimensionality reduction. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Apply the A\* algorithm to the given state-space problem provided and derive the optimal path cost from the source node (S) to the goal node (G). | CO3 | A | 10 |
|  | b. | Calculate the utility value for the following game tree using the Minimax algorithm.  Mini-Max Algorithm in AI | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Examine the role of predicate logic in knowledge representation and reasoning. | CO3 | An | 10 |
|  | b. | Analyze how Dempster–Shafer Theory supports reasoning under uncertainty in expert systems. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Construct a Recurrent Neural Network and describe the computation flow within a single time step. | CO4 | A | 10 |
|  | b. | Examine the role of Dropout and Batch Normalization in regularization of deep models. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Compare the effectiveness of Transfer Learning and traditional Neural Networks in minimizing training time. | CO5 | U | 10 |
|  | b. | Assess the contribution of attention mechanisms in transformer architectures for NLP tasks. | CO5 | An | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Investigate the integration of Artificial Intelligence in smart agriculture to enhance yield prediction and resource optimization. | CO6 | An | 10 |
|  | b. | Analyze recent AI-driven advancements in healthcare analytics with respect to patient safety and diagnostic accuracy. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Understand the existing machine learning techniques: it’s concepts, mathematical background, applicability, limitations and toolkit used in industries. |
| CO2 | Create AI/ML solutions for various societal problems. |
| CO3 | Apply some state-of-the-art development frameworks and software libraries in machine learning task realization. |
| CO4 | Evaluate the performance of machine learning algorithms using suitable metrics. |
| CO5 | Compare the strengths and limitations of selected machine learning algorithms and where they can be applied in different applications. |
| CO6 | Build and deploy production grade AI/ML applications |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS3009** | **Duration** | **3hrs** |
| **Course Title** | **INFORMATION SECURITY MANAGEMENT SYSTEM** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the CIA triad. Illustrate how each attribute supports business goals. | CO1 | U | 10 |
|  | b. | Analyze the role of Information Security Lifecycle in protecting enterprise assets. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the components of a comprehensive Security Policy and illustrate their importance in organizational security. | CO2 | U | 10 |
|  | b. | Examine the phases of Business Continuity Planning (BCP) and justify the need for preventive and corrective safeguards. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the Risk Management Life Cycle and demonstrate how risk treatment strategies are selected. | CO3 | A | 10 |
|  | b. | Analyze the role of Active Security Assessment (ASA) in identifying organizational vulnerabilities. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe the major clauses of ISO/IEC 27002 and demonstrate their role in formulating Security Design. | CO4 | U | 10 |
|  | b. | Analyze how Access Control mechanisms support secure systems development and maintenance. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Apply cryptographic techniques and digital signatures for secure communication in an organization. | CO5 | A | 10 |
|  | b. | Evaluate the process of ISMS audit and justify the need for corrective and preventive actions. | CO5 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Differentiate between CIA Triad and NSA Triad with suitable examples. | CO1 | An | 10 |
|  | b. | Assess the importance of authentication and non-repudiation in modern computing environments. | CO1 | E | 10 |
|  |  |  |  |  |  |
| 7. | a. | Apply ethical hacking techniques to evaluate security posture in an enterprise environment. | CO3 | A | 10 |
|  | b. | Assess the impact of system availability on overall information security. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain various professional certifications for Information Security professionals and their relevance in staffing the security function. | CO6 | U | 10 |
|  | b. | Create a set of ethical guidelines for InfoSec professionals addressing legal, organizational, and investigative responsibilities. | CO6 | C | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Design a comprehensive investigation workflow for handling internal security incidents, incorporating legal requirements, evidence handling procedures, and organizational responsibilities. | CO6 | C | 10 |
|  | b. | Analyze a real-world case where an organization failed to enforce proper employment policies. Identify the security lapses and propose corrective personnel security measures. | CO6 | E | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the need for information security policies, guidelines, and models. |
| CO2 | Understand risks and the need for good security practices. |
| CO3 | Apply techniques to combat threats and attacks. |
| CO4 | Analyze security incidents and identify root causes. |
| CO5 | Evaluate the performance of ISMS using controls and audits. |
| CO6 | Create organizational security policies, procedures, and contingency plans. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS3011** | **Duration** | **3hrs** |
| **Course Title** | **NETWORK AND SYSTEM SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the different types of security threats and attacks that can target an organization’s assets. Illustrate with examples how these threats impact the CIA Triad. | CO1 | U | 10 |
|  | b. | Compare and contrast discretionary, mandatory, and role-based access control models with examples. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 2. | a. | Differentiate between symmetric and asymmetric cryptosystems and explain how block and stream ciphers are used in symmetric encryption. | CO2 | U | 10 |
|  | b. | Explain how public-key cryptography ensures message authentication, integrity, and digital signature verification within a Public Key Infrastructure (PKI) framework. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 3. | a. | Explain the working of a Virtual Private Network (VPN) and discuss how VPN protocols ensure secure communication over public networks. | CO3 | U | 10 |
|  | b. | Analyze the impact of DDoS attacks on network availability and performance. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 4. | a. | Explain how buffer overflow vulnerabilities arise and illustrate the ways they can be exploited to compromise system security. | CO4 | A | 10 |
|  | b. | Explain Trusted Computing and its key components that ensure system integrity and secure execution. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 5. | a. | Examine the major security challenges in the Internet of Things (IoT) ecosystem and discuss the mechanisms to ensure device, network, and data security. | CO5 | A | 10 |
|  | b. | Explain the concept of side-channel attacks and analyze how CPU cache exploitation can compromise system security. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 6. |  | Users Alice and Bob use the Diffie–Hellman key exchange algorithm with a common prime p = 131 and a primitive root g = 2.  a) If Alice’s private key is a=34, compute the value she transmits to Bob. b) If Bob’s private key is b=92, compute the value he transmits to Alice. c) Determine the shared secret key established between Alice and Bob. d) Explain how the Diffie–Hellman key exchange ensures confidentiality of the shared key even over an insecure communication channel. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 7. |  | Discuss the mechanics of SQL injection attacks and the potential damage they can inflict on a web application. Discuss various mitigation techniques available to protect applications from SQL injection vulnerabilities. | CO4 | U | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Explain blockchain architecture that effectively addresses issues related to scalability, security, and transaction throughput, while also considering the role of the consensus protocol and privacy-preserving mechanisms in maintaining trust and efficiency. | CO6 | U | 10 |
|  | b. | A blockchain-based supply chain management system suffered a major breach caused by flaws in its smart contract logic and access control mechanisms. Examine the common security vulnerabilities in smart contract development that could lead to such incidents, and discuss the role of auditing tools, formal verification, and secure coding practices in enhancing the reliability and resilience of smart contracts. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recall the computer security principles and practices. |
| CO2 | Describe the cryptographic algorithms used in network and system. |
| CO3 | Interpret network features and vulnerabilities to design and enhance network security. |
| CO4 | Analyze the vulnerabilities and threats in software and web security. |
| CO5 | Appraise the security challenges related to the emerging technologies. |
| CO6 | Discuss the challenges of blockchain and its applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS3012** | **Duration** | **3hrs** |
| **Course Title** | **PRINCIPLES OF CYBER SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | A financial institution experiences a targeted cyber intrusion traced back to a phishing campaign. Apply the Kill-Chain Cyber Attack Life Cycle to identify each phase of the attack and construct appropriate defense measures that could be deployed at every stage to contain the intrusion. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 2. |  | A company’s operating system kernel shows unusual modifications after an attack. Explain the concept of rootkits and their potential impact on the security and stability of the operating system. | CO2 | U | 16 |
|  |  |  |  |  |  |
| 3. | a. | A corporate firewall fails to block an intrusion attempt. Explain how firewall configurations and intrusion detection systems complement each other in network defense. | CO3 | U | 10 |
|  | b. | A hospital’s database system faces an insider data leakage. Propose database security requirements and controls to protect sensitive health information. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 4. |  | Examine the internal structure of the Data Encryption Standard (DES) and explain its round functions emphasizing the role of substitution and permutation operations. | CO4 | U | 16 |
|  |  |  |  |  |  |
| 5. | a. | A social networking app faces public scrutiny over user data misuse. Discuss the relevance of privacy principles and policies in protecting digital identities. | CO5 | U | 8 |
|  | b. | A web platform faces regulatory audits for privacy compliance. Construct a privacy management system integrating data governance, consent, and audit controls. | CO5 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | A corporate database suffers from data exposure caused by poorly implemented query controls. Analyze the database vulnerabilities and assess their effects on reliability, integrity, and confidentiality of stored information. | CO3 | An | 8 |
|  | b. | A government portal implementing digital certificates faces identity spoofing attacks. Explain how cryptography enhances trust and authenticity in such systems. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 7. | a. | A document signing system must prevent forgery and unauthorized modification. Design a workflow using hash-based signatures and certificates for authenticity. | CO4 | A | 8 |
|  | b. | A wireless access point is compromised, exposing user credentials. Evaluate the vulnerabilities specific to wireless networks and their mitigation strategies. | CO2 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Following a disaster, an organization’s backup systems fail to restore data. Analyze gaps in disaster recovery and continuity planning. | CO6 | An | 10 |
|  | b. | An international hacking collective targets government systems. Discuss the legal and ethical boundaries defined by cyber warfare and international law. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Explain the various attacks in Cyberspace |
| CO2 | Classify the various risks that threaten Cyber Security |
| CO3 | Apply different controls to ensure the security of information |
| CO4 | Discover ways and means of identifying security breaches |
| CO5 | Recommend suitable controls and procedures for ensuring security |
| CO6 | Analyze the risk and maximize safety in transacting business in cyberspace |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS3013** | **Duration** | **3hrs** |
| **Course Title** | **DATA WAREHOUSING AND DATA MINING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Summarize the key differences in features of Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP). | CO1 | U | 8 |
|  | b. | Describe the three-tier data warehouse architecture with a neat block diagram, explaining the functions of each tier. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | Provide an overview about the general optimization techniques for efficient computation of data cubes. | CO2 | U | 8 |
|  | b. | Explore how sampling cubes work and how ranking cubes can be computed to resolve top-k queries. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 3. | a. | Outline the various correlation measures and discuss which ones are most suitable for mining large datasets, with reasons. | CO3 | U | 8 |
|  | b. | Summarize the major steps involved in data preprocessing effectively. | CO3 | U | 8 |
|  |  |  |  |  |  |
| 4. |  | Construct the confusion matrix for a binary classifier with two possible predicted classes: "yes" and "no". The class “yes” means they have the disease and "no" mean they do not have the disease. The classifier made a total of 165 patients was being tested for the presence of that disease. Out of those 165 cases, the classifier predicted "yes" 110 times, and "no" 55 times. False negatives (FN) is 5 patients who predicted not having disease, but they actually do have the disease. Calculate the following performance metrics along with its formula:   1. Accuracy 2. Error Rate 3. Precision 4. Recall 5. Specificity 6. F1-Score | CO4 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Provide an overview of the basic methodologies for stream data processing and querying. | CO5 | U | 8 |
|  | b. | How can the data be analyzed to identify trends? Given such data for two different stocks, can we find any similarities between the two? Explore it. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | Highlight the concept of social networks and its characteristics. | CO6 | U | 8 |
|  | b. | Identify and examine the various patterns commonly found in spatial data analysis. | CO6 | U | 8 |
|  |  |  |  |  |  |
| 7. |  | A financial analyst wants to segment customers based on their investment behavior using clustering techniques. The dataset below shows the monthly investment amount (in $) and the number of transactions for 10 customers.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Customer | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | | Monthly Investment ($) | 500 | 1500 | 800 | 2000 | 1200 | 700 | 1800 | 600 | 1700 | 1000 | | Number of Transactions | 5 | 15 | 7 | 20 | 12 | 6 | 18 | 5 | 16 | 10 |   Apply K-Means and K-Medoids clustering to divide the customers into 2 clusters. Assign each customer to a cluster. Compare the clusters obtained from K-Means and K-Medoids. Comment on any similarities or differences. | CO4 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | Consider the following transaction data from a fast food restaurant. Each transaction contains the items ordered by the customers.   |  |  | | --- | --- | | TID | List of Items | | T1 | Veg-burger, French-fries, Coke | | T2 | French-fries, Pepsi | | T3 | French-fries, Paneer-burger | | T4 | Veg-burger, French-fries, Pepsi | | T5 | Veg-burger, Paneer-burger | | T6 | French-fries, Paneer-burger | | T7 | Veg-burger, Paneer-burger | | T8 | Veg-burger, French-fries, Paneer-burger, Coke | | T9 | Veg-burger, French-fries, Paneer-burger |   Apply APriori algorithm to find all frequent item sets with minimum support threshold=22%. Provide the intermediate steps. Show pseudocode for the Apriori algorithm and its related procedures. How can we further improve the efficiency of Apriori-based mining? | CO3 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | describe the basic concepts of data warehousing, its architecture and implementation |
| CO2 | understand the concepts of data mining tasks and applications |
| CO3 | analyze and identify relevant algorithm for classification, clustering, prediction and association tasks for a given problem |
| CO4 | distinguish the principles of mining data streams, time-series data and sequence data |
| CO5 | summarize the principles and applications of different advanced mining techniques |
| CO6 | design and implement data mining algorithms using relevant tool for a given application |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **22CS2002** | **Duration** | **3hrs** |
| **Course Title** | **PREDICTIVE ANALYTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two applications of predictive modeling. | | CO1 | R | 1 |
| 2. | State the purpose of data cleaning in predictive modeling. | | CO1 | R | 1 |
| 3. | Write the Python syntax to select specific rows by their index in a pandas DataFrame. | | CO2 | R | 1 |
| 4. | Write a Python code to generate random integer between 45 and 100. | | CO2 | A | 1 |
| 5. | State the significance of the Central Limit Theorem in predictive modeling. | | CO3 | R | 1 |
| 6. | State the significance of using Z-statistic instead of a t-statistic in hypothesis testing. | | CO3 | R | 1 |
| 7. | Identify the class used to fit a linear regression model in Python’s ‘statsmodels’ library. | | CO4 | R | 1 |
| 8. | Differentiate between linear regression and logistic regression. | | CO4 | R | 1 |
| 9. | Given two points in 2-dimensional space, P1(6,8) and P2(4,3), calculate the Euclidean distance between them. | | CO5 | U | 1 |
| 10. | State the significance of temporal reasoning in knowledge representation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the importance of the **Knowledge Matrix** and **Task Matrix** in the development of a predictive modeling framework. | | CO1 | A | 3 |
| 12. | Write the formula (geometry-based) used in Monte Carlo simulation for approximating the value of π. | | CO2 | A | 3 |
| 13. | Write the Python code to convert the categorical variable into dummy variables for use in a Machine Learning model. | | CO3 | U | 3 |
| 14. | Write Python code to calculate the Variance Inflation Factor (VIF) to detect multicollinearity in a regression model. | | CO4 | U | 3 |
| 15. | Compute the Silhouette Coefficient for a data point A(18,8), with an average intra-cluster distance of 2 and an average nearest-cluster distance of 5. | | CO5 | A | 3 |
| 16. | Explain the importance of **defining functions for substantial individual tasks** in predictive modeling scripts. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the concepts of the bagging and boosting methods and explain their effectiveness in strengthening the accuracy of predictive models. | CO1 | A | 6 |
|  | b. | Write the Python code to accomplish the following tasks using the **pandas** library for the given dataset containing information about a set of employees. The dataset has **Employee\_id, Age, Department** ('HR', 'IT', 'Finance'), **Salary,** **Experience.** Handle the missing values in the **salary c**olumn by imputing them with the **median salary** of the dataset.   1. Convert the **department** categorical variable into dummy variables. 2. Normalize the **experience c**olumn using **Min-Max scaling** (range 0–1).   Combine the processed data into a new DataFrame and display the first few rows. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the Monte Carlo simulation method for estimating the value of π and outline the steps involved in the procedure. | CO2 | An | 6 |
|  | b. | **Analyze the following data using the Cumulative Distribution Function (CDF). The data represents the ages (in years) of a sample of 10 people: [28, 32, 35, 40, 45, 50, 35, 30, 65, and 70].**   1. Calculate the CDF for the given data. 2. Explain the purpose of the CDF in representing the probability distribution of the data | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the given dataset of students’ study hours and exam scores to determine whether there is a significant relationship between the number of study hours and exam performance using **hypothesis test.**   |  |  | | --- | --- | | **Study Hours** | **Exam Score** | | 2 | 50 | | 3 | 60 | | 4 | 70 | | 5 | 80 | | 6 | 85 | | CO3 | An | 6 |
|  | b. | Apply the Chi-square test to determine whether there is a significant association between **gender** and **preference for online vs. in-store shopping** in the dataset given below. Set the significance level at **0.05.**   |  |  |  |  | | --- | --- | --- | --- | | **Gender** | **Prefer Online** | **Prefer In-store** | **Total** | | Male | 80 | 40 | 120 | | Female | 70 | 60 | 130 | | **Total** | **150** | **100** | **250** | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Analyze the given dataset of defective items from a manufacturing process, assuming a Binomial distribution, and explain the estimation of the probability of defect (p) using the Maximum Likelihood Estimation (MLE) method.   |  |  |  | | --- | --- | --- | | **BatchID** | **DefectiveItems** | **BatchSize** | | 1 | 3 | 50 | | 2 | 5 | 60 | | 3 | 2 | 40 | | 4 | 4 | 55 | | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Construct a dendrogram for the below-given distance matrix using single linkage clustering approaches.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Clusters** | **A** | **B** | **C** | **D** | **E** | | A | 0 | 3 | 4 | 7 | 5 | | B | 3 | 0 | 6 | 6 | 7 | | C | 4 | 6 | 0 | 5 | 4.5 | | D | 7 | 6 | 5 | 0 | 2 | | E | 5 | 7 | 4.5 | 2 | 0 | | CO5 | An | 6 |
|  | b. | Develop a **decision tree classifier** using **scikit-learn** for the given dataset. Write a procedure outlining the steps for **data preprocessing, model training, visualization and evaluation**.  Dataset: Student Performance   |  |  |  |  | | --- | --- | --- | --- | | **Student ID** | **Hours Studied** | **Attendance %** | **Passed Exam (Yes=1, No=0)** | | 1 | 2 | 80 | 1 | | 2 | 1 | 85 | 1 | | 3 | 2 | 90 | 1 | | 4 | 3 | 95 | 0 | | 5 | 4 | 75 | 0 | | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the working principle of the ARIMA model and its significance in time series analysis with neat diagram. | CO6 | U | 6 |
|  | b. | A retail company wants to forecast the monthly sales of its flagship product for the next year. The company has collected the last 36 months of sales data. The data shows a clear seasonal pattern and some trend over time. Using the **Box-Jenkins method,** develop a Python code to forecast sales for the next 12 months.   |  |  | | --- | --- | | **Month** | **Sales** | | January,2025 | Rs.12,00,000 | | February,2025 | Rs.15,00,000 | | March, 2025 | Rs.45,00,000 | | April, 2025 | Rs.38,00,000 | | CO6 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the boosting ensemble method for improving the accuracy of predictive models. | CO1 | A | 6 |
|  | b. | Apply the **Elbow method** to a given customer segmentation dataset to determine the optimal number of clusters for K-Means clustering. Explain the step-by-step procedure and visualize the results using a suitable Python library.   |  |  |  | | --- | --- | --- | | **Customer\_Id** | **Annual Income** | **Spending Score** | | 1 | 15 | 39 | | 2 | 16 | 81 | | 3 | 17 | 6 | | 4 | 22 | 65 | | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the given sales dataset using Python code to perform the following operations:   |  |  |  | | --- | --- | --- | | **Product** | **Region** | **Sales** | | A | East | 120 | | B | West | 150 | | A | East | 180 |  1. Group data by **Product** and calculate total sales. 2. Apply **aggregation** and **filtering** to extract products with total sales greater than 250. 3. Demonstrate an **inner join** by combining this dataset with another dataset containing product category information. | CO2 | An | 6 |
|  | b. | Explain the role of version control tools like Git in efficiently managing time series projects with multiple updates and collaborative work. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the basic concepts and importance of predictive analytics |
| **CO2** | Describe data wrangling, and the process of preparing data for the models |
| **CO3** | Use statistical and visualization techniques for predictive models |
| **CO4** | Analyze performance of various regression and clustering techniques |
| **CO5** | Apply regression and classification model on applications for decision making |
| **CO6** | Build time series forecasting models in a variety of business contexts |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1005** | **Duration** | **3hrs** |
| **Course Title** | **PROGRAMMING FOR PROBLEM SOLVING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the software development life cycle phase that focuses on gathering the requirements in the program. | | CO1 | R | 1 |
| 2. | Write the basic header file used in ‘C’ program. | | CO1 | R | 1 |
| 3. | Name the operator that is used to display the size of the data type. | | CO2 | R | 1 |
| 4. | Determine the output for the following code:  #include<stdio.h>  void main ()  {  int x=15;  printf("%d",x++);  } | | CO2 | A | 1 |
| 5. | List the types of flow control statements. | | CO3 | R | 1 |
| 6. | Write the total number of characters support in C language. | | CO1 | U | 1 |
| 7. | Name a string function which is used to join two strings. | | CO4 | R | 1 |
| 8. | Define recursion. | | CO5 | R | 1 |
| 9. | Predict the output for the following code:  #include <stdio.h>  void sum(int m, int n)  {  int z;  z=m+n;  printf("%d",z);  }  void main() {  int a=10,b=12,c;  sum(a,b);  } | | CO5 | A | 1 |
| 10. | Predict the output of the following code.  #include<stdio.h>  struct Point {  int x;  int y;  };  int main()  {  struct Point p = {100, 200};  printf("%d", p.x);  } | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Evaluate the following expressions:   1. 22 + 3 < 6 && !5 || 22 = =7 && 22 – 2 > +5 2. a + 2 > b ||! c && a = = d \*a – 2 < = e   Where a=11, b=6, c=0, d = 7 and e=5. | | CO1 | A | 3 |
| 12. | Write a program that takes a user's age and validates it using relational operators to ensure it falls within a certain range (from 0 to 120). | | CO2 | A | 3 |
| 13. | Predict the output of the given C program. Justify your answer.   1. #include <stdio.h> 2. int main () 3. { 4. for (; ;) 5. { 6. Printf (" C programming "); 7. } 8. return 0;   } | | CO3 | U | 3 |
| 14. | Predict the output of the following code.  #include <stdio.h>  int main()  {  int a[4]={1,2};  int i;  for(i=0;i<4;i++)  {  printf("%d\n",a[i]);  }  return 0;  } | | CO4 | U | 3 |
| 15. | List the advantages and disadvantages of recursion. | | CO5 | R | 3 |
| 16. | Compare and contrast structures and unions in C. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the different basic data types in ‘C’ along with their memory size and range.  Write a program that declares one variable of each data type (int, float, char, double) and prints their sizes using the sizeof operator. | CO1 | A | 6 |
|  | b. | Explain about arrays in C? How are they declared and initialized? Write a ‘C’ program that reads 5 integer values into an array, calculates their sum and average, and displays the results. | CO1 | A | 6 |
| 18. |  | Write a C program to demonstrate the following bitwise operators: (Note: You can mention all the operators in a single program)   1. Bitwise OR 2. Bitwise XOR 3. Bitwise AND 4. Bitwise NOT | CO2 | A | 12 |
| 19. |  | Apply the bubble sort technique for sorting the numbers given in the list {15,0,5, 12,300,5,2} in ascending order and trace the output through C program. | CO3 | A | 12 |
| 20. |  | Explain the following steps involved in the C function (with example).  a. function declaration b. function definition c. Function call. | CO4 | U | 12 |
| 21. | a. | Construct a C program for Sum of n Natural Numbers Using Recursion. | CO5 | A | 6 |
|  | b. | Construct a C program to Reverse the given String Using Recursion. String: “PROGRAMMING” | CO5 | A | 6 |
| 22. |  | Apply the binary search algorithm for the below example and find the index position of the given key value. [Mention all the steps]  Consider the sorted array: 5 20 26 36 58 62 69 78 84 91 99  [Key value – 69]. | CO6 | A | 12 |
| 23. |  | Describe in detail about switch-case statement with a suitable example. | CO4 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop a ‘C’ program that takes a student's score as input (an integer value between 0 and 100) and uses a switch statement to determine the corresponding grade based on the following criteria:   1. Score 90 - 100: Grade A 2. Score 80 - 89: Grade B 3. Score 70 - 79: Grade C 4. Score 60 - 69: Grade D 5. Score 0 - 59: Grade F | CO2 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the fundamentals of computer and software development processes. |
| **CO2** | Identify the data type to represent the real time data representation and operators for computation |
| **CO3** | Prepare innovative solutions for the problem using branching and looping statements. |
| **CO4** | Decompose a problem into functions and synthesize a complete program using divide and conquer approach. |
| **CO5** | Formulate algorithms and programs using arrays, pointers and structures. |
| **CO6** | Create a new application software to solve real world problems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1009** | **Duration** | **3hrs** |
| **Course Title** | **ARTIFICIAL INTELLIGENCE IN IOT** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Enumerate the current challenges addressed by connected roadways. | | CO1 | R | 1 |
| 2. | State digitization. | | CO1 | R | 1 |
| 3. | Define IoT. | | CO2 | R | 1 |
| 4. | Label the IEEE standard of Zigbee. | | CO2 | R | 1 |
| 5. | State the need for optimization of IP. | | CO3 | R | 1 |
| 6. | Name the specific interface on the Raspberry Pi that can be controlled or accessed using Python programming. | | CO3 | R | 1 |
| 7. | Define Attack-as-an administration (Aaas). | | CO4 | R | 1 |
| 8. | List the approaches in Knowledge representation. | | CO4 | R | 1 |
| 9. | Define the role of machine learning in agriculture. | | CO5 | R | 1 |
| 10. | Enumerate few problems in conventional medical systems. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe about SANET. | | CO1 | U | 3 |
| 12. | Summarize the characteristics of Low Power and Lossy Networks (LLNs). | | CO2 | U | 3 |
| 13. | Differentiate between Microcontroller and Microprocessor. | | CO3 | U | 3 |
| 14. | Discuss briefly the architecture of Arduino UNO. | | CO4 | U | 3 |
| 15. | Summarize the kinds of knowledge. | | CO5 | U | 3 |
| 16. | Order the AI based service models developed for farmers. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Scenario: A leading automotive manufacturer developing a smart car equipped with advanced autonomous driving capabilities and innovative connectivity features. The company aims to revolutionize the driving experience by leveraging IoT technology to enhance safety, efficiency, and convenience for users. Illustrate the various sensors used for the smart car IoT application. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the major building blocks of IoT. | CO1 | A | 6 |
|  | b. | Illustrate the various actuator used for IoT applications. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain 6LoWPAN with examples. | CO2 | A | 6 |
|  | b. | Write a short note on smart objects and their characteristics. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Describe the components of the Arduino board with a neat diagram. | CO3 | U | 6 |
|  | b. | Construct the algorithm and Arduino sketch for blinking LED. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Examine a Scenario: A smart home automation company is developing a new AI-powered IoT device called "Home Genius" to revolutionize residential living. The device combines artificial intelligence with IoT sensors and actuators to provide personalized home automation, security, and energy management solutions. Consider factors such as user interface design, voice command integration, predictive analytics, energy efficiency optimization, and data privacy. As a product manager, responsible for the development of "Home Genius,"   1. Illustrate the design and the ways to market the AI-powered IoT device to meet the evolving needs of modern homeowners. 2. Outline the key features, functionalities, and use cases of "Home Genius" that differentiate it from existing smart home products. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | A scenario where a 20-story office building located in a bustling urban area. The building owner is committed to implementing sustainable and cost-effective practices while ensuring a comfortable and productive work environment for tenants. Develop an IoT-based smart building management system using the various methods of design methodology. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain the stages of Knowledge representation cycle. | CO5 | U | 6 |
|  | b. | Compare and contrast Robotic process automation and AI. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write in detail the key technologies to make 5G in reality using AI. | CO6 | A | 6 |
|  | b. | Sketch the components of AI required in Agriculture. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recognize the hardware and software components of IoT |
| **CO2** | Interpret technologies and protocols in IoT |
| **CO3** | Operate the tools in design and development |
| **CO4** | Demonstrate the practical applications and real-world scenarios |
| **CO5** | Relate security issues in IoT |
| **CO6** | Develop solutions to real time projects and case studies |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1012** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER ORGANISATION AND ARCHITECTURE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Explain the term Computer Architecture. | | CO1 | U | 1 |
| 2. | List the different phases of an Instruction Cycle. | | CO1 | R | 1 |
| 3. | Identify the different types of Interrupts. | | CO2 | R | 1 |
| 4. | Describe the function of DRAM with a suitable circuit diagram. | | CO2 | R | 1 |
| 5. | Define an I/O module. | | CO3 | U | 1 |
| 6. | State the significance of addressing modes. | | CO3 | R | 1 |
| 7. | Identify the role of Program Status Word. | | CO4 | U | 1 |
| 8. | Examine the 2’s complement subtraction of smaller number (101010) from larger number (111101). | | CO4 | R | 1 |
| 9. | Explain the disadvantages of implementing hardwired control unit. | | CO5 | U | 1 |
| 10. | Identify the memory component that stores microinstructions in microprogrammed control unit. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain bus arbitration and list its approaches. | | CO1 | An | 3 |
| 12. | Differentiate between Von Neumann and Harvard architectures with respect to memory organization and data flow. | | CO2 | U | 3 |
| 13. | Explain the limitations of Interrupt-Driven I/O and describe an alternative method to improve its efficiency. | | CO3 | An | 3 |
| 14. | Illustrate the given addressing mode by explaining its functionality and demonstrate its operation with a diagram. EA = (R). | | CO4 | U | 3 |
| 15. | Distinguish between write after read and read after write data hazard with a neat diagram. | | CO5 | An | 3 |
| 16. | Compare hardwired control and microprogram control with an example. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Describe Von Neumann Architecture with a neat diagram and explain the instruction cycle in detail with suitable examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Calculate the following by considering a fully associative mapped cache of size 512 KB with block size 1 KB. There are 17 bits in the tag.   1. Size of main memory 2. Number of lines in Cache | CO2 | A | 6 |
|  | b. | Explain interrupts and their importance in a computer system, along with the instruction cycle with interrupts. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the process of Programmed I/O and Interrupt-Driven I/O in handling I/O operations. | CO3 | U | 6 |
|  | b. | Illustrate a block diagram of the DMA module and demonstrate how it facilitates direct data transfer between memory and I/O devices. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Calculate the step-by-step process of multiplying 7 × 2 using Booth’s Algorithm, assuming a 4-bit binary representation for both numbers. Provide a detailed explanation of each step involved. | CO4 | A | 7 |
|  | b. | Compute the subtraction of -2 from -5 using 2’s complement method. | CO4 | A | 5 |
|  |  |  |  |  |  |
| 21. |  | Apply the syndrome word calculation error detection method to detect the error bit position and rectify the same. Sketch the necessary diagram for the following calculation. Consider the Data bits: 00001111. While writing this data bit into the memory, how many check bits are required. While reading the same data bit, the following is received from the memory: 00001110. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the various addressing modes commonly employed in modern processors by highlighting their characteristics with suitable examples and diagrams. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the block diagram of an I/O (Input/Output) module and elucidate its key components along with their respective functions. | CO5 | A | 8 |
|  | b. | Describe the various stages in which an instruction execution takes place using instruction cycle state diagram. | CO5 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate how the instructions flow through the various stages of pipelining. Identify the types of hazards which may occur during pipelining and propose suitable solutions to overcome the hazards. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Explain function of the Central Processing Unit. |
| **CO2** | Develop algorithms for error correction for memory modules (main and cache memory). |
| **CO3** | Design and understand various input and output modules for central processing unit. |
| **CO4** | Select and use standard addressing modes for logical and physical memory addressing. |
| **CO5** | List and define various stages of instruction pipelining in processor. |
| **CO6** | Explore various ways to implementing the micro instruction sequencing and execution. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1015** | **Duration** | **3hrs** |
| **Course Title** | **C PROGRAMMING AND APPLICATIONS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name any one open source operating system. | | CO1 | R | 1 |
| 2. | Give an example for Non-Volatile Memory. | | CO1 | R | 1 |
| 3. | Evaluate the following expression:  50 % 2 / 3 + 2 | | CO2 | U | 1 |
| 4. | Predict the output of the following Code:  main()  {  char x;  x = ‘a’;  printf(“%d\n”, x);  } | | CO2 | A | 1 |
| 5. | Predict the output of the following code.  #include  int main()  {  int a = 5;  printf("%d\n", a--);  printf("%d\n", --a);  return 0;  } | | CO3 | U | 1 |
| 6. | Determine the output of the following code.  #include <stdio.h>  int main()  {  for(int i = 0; i < 5; i++)  {  if(i == 3)  continue;  printf("%d ", i);  }  return 0;  } | | CO3 | U | 1 |
| 7. | Define a recursive function to calculate the factorial of a number | | CO4 | A | 1 |
| 8. | List any two built-in functions for mathematical operations. | | CO4 | R | 1 |
| 9. | Show a C function to compare two strings. | | CO5 | R | 1 |
| 10. | Recall the syntax of pointer declaration. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between System software and Application software. | | CO1 | An | 3 |
| 12. | Identify the tokens in the following code  #include<stdio.h>  Void main ()  {  int a ,b,Sum  a=5;  b=4;  Sum=a+b  Printf(“%d\n”,Sum) ;  } | | CO2 | U | 3 |
| 13. | Show the C code to display the odd and even numbers till n using for and while loop | | CO3 | A | 3 |
| 14. | Provide the function definition and function declaration to perform the sum of the array elements. | | CO4 | A | 3 |
| 15. | Declare and initialize two-dimensional array. | | CO5 | R | 3 |
| 16. | Illustrate the syntax of structure in C. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write algorithm for finding biggest number among 3 numbers. | CO1 | U | 6 |
|  | b. | Define flowchart and list the different symbols used for flowchart. Draw flow chart to find the average of three numbers. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Demonstrate the compilation and execution process of C with a neat diagram | CO2 | U | 8 |
|  | b. | Develop a C program to find the factorial of a number. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the various Conditional Branching Statements used in C with its syntax and flow diagram. | CO3 | R | 7 |
|  | b. | Write a program to generate n Fibonacci numbers. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. |  | Describe the classification of user-defined functions with suitable example. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Write a C program to take 5 values from the user, store them in an array and print the values. | CO5 | A | 7 |
|  | b. | Write a C program to find whether a given string is palindrome or not. | CO5 | A | 5 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate between call by value and call by reference with a suitable example. | CO4 | U | 6 |
|  | b. | Write a C program to sort the given n strings in alphabetical order | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Construct a “nested for” loop statement in C to print a multiplication table for a given number. | CO3 | A | 6 |
|  | b. | Illustrate the logic behind IF-ELSE ladder with suitable example. | CO3 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write a C program to maintain a record to store information about an employee, including their ID, name, salary, and department. Use structures and pointers define the above details and display the contents. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Infer the basic organization of computer and the ability to represent algorithms using flowcharts and pseudo code. |
| **CO2** | Practice C programming using various data types and operators to solve basic problems. |
| **CO3** | Implement conditional statements and looping to control program flow and repetition respectively. |
| **CO4** | Demonstrate the concept of reusability through functions and recursion. |
| **CO5** | Develop 1D, 2D arrays and string operations in C. |
| **CO6** | Apply the pointers in C for memory manipulation and efficient data access. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1017** | **Duration** | **3hrs** |
| **Course Title** | **CODING FOR PROBLEM SOLVING-PYTHON** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the output of the following python code:  print(type(30 + 8.5)) | | CO1 | U | 1 |
| 2. | List the different data types that can be stored in Python. | | CO1 | R | 1 |
| 3. | List any two features of tuple in python. | | CO2 | R | 1 |
| 4. | Determine the type of x after this statement: x = int(9.5) | | CO2 | A | 1 |
| 5. | Identify the output of s[-3:], given s=”Python” | | CO3 | U | 1 |
| 6. | State the output of the following python code: | | CO3 | R | 1 |
| 7. | Give an example of a user-defined function. | | CO4 | U | 1 |
| 8. | List any one feature of dictionary with an example. | | CO4 | R | 1 |
| 9. | Identify the output of the following code "abc".upper() | | CO5 | R | 1 |
| 10. | Name the function used to read an entire file as a single String. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write a program to print 5 natural numbers except 2 using control structures. | | CO1 | A | 3 |
| 12. | Differentiate between break and continue statements in Python with examples. | | CO2 | U | 3 |
| 13. | Write a Python program to check whether a given number is even or odd. | | CO3 | A | 3 |
| 14. | Write a Python program to check whether an element exists in a list or not. | | CO4 | A | 3 |
| 15. | Construct a user-defined function that calculates the factorial of a given number using recursion. | | CO5 | A | 3 |
| 16. | Write a Python program to check if a file exists before reading it | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | **Design** a Python program that demonstrates different numerical data types and variable assignments and explain the output in detail. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Develop a Python program that accepts the user’s age as input and categorizes them as a child, teenager, adult, or senior citizen using the if–elif–else statement. | CO2 | A | 6 |
|  | b. | Explain the Bitwise and Relational operators in Python with suitable examples and sample code. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Write a Python program to print Fibonacci series up to n terms. | CO3 | A | 6 |
|  | b. | Explain the logic of “if loop” with example program. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Describe the following String handling operations with example code and justifications:  isalpha(), find(), count(), startswith(),replace(),format() | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Demonstrate the concept of various operations that can be performed on the Lists and Tuples using Python. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Design a Python function to reverse a list and to find the square of each element in the list. | CO5 | A | 6 |
|  | b. | Write a python recursive functions to read a number as input and display the factorial of that number using loop. | C05 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the different file handling modes in Python with examples | CO6 | U | 6 |
|  | b. | Explain the process of manipulating files and directories in Python with an example program | CO6 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Write a Python program that takes a text file as input and returns the number of words of a given text file. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Examine the basic syntax and semantics of Python Programming language for problem solving. |
| **CO2** | Infer the concepts of operators and control statements. |
| **CO3** | Apply Programming concepts for string manipulation. |
| **CO4** | Select appropriate data structures available in python language for solving problems. |
| **CO5** | Design Python functions for real life problems. |
| **CO6** | Develop software solutions using file handling concepts. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2001** | **Duration** | **3hrs** |
| **Course Title** | **ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What is Artificial Intelligence? | | CO1 | U | 1 |
| 2. | Define an agent. | | CO1 | R | 1 |
| 3. | Define Backtracking search. | | CO2 | R | 1 |
| 4. | List the performance measures of search strategies. | | CO2 | R | 1 |
| 5. | What is propositional logic? | | CO3 | U | 1 |
| 6. | Define Unification algorithm | | CO3 | R | 1 |
| 7. | What is backward reasoning in problem-solving? | | CO4 | U | 1 |
| 8. | What is a weak slot in a slot and filler structure? | | CO4 | R | 1 |
| 9. | What is rote learning in AI? | | CO5 | U | 1 |
| 10. | What are the characteristics of expert systems? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What are the four components to define a problem? Define them. | | CO1 | An | 3 |
| 12. | Differentiate Blind Search and Heuristic Search. | | CO2 | U | 3 |
| 13. | Explain Resolution in brief with an example. | | CO3 | An | 3 |
| 14. | Explain how nonlinear planning using constraint posting differs from linear planning. | | CO4 | U | 3 |
| 15. | Draw and explain AI Knowledge representation Cycle. | | CO5 | An | 3 |
| 16. | Explain on Learning by Analogy. Give example. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the concept of typical intelligent agents and describe their main components. | CO1 | R | 6 |
|  | b. | Write a note on PEAS representation. Why PEAS representation is important? | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. |  | Elaborate in detail about problem-solving approach in artificial intelligence problems. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Discuss in detail the uninformed search strategies and compare the analysis of various searches. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Discuss AO\* algorithm in detail? | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the Minimax algorithm in detail. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate Backward Reasoning and Forward Reasoning. | CO4 | A | 6 |
|  | b. | Discuss briefly about Bayesian probability. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Explain what strong slot and filler structures are, contrasting them with weak slot and filler structures. Then, analyze how these structures are used in artificial intelligence by applying this knowledge to a detailed example. | CO5 | R | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss in detail about Explanation-based learning. | CO6 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the basics of Artificial Intelligence. |
| **CO2** | Identify the appropriate search algorithms for any AI problem. |
| **CO3** | Prepare appropriate knowledge - based rules to identify causal relationships and conditional independence of a real - world situation. |
| **CO4** | Select the appropriate search method for identifying different search spaces. |
| **CO5** | Evaluate the working knowledge of reasoning in the presence of incomplete and/or uncertain information. |
| **CO6** | Produce the learning theory for expert systems |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2004** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER NETWORKS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the main components of the internet. | | CO1 | R | 1 |
| 2. | Compare the efficiency of a wireless network over wired networks. | | CO1 | E | 1 |
| 3. | Identify the default port numbers used by FTP. | | CO2 | R | 1 |
| 4. | Select the most suitable application protocol for web application. | | CO2 | E | 1 |
| 5. | Recall the structure of UDP header fields. | | CO3 | R | 1 |
| 6. | Justify the necessity of IP protocol in networks. | | CO3 | E | 1 |
| 7. | List the main functions of the network layer. | | CO4 | R | 1 |
| 8. | Compare the pros and cons of DHCP in large-scale mobile networks. | | CO4 | E | 1 |
| 9. | Identify the function of ICMP. | | CO5 | R | 1 |
| 10. | Categorize link layer protocols based on access control mechanisms. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate among various delay components in a data transmission path. | | CO1 | An | 3 |
| 12. | Define the term Domain Name System (DNS). | | CO2 | R | 3 |
| 13. | Distinguish the principles behind the working of TCP and UDP. | | CO3 | An | 3 |
| 14. | Justify the transition from IPv4 to IPv6. | | CO4 | E | 3 |
| 15. | Compare and contrast RIP and OSPF routing protocols. | | CO5 | An | 3 |
| 16. | Assess the use of VLANs in enterprise LAN design. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe in detail the different types of guided and unguided transmission media used in communication systems | CO1 | U | 6 |
|  | b. | Illustrate and explain the various a wired access network and an wireless access network with respective figures. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain client-server interaction using HTTP protocol in detail with necessary diagram. | CO2 | U | 6 |
|  | b. | A packet of size **5 MB (40 x106** bits) is sent from **Host A** to **Host B** through a **single router**. The **link bandwidth** of each connection is **10 Mbps (10 x106** bits), and the **distance** between the nodes is **2000 km (2 x106** m). The **propagation speed** of the signal is **2 × 10⁸ m/s**. The router introduces an average **queuing delay** of **25 ms** and a **processing delay** of **5 ms**. Compute the total delay. | CO2 | A | 6 |
| 19. | a. | Explain the concepts of multiplexing and de-multiplexing with suitable examples. | CO3 | A | 6 |
|  | b. | Illustrate and explain the TCP for data transfer in a network. Describe its working mechanism and represent the TCP packet structure with a neat, labeled diagram. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail about the role of NAT in network configuration. | CO4 | U | 6 |
|  | b. | Tabulate and categorize the private, shared, or Multicast group or broadcast classes and also identify the following IP addresses for the same.  i) 172.16.45.10 ii) 239.255.255.250 iii) 100.64.10.15 iv) 172.16.4.255 | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the main components of Software Defined Networking (SDN), including data plane switches, the control plane (SDN controller) and control applications. | CO5 | U | 6 |
|  | b. | Compute the least-cost path from node ‘x’ to node ‘y’, using the distance vector routing algorithm, given that node ‘x’ maintains a distance vector Dx​ and knows the cost to each neighbor c(x,v). | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the concept of **channel partitioning** in TDMA & FDMA. Illustrate your answer with simple diagrams. | CO6 | U | 6 |
|  | b. | Illustrate and explain the **Cyclic Redundancy Check (CRC)** error detection technique with your own example. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the various design models while creating a simple network topology. | CO1 | U | 6 |
|  | b. | Construct a packet-switched network model for a small enterprise and explain how packets are routed efficiently through the network nodes. | CO1 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the structure of the OSI–ISO layered protocol model and illustrate the role of each layer in network communication. | CO1 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Identify the key architectural principles in computer network infrastructure and development. |
| **CO2** | Analyze the conceptual and implementation aspects of network applications. |
| **CO3** | Evaluate the transport layer protocols and their functionalities. |
| **CO4** | Apply optimized IP addressing scheme and forwarding mechanisms. |
| **CO5** | Explain the routing algorithms and management solutions for scaling networks. |
| **CO6** | Experiment with real time problems to build effective local and global networks. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2006** | **Duration** | **3hrs** |
| **Course Title** | **LARGE LANGUAGE MODEL** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the main function of the feed-forward layer in a Transformer block. | | CO1 | R | 1 |
| 2. | Predict the **tokenization method** that reduces vocabulary size while preserving meaning in Large Language Models (LLMs). | | CO1 | U | 1 |
| 3. | Infer the **role of CUDA** in training large neural networks. | | CO2 | U | 1 |
| 4. | Define **Zero-Shot Classification**. | | CO2 | R | 1 |
| 5. | Determine the **purpose of the [CLS] token** in BERT-based models. | | CO3 | A | 1 |
| 6. | Define **Dense Retrieval** in semantic search. | | CO3 | R | 1 |
| 7. | List two real-world application of Prompt Engineering in LLMs. | | CO4 | R | 1 |
| 8. | Identify the function of **quantization** in LLMs. | | CO4 | R | 1 |
| 9. | Define a **Vision Transformer (ViT).** | | CO5 | R | 1 |
| 10. | Predict the key role of **multimodal embeddings** in LLMs. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between attention mechanism and feed-forward network in Transformer models. | | CO1 | A | 3 |
| 12. | Analyze and outline how the GPT-2 tokenizer splits the following sentence:  text = "AI is smart, right?"  tokenizer.tokenize(text) | | CO2 | An | 3 |
| 13. | Compare Supervised and Generative Text Classification. | | CO3 | An | 3 |
| 14. | Distinguish between Nearest Neighbor Search and Vector Database Search in semantic search. | | CO4 | U | 3 |
| 15. | Describe the role of Instruction-Based Prompting in improving text generation accuracy. | | CO5 | U | 3 |
| 16. | Explain the process by which CLIP connects text and image embeddings for multimodal understanding. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the basics of LLMs. Discuss the importance of matrix computation on GPUs in scaling LLMs with suitable examples. | CO1 | U | 8 |
|  | b. | Summarize the workflow of Supervised Text Classification. How does model selection impact classification accuracy? | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Describe the GPU architecture and explain how CUDA kernels achieve parallel computation. Include memory hierarchy, thread blocks, and kernel execution with examples from LLM training. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Distinguish between the workflow of Supervised and Zero-Shot Text Classification.  Include data pre-processing, tokenization, fine-tuning, and evaluation metrics.  Compare their advantages and limitations. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Differentiate between various text clustering pipelines that includes embedding, dimensionality reduction and clustering the reduced embeddings. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain major Prompt Engineering strategies – zero-shot, few-shot, chain-of-thought, and instruction-based. Analyze how temperature and top-p affect generative output. Illustrate using a sample prompt and response. | CO5 | U | 8 |
|  | b. | Construct a LangChain pipeline integrating a prompt template, memory, and quantized model for contextual story generation.  Briefly explain the purpose of each component. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Apply the concept and workflow of Reranking in Semantic Search.  Describe how bi-encoder and cross-encoder models work together in a retrieval pipeline to improve precision and user relevance.  Illustrate your answer with a neat diagram of a real-world example. | CO3 | A | 8 |
|  | b. | Illustrate the function of cosine similarity in determining similarity between embeddings. Write the formula and briefly interpret what a high or low cosine value indicates. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | A company wants to analyze thousands of customer reviews to find common themes using topic modeling.  Explain the company’s use of the BERTopic pipeline – including vectorization, term frequency and IDF to accomplish the task. | CO4 | A | 8 |
|  | b. | Describe the various visualization tools in BERTopic that help managers clearly understand and present these topics. | CO4 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the ViT architecture and compare it with CNNs concerning feature extraction and attention mechanism. Discuss its role in multimodal learning. | CO6 | An | 8 |
|  | b. | Describe the process by which CLIP fuses image and text embeddings for joint understanding and generation. Provide a real-world application example. | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Examine the theoretical foundations of LLMs including neural networks. |
| **CO2** | Analyze the working methodology of GPU. |
| **CO3** | Apply supervised text classification methodologies, including zero-shot classification and classification employing generative models. |
| **CO4** | Illustrate diverse semantic search methodologies within LLMs. |
| **CO5** | Discover text clustering, topic modeling, and text generation through the utilization of GPT models. |
| **CO6** | Employ acquired knowledge to comprehend multimodal large language models. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2010** | **Duration** | **3hrs** |
| **Course Title** | **GENERATIVE AI** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Chain of Thought (CoT) reasoning. | | CO3 | R | 1 |
| 2. | Infer the purpose of RLHF. | | CO2 | U | 1 |
| 3. | State the use of Prompt Engineering in Generative AI. | | CO1 | R | 1 |
| 4. | Identify the main feature of an LSTM network. | | CO3 | R | 1 |
| 5. | Infer the need for positional embeddings in Transformer models. | | CO3 | U | 1 |
| 6. | State the relationship among query, key, and value in the attention mechanism. | | CO3 | R | 1 |
| 7. | Define Positional Embedding. | | CO3 | R | 1 |
| 8. | State the function of RMS Norm in Transformer training. | | CO4 | R | 1 |
| 9. | Infer the acronym DDPM. | | CO5 | U | 1 |
| 10. | Give an example of using AI in a construction company. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the components of Generative AI. | | CO1 | U | 3 |
| 12. | Give an example of tri-gram tokenizing approach. | | CO2 | U | 3 |
| 13. | Describe how auto-regressive generation produces text. | | CO3 | U | 3 |
| 14. | List out any 3 advanced features of Claude model. | | CO4 | R | 3 |
| 15. | Infer the use of Gaussian filter in diffusion models. | | CO5 | U | 3 |
| 16. | Define the contribution of Anthropic in the field of AI. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.of No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | An online news platform wants to automate news article writing, image generation, and video summaries. Identify the relevant Generative AI domains, recommend models or tools, and justify how they improve content production. | CO1 | R | 6 |
|  | b. | List any six characteristics of GPT model. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 18. |  | Analyze the evolution from traditional neural networks to large language models (LLMs). List out the advancements enabled modern LLMs to outperform earlier architectures. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Illustrate the architecture of the Transformer model by detailing the roles of the encoder, decoder, and the self-attention mechanism, and explain why this architecture is considered revolutionary for NLP tasks. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Compare the architecture of Google Bard with the Transformer-based other models. Infer the key differences in their underlying mechanisms and its impact’s influence on intended applications. | CO4 | An | 6 |
|  | b. | Examine supervised fine-tuning and reinforcement learning from human feedback (RLHF) in improving ChatGPT responses. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the human-centered design philosophy of Claude 2. Discuss how does it ensure ethical, context-sensitive, and safe AI behavior. | CO4 | An | 6 |
|  | b. | Compare and contrast Generative AI applications in healthcare and marketing. Discuss how the technology transforms each sector and potential ethical concerns. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate retrieval-augmented generation approaches in Bard versus traditional GPT models. | CO4 | U | 6 |
|  | b. | Develop a Multi-label zero-shot text classifier using an open-source framework with necessary process flow. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the U-Net architecture which is a diffusion model. Explain the role of skip connections, encoding-decoding layers, and attention mechanisms in improving image generation quality. | CO5 | U | 6 |
|  | b. | Describe the complete forward diffusion process and the reverse denoising process of Diffusion Probabilistic Models (DPM), including the probabilistic principles and mechanisms that enable accurate generation. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze how Generative AI and immersive technologies enhance teaching, learning, and administrative decision-making in the educational Metaverse. Discuss the content from the following perspectives:   * The role of AI tools in student data analysis, personalized learning paths, and adaptive assessment. * fine-tuned generative models support interactive lesson creation, virtual labs, and immersive simulations. * The ethical, privacy, and accessibility challenges that arise in Metaverse-based education. * Suitable examples or case studies demonstrating practical impact, such as improved engagement, learning outcomes, or teacher support. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Identify the components and domains of generative AI, including the models used by current players in the field. |
| **CO2** | Memorize the key features and characteristics of large language models, such as transformer architecture and contextual embedding. |
| **CO3** | Explain the evolution of neural networks to large language models and the principles behind their functioning. |
| **CO4** | Interpret the architecture and functionality of chatgpt and other models. |
| **CO5** | Assess the ethical considerations and biases inherent in large language models, particularly in the context of chatgpt and its applications. |
| **CO6** | Evaluate the potential impact and effectiveness of generative AI techniques in diverse fields. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2011** | **Duration** | **3hrs** |
| **Course Title** | **DATASTRUCTURES AND ALGORITHMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Give an algorithm that has a logarithmic running time. | | CO1 | U | 1 |
| 2. | Identify the number of times the comparison statement in line number 4 of the following algorithm is executed.   1. Algorithm trial(n): 2. i = n 3. while i >= 1: 4. print(“i = “, i) 5. i = i - 1 | | CO1 | A | 1 |
| 3. | Write the best-case time complexity of the insertion sort algorithm. | | CO1 | U | 1 |
| 4. | Predict the total number of moves required to solve the Tower of Hanoi problem with 4 discs. | | CO2 | A | 1 |
| 5. | State the outcome of Quick Sort after the first pass of the algorithm. | | CO4 | R | 1 |
| 6. | Identify the number of iterations required by radix sort for the list: 45, 786, 21, 9, 4576, 98, 35, 2, 65, 125 | | CO4 | R | 1 |
| 7. | Identify the type of tree traversal for the following code.  public void func(Tree root)  {  func(root.left());  func(root.right());  System.out.println(root.data());  } | | CO5 | U | 1 |
| 8. | Determine the specific type of complete binary tree shown in the diagram.  [Tree is example for binary tree since with two children & the left & right children](https://www.sanfoundry.com/wp-content/uploads/2018/07/binary-tree-operations-questions-answers-q2.png) | | CO5 | U | 1 |
| 9. | Examine the given trees (a) and (b) and determine which one satisfies the properties of an AVL tree and which one does not. | | CO5 | A | 1 |
| 10. | Predict whether the given graph is cyclic or acyclic. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write a brief note on Abstract Data Type. | | CO1 | A | 3 |
| 12. | Evaluate the postfix expression **“ABC+\*D-”,** where A =5, B = 2, C = 6 and D = 20 using stack. | | CO2 | An | 3 |
| 13. | Consider the following circular linked list:    Write the code to insert “23” at the front of the above circular linked list. | | CO3 | An | 3 |
| 14. | Rewrite the order of values after each iteration by applying the bubble sort algorithm to arrange the list {18, 32, -11, 6, 68, 2, -34} in ascending order. | | CO4 | U | 3 |
| 15. | Explain how the hash function VALUE mod 7 works and describe how linear probing resolves collisions when inserting the values 28, 39, 17, 45, and 49 into a hash table of size 7. | | CO4 | U | 3 |
| 16. | Give an overview about weighted and directed graphs with an example. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the time and Space complexity with a suitable example. | CO1 | U | 6 |
|  | b. | Write an algorithm to perform insert and delete operations in a stack. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the conversion of infix expressions into its equivalent postfix expressions using stack:   1. (a+ b - c) / (d - e) + f 2. g \* (h + i) \* j - k \* (l + m / n) | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Implement a queue using an array. The queue should support the operations enqueue, dequeue, isFull, and isEmpty. Write the pseudocode (or class implementation) and illustrate the state of the queue after performing the sequence of operations:  enqueue(10), enqueue(20), enqueue(30), dequeue(), enqueue(40). | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Describe the following functions in a singly linked list with suitable pseudocode:   * Insert at the front * Delete from the end | CO3 | U | 8 |
|  | b. | Consider the following doubly linked list scenario. Write the pseudocode to delete a node (like the one containing “Joshua”) from the middle of a doubly linked list.  https://miro.medium.com/v2/resize:fit:700/1*v9rGcGh8EPmLn3Q2LqXEtw.jpeg | CO3 | An | 4 |
|  |  |  |  |  |  |
| 21. |  | Write an algorithm for Merge Sort and illustrate the working of the merge sort algorithm in the list of numbers: 42, 23, 74, 11, 65, 58, 94, 36, 99, and 87. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Construct a binary search tree by inserting the values **35, 46, 29, 23, 34, 28, 9, 32, 73, 63, 92.** | CO5 | A | 6 |
|  | b. | Construct a B-tree of order 5 from the list of items: A, G, F, B, K, D, H, M, J, E, S, I, R, X, C, L, N, T, U, P. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Build the AVL tree for the following sequence of numbers: 15, 17, 11, 7, 53, 3, 13, 12, 8, 60, and 19.Illustrate each insertion and rotation performed during the tree formation process. | CO5 | A | 8 |
|  | b. | Illustrate the pseudocode to perform linear search on a given set of ‘n’ numbers. Using the algorithm, search for the element 48 in the set [1S1, 43, 24, 54, 48, 63, 82, 19] | CO4 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate Breadth-First Traversal and Depths-First Traversal of a graph data structure with the pseudocode. Apply the algorithm to the following graph: | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze the time and space complexity of the algorithms. |
| **CO2** | Develop stack and queue operations using arrays. |
| **CO3** | Develop dynamic data structures using linked lists. |
| **CO4** | Apply sorting, searching, and hashing techniques for data-driven applications. |
| **CO5** | Develop tree-based data structures. |
| **CO6** | Choose suitable graph representations and traversals. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2013** | **Duration** | **3hrs** |
| **Course Title** | **DATABASE MANAGEMENT SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Recall the functions of database management systems and database administrators in software applications. | | CO1 | U | 1 |
| 2. | Identify a primary key in the students’ mark analysis system. | | CO1 | R | 1 |
| 3. | State the difference between DELETE and TRUNCATE commands in SQL. | | CO2 | R | 1 |
| 4. | Write the SQL command to create a table named Employee with attributes (EmpID, Name, Salary). | | CO2 | R | 1 |
| 5. | Give the definition of 1NF and 2NF in simple terms. | | CO3 | U | 1 |
| 6. | What is a composite attribute? Give an example. | | CO3 | R | 1 |
| 7. | Why is RAID used in DBMS? | | CO4 | U | 1 |
| 8. | State the purpose of ordered indexing | | CO4 | R | 1 |
| 9. | What is a transaction in DBMS? Give an example. | | CO5 | U | 1 |
| 10. | Give two real-life examples where a graph database can be used. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What is a foreign key? Give a simple example of its use. | | CO1 | An | 3 |
| 12. | Compare INNER JOIN and OUTER JOIN in SQL with a simple example. | | CO2 | U | 3 |
| 13. | List the three types of anomalies in a database and give a simple example for each. | | CO3 | An | 3 |
| 14. | Outline a B-Tree of order 3 for the keys: 10, 20, 5, 6, 12. Then insert 15 into the tree. | | CO4 | U | 3 |
| 15. | Explain ACID properties with a simple bank transaction example. | | CO5 | An | 3 |
| 16. | Explain Key–Value based NoSQL databases with a simple example. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | List the 8 types of keys in a relational database. Give an example for each. | CO1 | U | 8 |
|  | b. | Consider the following Employees table. Write an SQL query to   1. Find the names and departments of employees who earn more than the *average salary* of their respective departments. 2. Display the highest-paid employee in each department.  |  |  |  |  | | --- | --- | --- | --- | | **EmpID** | **Name** | **Dept** | **Salary** | | 101 | Alice | HR | 40000 | | 102 | Bob | IT | 50000 | | 103 | Charlie | Finance | 45000 | | 104 | David | IT | 55000 | | 105 | Eva | HR | 42000 | | 106 | Frank | Finance | 48000 | | 107 | Grace | IT | 60000 | | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Explain the difference between the UNION and INTERSECT operations in SQL. Use suitable examples table to illustrate your answer. | CO2 | U | 6 |
|  | b. | Explain what is a trigger in SQL. Create a trigger on the Student table that automatically sets the RegDate column to the current date whenever a new student is inserted.   |  |  |  |  | | --- | --- | --- | --- | | **StudentID** | **Name** | **Course** | **RegDate** | | 1 | Anitha | BCA | 2025-01-15 | | 2 | Raj | MCA | 2025-01-18 | | 3 | Priya | B.Tech | 2025-02-02 | | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Examine the concept of a Functional Dependency in the context of relational databases. Illustrate your answer with a suitable example to highlight its significance in database design. | CO3 | U | 5 |
|  | b. | Normalize the following table to 3NF.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **EmpID** | **EmpName** | **Dept** | **DeptHead** | **Projects** | **Salary** | | 201 | John | CS | Alice | Alpha, Beta | 5000 | | 202 | Mary | CS | Alice | Beta | 5500 | | 203 | Steve | IT | Bob | Gamma | 6000 | | 204 | John | CS | Alice | Alpha | 5000 | | CO3 | An | 7 |
|  |  |  |  |  |  |
| 20. | a. | i. Compare static hashing and dynamic hashing in database file organization in terms of performance, scalability, and space utilization. [3]  ii. A database initially uses static hashing with 4 buckets. As the number of records grows, the overflow chains are increasing, causing slower access. Suggest a suitable hashing technique to overcome this problem, explain why it is better, and illustrate with an example. [3] | CO4 | U | 6 |
|  | b. | Draw a B-Tree of order 4 for the keys: 15, 25, 5, 10, 20, 30. Show the tree after inserting 12. After constructing the B-Tree as above, insert 18 into the tree. Show all splits and changes in the tree structure. Then explain why B-Trees maintain balance and how the order affects the maximum number of keys per node. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain what serializability is in the context of database transactions with an example. | CO5 | U | 5 |
|  | b. | Given the following transactions:  T1: Read(A), Write(A)  T2: Read(A), Write(A)   * Draw a schedule showing the operations interleaved. * Determine if the schedule is conflict-serializable. * If not, show a serial schedule equivalent to it. | CO5 | An | 7 |
|  |  |  |  |  |  |
| 22. | a. | Briefly explain the parts of an Entity-Relationship (ER) Diagram? | CO3 | U | 6 |
|  | b. | Draw a neat ER diagram for this scenario. Identify entities, primary keys, attributes, and relationships with cardinalities.  A Streaming Platform (like Netflix) manages its data as follows:   * The platform has Users, Shows, and Subscriptions. * Each User has exactly one active Subscription, but a Subscription can be shared by multiple Users (family plan). * Shows can belong to multiple Genres, and each Genre can include multiple Shows. * Users can rate Shows they watch. Each rating is associated with one User and one Show. * Users can create Watchlists, and each Watchlist can contain multiple Shows. A Show can be in multiple Watchlists. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | A database administrator is designing a new database system for a large e-commerce platform. Compare and evaluate the different file organization methodsin terms of access speed, insertion/deletion efficiency, and storage utilization. For each method, give a real-world scenario where it would be most appropriate. | CO4 | U | 6 |
|  | b. | Given the following table of instructors, organize the records in:   * Sequential order by InstructorID * Hash organization using Hash Function: InstructorID mod 5  |  |  |  |  | | --- | --- | --- | --- | | **InstructorID** | **Name** | **Dept** | **Salary** | | 105 | Eva | Finance | 70000 | | 101 | Alice | Comp. Sci. | 60000 | | 108 | Helen | Music | 50000 | | 104 | David | History | 58000 | | 103 | Charlie | Comp. Sci. | 62000 | | 107 | Grace | Elec. Eng. | 68000 | | 102 | Bob | IT | 55000 | | 106 | Frank | Biology | 72000 | | CO4 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Define and explain the CAP Theorem in distributed systems. | CO6 | U | 5 |
|  | b. | Google Drive is a distributed cloud storage system used by millions of users worldwide. Considering the CAP theorem, identify which two properties it prioritizes. Explain your reasoning and discuss the implications of this choice for user experience. | CO6 | An | 7 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the functions of database management systems and database administrators in software applications. |
| **CO2** | Implement sql queries to retrieve, update, and manipulate data in a relational database. |
| **CO3** | Design the database by understanding the concept of er - model and normalization technique. |
| **CO4** | Develop and implement database object file structure and index schema. |
| **CO5** | Describe the techniques of transaction process and concurrency control strategies. |
| **CO6** | Apply nosql concepts effectively in real-world database scenarios. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2022** | **Duration** | **3hrs** |
| **Course Title** | **INTERNET OF THINGS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Describe Internet of Things. | | CO1 | U | 1 |
| 2. | List any two challenges in IoT implementation. | | CO1 | R | 1 |
| 3. | Identify two types of sensors used in IoT systems. | | CO2 | R | 1 |
| 4. | Recall any two communication modules used in IoT. | | CO2 | R | 1 |
| 5. | Explain the term remote data monitoring in IoT. | | CO3 | U | 1 |
| 6. | State the function of an actuator in an IoT device. | | CO3 | R | 1 |
| 7. | Give two examples of IoT connectivity protocols. | | CO4 | U | 1 |
| 8. | Recall any two IoT communication technologies. | | CO4 | R | 1 |
| 9. | Give any two IoT applications in healthcare. | | CO5 | U | 1 |
| 10. | Describe any one real-world IoT project you can develop. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the impact of IoT in industrial automation. | | CO1 | An | 3 |
| 12. | Explain how sensors and actuators work together in IoT devices. | | CO2 | U | 3 |
| 13. | Analyze how remote device control is achieved through IoT platforms. | | CO3 | An | 3 |
| 14. | Infer the importance of protocol selection in IoT system design. | | CO4 | U | 3 |
| 15. | Analyze IoT applications in agriculture and environmental monitoring | | CO5 | An | 3 |
| 16. | Explain how Arduino and Raspberry Pi can be integrated in an IoT project. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the IoT architecture with a neat diagram and explain each layer in detail. | CO1 | U | 6 |
|  | b. | Discuss the evolution of the Internet of Things from M2M communication. Explain the key drivers and challenges in adopting IoT technologies. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the role of sensors and actuators in IoT. | CO2 | U | 6 |
|  | b. | Explain the IoT functional stack in detail. How does the data management and compute stack differ from the core IoT functional stack? | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the process of remote data collection and control using IoT cloud platforms such as ThingSpeak or AWS IoT. | CO3 | An | 6 |
|  | b. | Analyze how sensor networks are used for environmental monitoring. Discuss the communication protocols and network topologies used. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Compare various IoT communication protocols such as MQTT, CoAP, and HTTP in terms of efficiency and scalability. | CO4 | U | 6 |
|  | b. | Compare the major IoT communication protocols such as ZigBee, Bluetooth Low Energy, and LoRaWAN in terms of range, power, and data rate. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Analyze various domain-specific IoT applications in smart cities, healthcare, and logistics with suitable examples. | CO5 | An | 6 |
|  | b. | Examine the role of IoT in energy management and smart retail systems. Provide case studies illustrating real-world implementations. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the architecture and programming model of the Arduino and demonstrate how it can interface with sensors for data acquisition. | CO5 | A | 6 |
|  | b. | Explain in detail how Arduino can be interfaced with a temperature and humidity sensor. Include the circuit diagram and sample code. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Design a small IoT prototype for monitoring environmental parameters such as temperature and humidity using Raspberry Pi. | CO5 | A | 6 |
|  | b. | Design an IoT-based smart irrigation system using Raspberry Pi and suitable sensors. Discuss hardware, software, and data flow. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Develop a practical IoT solution for smart healthcare monitoring using Arduino and cloud connectivity. Justify the hardware and software choices. | CO6 | A | 6 |
|  | b. | Write a complete IoT solution for a smart transportation system. Explain the architecture, sensors used, communication technologies, and cloud integration. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the concept of Internet of Things along with its hardware and software components. |
| **CO2** | Recognize I/O devices, sensors & communication modules. |
| **CO3** | Apply techniques for remote data monitoring and device control. |
| **CO4** | Compare the connectivity technologies and protocols in IoT. |
| **CO5** | Infer IoT applications and case studies. |
| **CO6** | Create practical IoT projects for real - world applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2024** | **Duration** | **3hrs** |
| **Course Title** | **DATA SCIENCE ECOSYSTEM** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the purpose of Data Science in the field of Education. | | CO1 | R | 1 |
| 2. | List the components of Data Science. | | CO1 | R | 1 |
| 3. | Write a Python code to visualize the data using a bar chart. | | CO2 | A | 1 |
| 4. | Identify the command used to sort the dataset in descending order. | | CO2 | R | 1 |
| 5. | Construct the null and alternative hypotheses for the claim that the mean blood pressure of men is greater than or equal to 130 mmHg. | | CO3 | A | 1 |
| 6. | List the statistical measures of central tendency | | CO3 | R | 1 |
| 7. | A simple linear regression model is established to predict a student's final exam score (Y) based on the number of hours studied (X). The resulting regression equation is: Y = 55 + 5X. If a student studies for 4 hours, predict the final exam score. | | CO4 | A | 1 |
| 8. | Discover the number of final clusters obtained from the bottom-up clustering method when a specific cut level is applied to the dendrogram shown. | | CO4 | U | 1 |
| 9. | Differentiate between collaborative filtering and content-based filtering | | CO5 | U | 1 |
| 10. | Summarize the importance of fairness in machine learning models. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the application of data science in the field of automotive industry. | | CO1 | U | 3 |
| 12. | Explain the commands to detect missing values in a Pandas DataFrame and fill them using forward fill and backward fill methods with suitable examples. | | CO2 | U | 3 |
| 13. | Construct a box plot and find IQR using the five-number summary for the given data.  18, 27, 34, 52, 54, 59, 61, 68, 78, 82, 85, 87, 91, 93, 100 | | CO3 | A | 3 |
| 14. | Differentiate between Agglomerative and Divisive Hierarchical Clustering. | | CO4 | An | 3 |
| 15. | Explain the approaches to create different hybrid recommendation systems. | | CO5 | U | 3 |
| 16. | Differentiate between transparency and accountability in data science with suitable examples. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | You're a data scientist at 'PowerGrid Utilities', which is struggling with 10% energy distribution inefficiencies during peak hours. The operations team wants to forecast energy demand patterns to optimize grid management. Explain the data science life cycle for this prediction model. | CO1 | U | 8 |
|  | b. | Discuss various features of Bigdata. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Write Python code snippet for the below queries:   * Create a dataframe from a dictionary and display it.   Sampledata: {'Name':['Alice','Bob','Charlie',NaN,'Eve'],'Age':[25,30,NaN,28,35], 'Salary':[50000, NaN,70000,60000,80000]}   * Check for duplicate rows in the dataframe. * Fill NaN in 'Age' column with the median age. * Filter records where ‘Salary’ is above 55000. * Add a new row with values ['Frank', 32, 65000]. * Calculate the total salary of all employees. * Reset the index of the dataframe. * Drop the column ‘Salary’ permanently. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Apply the concept of the Pearson correlation method and calculate the correlation coefficient for the following dataset.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X | 10 | 12 | 16 | 18 | 19 | 25 | | Y | 12 | 23 | 10 | 15 | 11 | 20 | | CO3 | A | 8 |
|  | b. | A nutritionist measures the daily calorie intake of 25 adult women in a city and finds a sample mean of 2200 kcal with a standard deviation of 150 kcal. Calculate a 95% confidence interval for the average daily calorie intake of all adult women in the city (Z=1.96). | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Given the initial centroids C1(5, 3) and C2(10, 15), apply the K-Means clustering process for two iterations. Calculate and show the cluster assignments and the updated centroids after each iteration.   |  |  | | --- | --- | | **x1** | **x2** | | 5 | 3 | | 10 | 15 | | 15 | 12 | | 24 | 10 | | 30 | 45 | | 85 | 70 | | 71 | 80 | | 60 | 78 | | 55 | 52 | | 80 | 91 | | CO4 | A | 8 |
|  | b. | Discuss the different types of machine learning algorithms and their applications. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the techniques used to pre-process the dataset by handling null values with suitable examples. | CO2 | U | 8 |
|  | b. | A machine learning model was developed to classify emails as 'Spam' (Positive) or 'Not Spam' (Negative). After testing the model on 200 emails, the following Confusion Matrix was obtained:   |  |  |  | | --- | --- | --- | |  | **Predicted: Spam (P)** | **Predicted: Not Spam (N)** | | **Actual: Spam** | 70 | 10 | | **Actual:Not Spam** | 20 | 100 |   Calculate the model's Accuracy, Recall, Precision, and F1-score for the model. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | You are building a movie recommendation system. Movies are classified as either "Must Watch" (Class 1) or "Skip" (Class 0) based on two features:  x1: User Rating (out of 10)  x2: Budget (in millions of dollars)  The training data is as follows:    A new movie has been released with:  Rating = 7.0  Budget = 90 million dollars  Use the k-Nearest Neighbors (k-NN) algorithm with k=3 to classify this new movie (Should it be "Must Watch" or "Skip"). Use the Euclidean distance metric. | CO4 | An | 8 |
|  | b. | Explain the concept of Linear Regression. Derive the equation of the best-fit line using the least squares method. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the key differences between user-based collaborative filtering and item-based collaborative filtering in recommendation systems. Discuss the advantages and disadvantages of each approach. | CO5 | U | 8 |
|  | b. | Discuss performance metrics to evaluate the recommendation systems. | CO5 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A popular fitness application collects user data such as location, heart rate, and sleep patterns to provide health insights. Recently, it was discovered that the app shares anonymized user data with third-party advertisers. However, a data breach revealed that some “anonymized” datasets could be re-identified by linking them with external public data sources. Analyze the ethical implications of this situation in terms of *privacy, confidentiality, and informed consent.* As a data scientist, illustrate the ethical and technical measures you would implement to prevent such ethical breaches in the future. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Illustrate the fundamental concepts and purposes of data science. |
| **CO2** | Describe the processes involved in working with data. |
| **CO3** | Apply descriptive statistics and exploratory data analysis techniques. |
| **CO4** | Recognize different types of machine learning algorithms and their applications. |
| **CO5** | Utilize content-based and collaborative filtering techniques to develop recommender systems. |
| **CO6** | Infer the ethical considerations in data science. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2028** | **Duration** | **3hrs** |
| **Course Title** | **MACHINE LEARNING TECHNIQUES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define reinforcement learning. | | CO1 | R | 1 |
| 2. | Identify the main goal of feature selection in data preprocessing. | | CO1 | R | 1 |
| 3. | Determine the predicted Y value using the linear regression equation , for . | | CO2 | A | 1 |
| 4. | Identify the activation function is commonly used in logistic regression. | | CO3 | R | 1 |
| 5. | Compute the Euclidean distance between two points A(3, 4) and B(6, 8). | | CO3 | A | 1 |
| 6. | Identify which clustering algorithm produces a dendrogram as output. | | CO4 | R | 1 |
| 7. | State one advantage of K - medoids over K – means clustering algorithm. | | CO4 | R | 1 |
| 8. | Identify the main goal of ensemble learning. | | CO5 | R | 1 |
| 9. | Apply your understanding of cross-validation to determine — in a 5-fold cross-validation, how many folds are used for testing in each iteration? | | CO5 | A | 1 |
| 10. | Analyze what a model with high bias and low variance indicates about its learning behavior. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Determine the final hypothesis using the Find-S Algorithm for the given weather dataset.   |  |  |  | | --- | --- | --- | | **Outlook** | **Temperature** | **Play** | | Sunny | Hot | No | | Sunny | Mild | Yes | | Rainy | Cool | Yes | | | CO1 | A | 3 |
| 12. | Differentiate ‘Data transformation’ from ‘Data reduction’ | | CO2 | U | 3 |
| 13. | Compare and contrast between K-means and fuzzy C-means clustering. | | CO4 | An | 3 |
| 14. | Distinguish between classification and regression trees. | | CO5 | U | 3 |
| 15. | Differentiate between Linear Regression and Logistic Regression in terms of purpose, output type, and application area. | | CO3 | U | 3 |
| 16. | Compute accuracy, precision, recall, and F1-score for the given confusion matrix summarizes a model’s performance.   |  |  |  | | --- | --- | --- | | **Actual / Predicted** | **Yes** | **No** | | **Yes** (Actual Positive) | 40 | 10 | | **No** (Actual Negative) | 5 | 45 | | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine the consistent hypothesis using the Candidate elimination algorithm for the given dataset.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | # | Color | Toughness | Fungus | Appearance | Poisonous | | 1 | Green | Hard | No | Wrinkled | Yes | | 2 | Green | Hard | Yes | Smooth | No | | 3 | Orange | Hard | No | Wrinkled | Yes | | 4 | Green | Soft | Yes | Smooth | Yes | | 5 | Green | Hard | Yes | Wrinkled | Yes | | CO1 | A | 6 |
|  | b. | Explain the concepts underlying geometric and logical models in machine learning with illustrative examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Consider a dataset containing the ages of patients: 12, 18, 22, 25, 30, 35, 40, 45, 50, 55, 60, 65   1. Apply equal-frequency binning with 3 bins and perform smoothing by bin means. 2. Apply smoothing using bin boundaries for the same data. 3. Explain how discretization can help in forming a concept hierarchy (e.g., “child”, “adult”, “senior”). | CO2 | A | 6 |
|  | b. | Explain the major data transformation techniques used in data preprocessing. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Calculate regression coefficient, Ypred and Error value by analyzing the data given below.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Price(Rs) | 10 | 12 | 13 | 12 | 16 | 15 | | Amount Demanded | 40 | 38 | 43 | 45 | 37 | 43 | | CO3 | A | 8 |
|  | b. | Explain the concept of Support Vector Machine (SVM) with a neat diagram. Describe how SVM finds the optimal separating hyperplane between two classes and define the terms support vectors, margin, and kernel function. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Apply the K means Algorithm and cluster the below data by assuming k=3 with initial centroids as (2, 10) and (5,8).   |  |  |  | | --- | --- | --- | | S. No | X | Y | | 1 | 2 | 10 | | 2 | 2 | 5 | | 3 | 8 | 4 | | 4 | 5 | 8 | | 5 | 7 | 5 | | 6 | 6 | 4 | | 7 | 1 | 2 | | 8 | 4 | 9 | | CO4 | A | 8 |
|  | b. | Differentiate between Agglomerative and Divisive Hierarchical Clustering with a neat diagram. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Apply the Apriori algorithm to the following transactional dataset to generate frequent item sets using minimum support of 60% and strong association rules with minimum confidence of 80%.   |  |  | | --- | --- | | **Transaction ID** | **Items Purchased** | | T1 | Bread, Milk | | T2 | Bread, Diaper, Beer, Eggs | | T3 | Milk, Diaper, Beer, Cola | | T4 | Bread, Milk, Diaper, Beer | | T5 | Bread, Milk, Diaper, Cola | | CO5 | A | 8 |
|  | b. | Explain the working of the Decision Tree algorithm with a neat diagram. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Apply perceptron learning algorithm for the given OR gate and update the weights for one iteration. Initial weights are W1=0.4, W2=0.1, threshold=0.3 and the learning rate is 0.2.   |  |  |  | | --- | --- | --- | | X1 | X2 | Y | | 0 | 0 | 0 | | 0 | 1 | 1 | | 1 | 0 | 1 | | 1 | 1 | 1 | | CO3 | A | 8 |
|  | b. | Explain Simple Linear Regression and Multiple Linear Regression with their mathematical formulations. How do they differ in terms of assumptions and applications? | CO3 | U | 4 |
|  |  |  |  |  |  |
| 23. |  | Examine a SOM network with four input nodes and two output nodes, where the weight vectors are w₁ = (0.5, 0.7, 0.3, 0.9) and w₂ = (0.12, 0.7, 0.9, 0.2). Determine the winning neurons and updated weights, when the input vectors X₁ = (0.2, 0.3, 0.8, 0.2) and X₂ = (0.2, 0.6, 0.23, 0.4) are applied. Assume learning rate is 0.1 | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the suitability of K-fold, Stratified K-fold, Leave-One-Out, and 0.632 Bootstrap cross-validation methods with examples for a machine-learning model to predict loan defaults, where the target variable is imbalanced, with 20% of customers in the positive class and 80% in the negative class. | CO6 | An | 8 |
|  | b. | Explain the different types of loss functions used in machine learning models. Give one example each for regression and classification tasks. | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recall the concepts and background of machine learning techniques. |
| **CO2** | Explain the data preprocessing and feature engineering steps. |
| **CO3** | Apply suitable linear/nonlinear/probabilistic machine learning algorithms for a given task. |
| **CO4** | Demonstrate the working principle of distance-based algorithms to handle the data. |
| **CO5** | Develop tree and rule-based machine learning algorithms for suitable applications. |
| **CO6** | Evaluate the performance of machine learning models using suitable metrics. Recall specific requirements and comprehend the architecture of embedded systems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2030** | **Duration** | **3hrs** |
| **Course Title** | **NATURAL LANGUAGE PROCESSING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the sub fields of representing linguistics. | | CO1 | R | 1 |
| 2. | Calculate the number of types and tokens in the given sentence,  ***“Machine learning is learning from data and learning improves with more data”.*** | | CO1 | A | 1 |
| 3. | Describe the two broad categories of part of speech with example. | | CO2 | U | 1 |
| 4. | List the components of hidden Markov model (HMM). | | CO2 | R | 1 |
| 5. | Identify the use of parse tree in context free grammar. | | CO3 | R | 1 |
| 6. | Write the production rules of Noun Phrase (NP). | | CO3 | A | 1 |
| 7. | Predict the context words for the sentence “Machine learning models perform well when trained on large datasets” with C=2, and the center word is ‘models’. | | CO4 | A | 1 |
| 8. | Differentiate between Lemmas and Senses. | | CO4 | U | 1 |
| 9. | Define template filling. | | CO5 | R | 1 |
| 10. | Name the four classes of speech acts. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Consider the training corpus with four sentences:  ***<s> She likes reading novels </s>***  ***<s> He likes watching movies </s>***  ***<s> They enjoy reading books </s>***  ***<s> He enjoys watching cricket </s>***  ***<s> She enjoys reading magazines </s>***  Estimate the Bigram probability of the test sentence  ***<s> She enjoys reading books </s>*** | | CO1 | U | 3 |
| 12. | Identify the named entities in the sentence: “Google was founded in 1998 by Larry Page and Sergey Brin while they were PhD students at Stanford University in California, and Sundar Pichai is the current CEO”. | | CO2 | R | 3 |
| 13. | Define dependency grammar and identify the dependency of each word in the following sentence.  ***“I prefer the morning light through Paris”.*** | | CO3 | R | 3 |
| 14. | Differentiate between distributional similarity and semantic relatedness with example. | | CO4 | U | 3 |
| 15. | Examine the EVENT from the below paragraph.  On Friday, NASA successfully landed the Perseverance rover on Mars after a seven-month journey through space. The mission aims to search for signs of ancient microbial life and collect rock samples for future return to Earth. Engineers at the Jet Propulsion Laboratory celebrated as the rover sent its first images from the Martian surface moments after touchdown. | | CO5 | A | 3 |
| 16. | Sketch the architecture of Beam search decoding with a beam width of k = 2. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Apply Levenshtein dynamic programming approach with 2D array to calculate the edit distance to transform ‘***DEFINITION’*** (row-wise) and ***‘PERMISSION’*** (column-wise). | CO1 | A | 6 |
|  | b. | Given a set of unigram and bigram probabilities, calculate the probability of the following sequence ***‘<s>* students study machine learning topics*</s***>**’** according to the Bigram language model.  P(students | <s>) = 2/10, P(study | students) = 3/10, P(students | study) = 4/10,  P(machine | study) = 2/8, P(study | machine) = 4/8, P(learning | machine) = 3/9, P(topics | learning) = 2/7, P(</s> | topics) = 4/10, P(learning | topics) = 2/7, P(students) =1/4. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Estimate the appropriate POS tag for the given sentence.  "***She enjoys reading books***" based on the given probabilities.  **Transition Probabilities (A):** (These probabilities are hypothetical)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **From / To** | **PRP** | **VBZ** | **VBG** | **NN** | | **PRP** | 0.1 | 0.6 | 0.2 | 0.1 | | **VBZ** | 0.0 | 0.1 | 0.7 | 0.2 | | **VBG** | 0.0 | 0.1 | 0.2 | 0.7 | | **NN** | 0.3 | 0.3 | 0.2 | 0.2 |   **Emission Probabilities (B):**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Word** | **PRP** | **VBZ** | **VBG** | **NN** | | **She** | 0.9 | 0.0 | 0.1 | 0.0 | | **enjoys** | 0.0 | 0.8 | 0.0 | 0.0 | | **reading** | 0.0 | 0.0 | 0.7 | 0.0 | | **books** | 0.1 | 0.0 | 0.0 | 0.8 |   **Initial Probabilities (π):**  PRP: 0.6  VBZ: 0.1  VBG: 0.1  NN: 0.2 | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain CKY algorithm and construct a Parse tree. The CKY table for the sentence **“We reserved an apartment in London”** with the given CNF grammar,  S -> NP VP  VP -> V NP  VP -> V X  X -> NP PP  PP -> P NP  NP -> 'We'  NP -> DT N  NP -> 'London'  DT -> 'an'  N -> 'apartment'  V -> 'reserved'  P -> 'in' | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the process of word embedding using the Word2Vec model, and describe the two commonly used architectures for embedding text data. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discriminate the challenges and limitations in Semantic Role Labeling (SRL) to find the semantic role of arguments. | CO5 | An | 6 |
|  | b. | Evaluate the effectiveness of various relation extraction algorithms in accurately identifying semantic relationships between entities in text. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain four different smoothing techniques that can be applied to handle unseen bigrams. | CO1 | U | 6 |
|  | b. | Determine the concept of Transition-Based Dependency Parsing with its algorithm. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | A tech startup is developing a multilingual translation app to convert user messages between English, Spanish, and French in real-time. Analyze the application of the Encoder-Decoder architecture in this scenario. | CO6 | An | 6 |
|  | b. | Describe the process of Automatic Temporal Analysis and examine the key steps involved in identifying and extracting temporal expressions. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine the ethical and technical challenges in designing a chatbot that ensures patient data privacy and delivers medically appropriate responses. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Identify the different linguistic components of natural language. |
| **CO2** | Design a morphological analyzer for a given natural language. |
| **CO3** | Prefer appropriate parts of speech technique. |
| **CO4** | Choose the appropriate parsing techniques necessary for a given language and applications. |
| **CO5** | Decide on the appropriate semantic techniques necessary for a given language and applications. |
| **CO6** | Design applications involving natural language. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2032** | **Duration** | **3hrs** |
| **Course Title** | **OBJECT ORIENTED PROGRAMMING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Predict the output of the following program:  class String\_Sub {  public static void main(String args[]) {  String str = “program”;  System.out.println(str.substring(2, 5));  }  } | | CO1 | U | 1 |
| 2. | State the acronym of JDK. | | CO1 | R | 1 |
| 3. | Create an object for the following class:  class Book {  String title;  double price;  } | | CO2 | R | 1 |
| 4. | Write the syntax to define a package. | | CO2 | U | 1 |
| 5. | Predict the output of the following code:  enum Colors { RED, BLUE, GREEN };  System.out.println(Colors.BLUE.ordinal()); | | CO3 | A | 1 |
| 6. | Define: Autoboxing. | | CO3 | R | 1 |
| 7. | Name the thread method that creates delay in execution of thread. | | CO4 | R | 1 |
| 8. | Identify the need of Port Number in socket programming. | | CO5 | U | 1 |
| 9. | List any one subclass of the OutputStream class. | | CO5 | R | 1 |
| 10. | Define: Byte streams. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the use of “static” keyword with an example. | | CO1 | R | 3 |
| 12. | Distinguish between Method Overloading and Method Overriding. | | CO2 | U | 3 |
| 13. | Differentiate checked exceptions from unchecked exceptions in Java. | | CO3 | U | 3 |
| 14. | List any three uses of collections. | | CO3 | R | 3 |
| 15. | Describe the life cycle of the thread with neat sketch. | | CO4 | U | 3 |
| 16. | Describe the use of JFrame in a Swing application. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the major features of Object-Oriented Programming with examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Write a Java program using a switch statement to display the day of the week based on the number entered by the user (1 for Monday, 2 for Tuesday, … 7 for Sunday). | CO1 | A | 6 |
|  | b. | Write a Java program to create a class **Employee** with data members: empId, empName, and salary.   * Include a method **displayEmployee()** to print the employee details. * In the **Main** class, create two **Employee** objects to represent company staff and display their details. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Write a Java program to demonstrate both multilevel and hierarchical inheritance using a University system.   * In the multilevel inheritance, create classes University → College → Department to represent the hierarchy of an institution. * In the hierarchical inheritance, let both Faculty and Student classes inherit from the Department class. * Each class should include appropriate data members and methods to display details such as university name, college code, department name, faculty details, and student details.   Implement the program to show how data and methods are inherited and accessed across different levels of inheritance. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Create an abstract class Shape with abstract methods area() and perimeter(). Derive two subclasses (i) Rectangle and (ii) Circle that implement these methods. Read the required dimensions from the user and display the area and perimeter for each shape. | CO2 | A | 6 |
|  | b. | Explain the process of file reading and writing using FileReader and FileWriter streams. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Write a Java program to demonstrate the use of ArrayList to store and manage integer values. The program should perform the following operations:   * Add elements to the ArrayList * Remove an element from the ArrayList * Access (retrieve) an element from the ArrayList using its index   Display appropriate messages after each operation to show the working of the ArrayList. | CO3 | A | 6 |
|  | b. | Explain the exception handling mechanism in Java, describing the use of the keywords try, catch, throw, and finally with suitable examples. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Write a Java program using **multithreading** to create three threads and perform the following tasks:   * + **Thread 1** should print all **odd numbers** between **1 and 30**.   + **Thread 2** should print all **multiples of 5** between **1 and 30**.   + **Thread 3** should print all **prime numbers** between **1 and 30**.  1. Each thread should print its output with a **delay of 1 second** between each number. 2. Display the **thread name** along with each printed value. 3. Show the use of start(), run(), and sleep() methods. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Write a Java Socket program to implement a client–server chat application that enables real-time two-way communication between a client and a server over TCP. The program should display messages that are sent and received at both ends. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop a **Java Swing GUI application program** to implement a **Product Inventory Management System**. The application should allow the user to enter the following details through swing components and display the details in a message box when the user clicks the submit button.   * + Product Code   + Product Name   + Product Price   + Product Stock/Quantity | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Reproduce the basic programming constructs of object-oriented programming. |
| **CO2** | Compute the solutions through OOP principles including classes, objects, inheritance, polymorphism, encapsulation, and abstraction. |
| **CO3** | Practice the professional standards by handling exceptions, using enumeration, autoboxing/unboxing, generics, and built-in collection frameworks. |
| **CO4** | Examine the significance of Multithreading in enhancing the performance and responsiveness of tasks by concurrent execution. |
| **CO5** | Apply I/O operations, networking, and GUI development to leverage the extensive standard libraries and APIs for various tasks. |
| **CO6** | Develop real-time applications based on requirements, employing object- oriented programming methodologies. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV/DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2035** | **Duration** | **3hrs** |
| **Course Title** | **OPERATING SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the goals of an operating system. | | CO1 | U | 1 |
| 2. | List the function of mode bit in terms of Kernal mode and user mode. | | CO1 | R | 1 |
| 3. | Sketch the pictorial representation of the Process Control Block (PCB). | | CO2 | R | 1 |
| 4. | Name the system call used to create the process. | | CO2 | R | 1 |
| 5. | Define race condition. | | CO3 | U | 1 |
| 6. | List the three requirements that a solution to critical section problem must satisfy. | | CO3 | R | 1 |
| 7. | Describe sparse address spaces. | | CO4 | U | 1 |
| 8. | Define fragmentation. | | CO4 | R | 1 |
| 9. | Identify the three types of users who access the file. | | CO5 | U | 1 |
| 10. | Predict the term that is used to describe an arrangement where Device A is connected to Device B, Device B is connected to Device C, and Device C is plugged into a computer port. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the uses of multiprocessor system. | | CO1 | R | 3 |
| 12. | Imagine a system administrator is working for a multitasking operating system. During routine operations, multiple processes are executed concurrently. Suddenly, an interrupt occurs, and the operating system needs to switch the CPU core to a different process. Describe the steps involved in the context switch that the operating system performs in response to this interrupt. | | CO2 | U | 3 |
| 13. | Illustrate acquire () and release () function in Mutex Locks. | | CO3 | U | 3 |
| 14. | Describe copy on write with an example. | | CO4 | U | 3 |
| 15. | Sketch the process of opening a file in an operating system, highlighting the interactions between user space, kernel memory, and secondary storage. | | CO5 | An | 3 |
| 16. | Compare status register with control register. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain Interrupt with interrupt-driven I/O cycle. | CO1 | U | 6 |
|  | b. | Describe System call. Compare Windows system calls with Unix system call in terms of process control, file management, device management, information maintenance, communication and protection. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Consider the following set of processes, with the length of the CPU burst time and arrival time given in milliseconds.   |  |  |  |  | | --- | --- | --- | --- | | **Process** | **Arrival Time** | **Burst Time** | **Priority** | | P1 | 0 | 6 | 2 | | P2 | 1 | 2 | 3 | | P3 | 2 | 8 | 1 | | P4 | 3 | 4 | 4 |   Calculate average waiting time (AWT) and turnaround time (TAT) for the following algorithm using Gannt chart.   * FCFS * SJF (non-preemptive) * SJF (preemptive) * Priority Scheduling (non-preemptive) * Priority Scheduling (preemptive) * Round Robin with Time Quantum = 2 ms. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | In a library management system, multiple librarian processes access a shared database to check book availability (readers) or update records (writers). To ensure synchronization, semaphores are used: rw\_mutex (ensuring exclusive writer access), mutex (protecting updates to read\_count), and read\_count (tracking active readers). Readers can access the database simultaneously, but writers need exclusive access. Analyze the steps in achieving synchronization. | CO3 | An | 6 |
|  | b. | Explain producer and consumer problem with an example. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Consider the following reference string 2,5,3,4,2,3,5,5,6,3,4,5,3,4,2.  for a memory with three (03) frames. Estimate the number of page faults using FIFO, LRU and Optimal page replacement algorithms and check whether this reference string suffers from Belady’s anomaly using 4 frames in FIFO. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | A university maintains student records in a file named "students.dat", which includes details such as student ID, name, and grades. The administration performs various operations such as adding new records, updating grades, and deleting records of graduated students. Analyze the different file operations required to manage student records efficiently. | CO5 | An | 6 |
|  | b. | Explain the following with a neat sketch   * Single level directory * Two level directory * Tree structured directory | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Consider the following Allocation, Need, and Available matrices for a system which has 3 resource type of A (10), B (5), and C (7).   | Process | Allocation | Max | Available | | --- | --- | --- | --- | |  | A B C | A B C | A B C | | P0 | 0 1 0 | 7 5 3 | 3 3 2 | | P1 | 2 0 0 | 3 2 2 |  | | P2 | 3 0 2 | 9 0 2 |  | | P3 | 2 1 1 | 2 2 2 |  | | P4 | 0 0 2 | 4 3 3 |  |   i) Determine the safe state sequence using the safety algorithm.  ii)Analyze whether Process P1’s request for (1,0,2) can be granted immediately based on the available resources. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | On a system using simple segmentation, Compute the physical address for the logical address, logical address is given in the following segment table. If the address generates a segment fault, indicate so.   |  |  |  | | --- | --- | --- | | Segment | Base | Length | | 0 | 330 | 124 | | 1 | 876 | 211 | | 2 | 111 | 99 | | 3 | 498 | 302 |   A) 0,99 B) 2,78 C) 1,265 D) 3,222. | CO4 | A | 6 |
|  | b. | Given six memory partitions of 100 MB, 170 MB,40MB, 205 MB, 300 MB, and 185 MB (in order). Calculate the free space that is available using first-fit, best-fit, and worst-fit algorithms of processes of size 200 MB,15MB, 185 MB,75MB, 175 MB, and 80MB (in order). | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Consider that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1,805. The queue of pending requests, in FIFO order, is: 2,069; 1,212; 2,296; 2,800; 544; 1,618; 356; 1,523; 4,965; 3,681. Starting from the current head position, Calculate the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each FCFS, SSTF, SCAN and C – SCAN disk-scheduling algorithms. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Summarize the basic concepts and components of an operating system. |
| **CO2** | Identify and differentiate between various types of scheduling algorithms including preemptive and non - preemptive approaches. |
| **CO3** | Apply and solve classic synchronization problems and deadlock. |
| **CO4** | Explore virtual memory concepts, including paging and segmentation, and their role in improving memory utilization |
| **CO5** | Examine the fundamental concepts of file systems and their significance in operating systems. |
| **CO6** | Evaluate the performance and reliability of storage structures and i/o management techniques in various operating system environments. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2036** | **Duration** | **3hrs** |
| **Course Title** | **OPTIMIZATION METHODOLOGIES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the type of the given constraint  3x1 + 2x2 ≤ 600. | | CO1 | U | 1 |
| 2. | List the applications of optimization in the field of computer science. | | CO1 | R | 1 |
| 3. | Convert the following linear programming model to the standard linear programming (SLPP) model.  Max Z = 30x + 40y  Subjected to the constraints  3x + 2y ≤ 600  3x + 5y ≤ 800  5x + 6y ≤ 1100  x, y ≥ 0 | | CO2 | U | 1 |
| 4. | Define feasible region in linear programming. | | CO2 | R | 1 |
| 5. | Identify any two methods for solving Integer Programming problems. | | CO3 | U | 1 |
| 6. | State the given transportation problem to a balanced transportation problem. | | CO3 | R | 1 |
| 7. | List the techniques used in unconstrained optimization for a nonlinear programming problem. | | CO4 | R | 1 |
| 8. | Identify whether the function is concave or convex.  f(x) = 100 – x2 | | CO4 | U | 1 |
| 9. | Identify two heuristic algorithms for solving Traveling Salesman Problem. | | CO5 | U | 1 |
| 10. | Infer the main objective of Vehicle Routing problem. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Convert the given primal linear programming problem to dual problem.  Max z = 2x1 + 3x2  subjected to the constraints  2x1 + 2x2 ≤ 120  x1 10  x1, x2 0. | | CO1 | U | 3 |
| 12. | Describe the steps involved in the formulation of linear Programming model. | | CO2 | U | 3 |
| 13. | Determine the objective function and constraints for the given network graph as an integer programming problem, assuming node 1 is the source and node 6 is the destination. | | CO3 | A | 3 |
| 14. | Illustrate the Bordered Hessian matrix for the following NLPP:  z = 6x + 5y  subjected to the constraints  x + 5y = 7  x, y ≥ 0 | | CO4 | U | 3 |
| 15. | Determine the Longest Common Subsequence (LCS) for the given DNA sequences.  Sequence 1: AGCTBFA  Sequence 2: GACTBCA | | CO5 | A | 3 |
| 16. | A delivery company needs to plan a route to visit five locations (A, B, C, D, E) starting and ending at any location. The goal is to minimize total travel distance. The distances between locations (in miles) are shown below. IllustrateNearest Neighbor heuristic method to determine the feasible tour and its total traveled distance starting from city A. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Classify the different types of optimization problems. | CO1 | U | 8 |
|  | b. | Construct the LPP model with respect to objective function and constraints for the diet of a sick person that contains at least 4000 units of vitamins, 50 units of minerals and 1400 calories. Two foods X and Y are available at a cost of Rs. 4 and Rs. 3 per unit respectively. One unit of food X contains 200 units of vitamins, 1 unit of minerals and 40 calories, whereas one unit of food Y contains 100 units of vitamins, 2 units of minerals and 40 calories. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. |  | Apply the simplex method to find the optimal solution of the given maximization problem.  Maximize z=2x+6y  subjected to the constraints:  6x+8y ≤ 85  4x+3y ≤ 70  x, y ≥ 0 | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Solve the given optimization problem using the graphical method.  Maximize Z= 3x1+2x2  Subjected to the constraints:  100  80  40  x1, x2 ≥ 0 | CO3 | A | 8 |
|  | b. | Calculate the transportation cost from the following table using the least cost cell method.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Kanpur** | **Pune** | **Delhi** | **Supply** | | **Jaipur** | 4 | 5 | 1 | 40 | | **Udaipur** | 3 | 4 | 3 | 60 | | **Mumbai** | 6 | 2 | 8 | 70 | | **Demand** | 70 | 40 | 60 |  | | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. |  | Determine the optimal value for the given function up to 4 iterations with a tolerance of ∆ = 0.5 using the Dichotomous method.  Minimize f(x) = (x – 1)2 + 3 for the interval (-3, 6) | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Apply the Floyd algorithm to determine the shortest path between all vertices in the given graph. | CO5 | A | 6 |
|  | b. | Apply Vogel’s Approximation Method (VAM) step by step to determine the initial feasible solution for the given problem: A logistics company is responsible for delivering eco-friendly packaging materials from its three warehouses to four retail stores located in different cities. The company wants to minimize the total transportation cost while meeting the demand of each store and not exceeding the supply capacity of any warehouse. The supply, demand, and transportation cost (in ₹ per unit) are given below.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | S1 | S2 | S3 | S4 | Supply | | W1 | 19 | 30 | 50 | 10 | 7 | | W2 | 70 | 30 | 40 | 60 | 9 | | W3 | 40 | 8 | 70 | 20 | 18 | | Demand | 5 | 8 | 7 | 14 |  | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Solve the given integer programming using the Branch and Bound technique. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Apply forward recursion to find the shortest distance and path for City Scape Couriers that needs to deliver a package from their main depot (a) to a final Destination (i) over a multi-city network. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Apply Johnson’s algorithm for the following scenario:  A manufacturing company, produces electronic parts that pass through two stages in its supply chain— Assembly (Machine M1) and Testing & Packaging (Machine M2). Seven orders are received from different clients. Each order must first be assembled and then tested before shipment. The company wants to determine the optimal processing sequence of these orders to minimize the total production time and ensure on-time delivery.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Job | J1 | J2 | J3 | J4 | J5 | J6 | J7 | | M1 (Assembly) | 4 | 9 | 6 | 2 | 7 | 5 | 8 | | M2 (Testing &Packaging) | 6 | 3 | 8 | 7 | 5 | 9 | 4 | | CO6 | A | 6 |
|  | b. | Describe vehicle routing problem and traveling salesman problem for solving logistics in real world applications, | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Formulate the optimization problems |
| **CO2** | Describe the appropriate linear programming techniques. |
| **CO3** | Infer the mathematical tools that are needed to solve various optimization problems. |
| **CO4** | Apply dynamic programming technique to solve complex problems. |
| **CO5** | Identify and develop operations research model describing a real - life problem. |
| **CO6** | Apply the knowledge to solve the queuing problems |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2044** | **Duration** | **3hrs** |
| **Course Title** | **SOFTWARE ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | **State** the key characteristics that define the nature of software. | | CO1 | R | 1 |
| 2. | **Explain** the role of Scrum in Agile process models. | | CO1 | U | 1 |
| 3. | **Identify** the main activities involved in requirements engineering. | | CO2 | U | 1 |
| 4. | **Describe** the purpose of scenario-based modelling in software analysis. | | CO2 | U | 1 |
| 5. | **Classify** the different architectural styles used in software design. | | CO3 | U | 1 |
| 6. | **Examine** the importance of user experience design in software engineering. | | CO3 | A | 1 |
| 7. | **State** the difference between white-box and black-box testing. | | CO4 | R | 1 |
| 8. | **Illustrate the use of** Selenium for automated web application testing. | | CO4 | U | 1 |
| 9. | **Identify** the key objectives of Software Configuration Management (SCM). | | CO5 | R | 1 |
| 10. | **Describe** how Six Sigma contributes to improving software quality. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the role of Agile Teams in ensuring adaptability and collaboration during the Scrum process. | | CO1 | A | 3 |
| 12. | Examine the scenario-based modeling that aids in understanding user interactions and system functionality. | | CO2 | A | 3 |
| 13. | Identify the Golden Rules of User Interface Design and justify their importance in enhancing user experience. | | CO3 | U | 3 |
| 14. | Describe the significance of automated testing tools such as Selenium in improving the efficiency of the testing process. | | CO4 | U | 3 |
| 15. | Examine the use of software metrics to assess and improve software quality throughout the development life cycle. | | CO5 | A | 3 |
| 16. | Identify the major stages in risk management and discuss how risk mitigation ensures project success. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | **Describe** the key characteristics of different software process models such as Waterfall, Prototyping, and Evolutionary models. How do these models influence software development outcomes? | CO1 | U | 6 |
|  | b. | **Explain** the role of Agile teams to implement Scrum principles for iterative and incremental software development. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | **Classify** the different types of requirements gathered during the requirement engineering phase and **describe** their significance in building the analysis model. | CO2 | U | 6 |
|  | b. | **Examine** the process of scenario-based modeling and its role in validating and refining system requirements. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | **Describe** the fundamental **design concepts** that guide the transition from requirements to a software architecture. | CO3 | R | 6 |
|  | b. | **Develop** a component-level design for a given class-based system, illustrating the use of refactoring and user experience design principles. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | **Explain** the various testing strategies used in object-oriented systems, highlighting the differences between unit and integration testing. | CO4 | U | 6 |
|  | b. | Explain the difference between Black Box Testing and White Box Testing with suitable scenarios where each testing approach is most effectively applied. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | **Illustrate** the objectives of Statistical Software Quality Assurance and **describe** how Six Sigma contributes to improving software quality. | CO5 | A | 6 |
|  | b. | **Describe** the types of software metrics and **their usage** to assess and ensure software quality. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | **Examine** the human aspects involved in software engineering and **explain** effective team collaboration that influences project success. | CO1 | A | 6 |
|  | b. | **Describe**  the **Unified Process Model** that integrates iterative development with risk management. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | **Identify** the major **challenges faced during requirements elicitation** and **explain** the stakeholder communication that can overcome these challenges. | CO2 | U | 6 |
|  | b. | **Develop** a **use case diagram** and a corresponding **functional model** for an online library management system, emphasizing the link between user needs and system behavior. | CO1 | A | 6 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | **Describe** the steps involved in the project planning process with empirical estimation models in COCOMO II that can assist in cost estimation. | CO6 | U | 6 |
|  | b. | **Identify** the major risks in software projects and **develop** a suitable risk mitigation and monitoring strategy for an ongoing project. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Discover an effective software engineering process to develop software-intensive systems. |
| **CO2** | Translate the requirements specification into an implementable design. |
| **CO3** | Construct UML diagrams along with design strategies and design patterns. |
| **CO4** | Analyze architectural design methods. |
| **CO5** | Evaluate the system using various testing strategies. |
| **CO6** | Develop the software system with quality measures |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2046** | **Duration** | **3hrs** |
| **Course Title** | **THEORY OF COMPUTATION** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Let ∑ = {0, 1} and L be a language of strings ending with ‘01’. Identify the strings with length 3. | | CO1 | R | 1 |
| 2. | Infer the homomorphic image of the language L denoted by regular expression  r = (0+1)\*(10)+ , given h(0)=01 and h(1)=11. | | CO1 | U | 1 |
| 3. | Identify which of the strings 01, 001, 110, and 101 are accepted by the following NFA.  Image result for non deterministic finite automata | | CO2 | R | 1 |
| 4. | Design a DFA that accepts string having odd number of b’s over {a, b}. | | CO2 | A | 1 |
| 5. | State pumping lemma for Context Free Language. | | CO3 | R | 1 |
| 6. | Eliminate useless symbols and productions from G= (V, T, P, S) where V={S,A,B,C} and T={a,b} with following productions (P).  S → aS/A/C  A → a  B → aa  C → aCb | | CO3 | U | 1 |
| 7. | Define Push Down Automata. | | CO4 | R | 1 |
| 8. | Write the instantaneous description for the input string ‘**ab’, for the g**iven a Turing Machine with transitions δ(q₀, a) 🡪 (q₁, X, R) and δ(q₁, b) 🡪 (q2, X, R). | | CO5 | A | 1 |
| 9. | List two undecidable problems. | | CO6 | R | 1 |
| 10. | State Rice Theorem. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare the languages described in Chomsky hierarchy. | | CO1 | U | 3 |
| 12. | Convert the given NFA to DFA. | | CO2 | U | 3 |
| 13. | Show that the following grammar is ambiguous for the string ‘aab’,  S 🡪 AB | aaB  A 🡪 a | aA  B 🡪 b | | CO3 | U | 3 |
| 14. | Construct the equivalent NPDA for the grammar,  S 🡪 aXYY | aXX  X 🡪 aYY | a  Y🡪 bYY | X. | | CO4 | A | 3 |
| 15. | Design a Turing Machine for L(01\*0). | | CO5 | A | 3 |
| 16. | Show that Recursively Enumerable Languages are closed under union. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Construct NFA for the language L=((ab)\*ab)+(ba\*). | CO2 | A | 6 |
|  | b. | Convert the given NFA to DFA.  finite automata (1).jpg | CO2 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Construct the minimized DFA for the given diagram.  Minimization of DFA | CO2 | A | 6 |
|  | b. | State and prove the pumping lemma for regular languages. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Transform the following Context Free Grammar and convert it into CNF and GNF.  S 🡪ABDd | CDc  A 🡪 BD  B 🡪 bB | λ  C 🡪 cC  D 🡪 dD | d | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Construct NPDA that accept the languages on ∑ = {a, b} for the Language  L = {a n b m c n+m : n ≥ 1, m ≥ 1}. | CO4 | A | 6 |
|  | b. | Construct the equivalent Context Free Grammar for the given Push Down Automata M = ({q0, q1}, {a,b}, {Y,Z}, δ, q0, Z, { q1}), where δ is defined as,  δ(q0, a, Z ) = { (q0,YZ ) }  δ(q0, a, Y ) = { (q0,YY ) }  δ(q0, b, Y ) = { (q1,YY) }  δ(q1, a, Y ) = { (q1, ε) }  δ(q1, ε , Z ) = { (q1, ε) } | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Design a Turing Machine for the language L= { 0n21n : n ≥ 1} and show that the string ‘00211’ is a member of this language. | CO5 | A | 8 |
|  | b. | Explain the TM as Computer of Integer functions. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Prove that the regular languages are closed under the following properties,  i) Union  ii) Intersection  iii) Reverse | CO1 | U | 6 |
|  | b. | Apply CYK algorithm, check whether ‘baaba’ is a member of the language represented by the grammar,  S 🡪 AS | a  A 🡪 SA | b | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Analyze the variants of Turing Machine compared to standard Turing Machine with suitable diagrams. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the working of the Universal Turing Machine. | CO6 | U | 6 |
|  | b. | Describe the following.  i) Recursive Language  ii) Recursively Enumerable Language | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Extend the understanding of alphabets, strings, languages, and grammar, including the concepts of production and derivation. |
| **CO2** | Develop a deep understanding of deterministic and nondeterministic finite automata, and the equivalence between DFA and NFA. |
| **CO3** | Examine the closure properties of context - free languages, and apply these properties to construct new context - free languages. |
| **CO4** | Interpret the language recognized by pushdown automata. |
| **CO5** | Interpret the language acceptance by turing machines, understanding the computational capabilities and limitations. |
| **CO6** | Apply theoretical results to identify undecidable properties of languages and turing machines, developing problem - solving skills in the context of undecidability. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2048** | **Duration** | **3hrs** |
| **Course Title** | **WEB TECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the HTML tag used to insert an image into a webpage. | | CO1 | R | 1 |
| 2. | Differentiate between inline and block elements in HTML with an example. | | CO1 | U | 1 |
| 3. | State the CSS property used to create space between the content of an HTML element and its border. | | CO1 | R | 1 |
| 4. | Identify the use of *opacity* property in CSS. | | CO1 | R | 1 |
| 5. | Write a JavaScript statement to declare a constant named pi and assign it the value 3.14. | | CO2 | A | 1 |
| 6. | State the role of the val() function in jQuery when accessing the form input. | | CO3 | R | 1 |
| 7. | Identify the Bootstrap class used to create a button with primary styling. | | CO1 | R | 1 |
| 8. | Write a simple React functional component named Greet that returns a paragraph with the text “Hi there!”. | | CO4 | A | 1 |
| 9. | Interpret what the command db.products.deleteOne({productID: "P101"}) does in MongoDB. | | CO5 | U | 1 |
| 10. | Cite the function used to start the express server in NodeJS. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the HTML code to display a heading “Hello World!”, a paragraph “Learning HTML is fun!”, and an image banner.jpg with alt text “Homepage Banner”. | | CO1 | A | 3 |
| 12. | Write the CSS code to style a heading with the following properties: text color: maroon, font size: 24px, background color: beige. | | CO1 | A | 3 |
| 13. | Describe the following Hyperlinks in HTML with an example for each.   * Link to External Website * Email Link * Phone Link | | CO1 | U | 3 |
| 14. | Write a JavaScript function named showMessage that displays an alert box with the message “Submission Successful!” when it is called. | | CO2 | A | 3 |
| 15. | Differentiate between the MongoDB commands find() and findOne() with suitable examples. | | CO5 | U | 3 |
| 16. | Explain how to use Node.js to write the contents “Hello World” into a file named output.txt using the built-in fs module. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | **Illustrate** the structure of an HTML form designed for a **Course Registration Portal** by **organizing** the following elements with appropriate placeholder text and styling for clarity and accessibility:   * **Text Boxes**: Student Name, Email Address, and Registration Number * **Password Field**: For portal login, with a placeholder indicating password requirements * **Date Selector**: To choose the course start date * **Text Area**: For student remarks or learning goals * **Check Box**: Option to subscribe to course updates and notifications * **Radio Buttons**: Mode of learning (e.g., 'Online', 'Offline', 'Hybrid') * **Dropdown Menu**: Course selection (e.g., 'Web Development', 'Data Science', 'Cybersecurity', 'AI & ML') * **Buttons**: Submit and Reset   Use appropriate HTML tags and attributes to ensure semantic structure, input validation, and a professional layout. | | CO1 | A | 12 |
|  |  | |  |  |  |
| 18. | a. | Construct an HTML table to display the **two-day seminar timetable** for a college event. Your table should clearly present session names, timings, and speakers, and must meet the following design specifications:   * **Borders**: Apply borders around all table cells. * **Header Row**: Include a heading titled “Seminar Timetable” that spans two columns. * **Day Labels**: Use the second row to label the columns as “Day1” and “Day 2”. * **Merged Session**: Add a third row with a session (e.g., “Welcome Address”) that spans both columns. * **Individual Sessions**: Populate the fourth and fifth rows with sessions specific to Day 1 and Day 2. * **HTML Tags**: Use appropriate tags and attributes such as colspan and rowspan to achieve the required layout. | CO1 | A | 6 |
|  | b. | Explain the following **CSS position properties** by applying to the above question 18 (a) using HTML and CSS. (i)Relative Position (ii) Absolute Position. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | ABC College wants to design a **student information card** on their website. The card should have a **border, padding, margin, and a hover effect** where the background color changes smoothly when the mouse is moved over it.  **Write the necessary HTML and CSS code** to design this card with the following requirements:   * Card width should be 300px. * Add 15px padding inside the card. * Keep 20px margin around the card. * Add a 2px solid border. * On hover, change the background color with a smooth transition. | CO4 | A | 6 |
|  | b. | You are designing a **Travel Website** for a tourism company. The homepage should show:   * An **unordered list** of **popular travel destinations** (e.g., Paris, Tokyo, Dubai). * For the destination **Paris**, include a **nested ordered list** that lists the **top 3 tourist attractions** in order of popularity (e.g., Eiffel Tower, Louvre Museum, Notre-Dame).   **Write the HTML code** to represent the above information using proper list tags and nesting structure. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 20. | Write a HTML page with embedded JavaScript that converts a weight value from **grams to kilograms** using the formula:  Your form should include the following components:   * **Text Box**: To enter the weight in grams (placeholder: “Enter weight in grams”) * **Convert Button**: To trigger the conversion * **Reset Button**: To clear the form * **Output Section**: To display the converted weight in kilograms   Ensure the interface is user-friendly, input is validated, and the result is dynamically displayed using appropriate HTML structure and JavaScript logic. | | CO2 | A | 12 |
|  |  | |  |  |  |
| 21. | You are developing a **Product Showcase Web Page** for an e-commerce site. The page should have the following functionality:   1. Display **three product images** initially hidden using CSS property display:none. 2. Provide buttons to **show** and **hide** the product images using show() and hide(). 3. Provide a **fade-in** button that gradually displays all product images using fadeIn() and a **fade-out** button that gradually hides them using fadeOut(). 4. Provide a **slide-down** button to reveal product descriptions under each image using slideDown() and a **slide-up** button to hide the descriptions using slideUp().   **Write the HTML and jQuery code** to implement these functionalities. | | CO3 | A | 12 |
|  |  | |  |  |  |
| 22. | A **tech gadget store** wants to manage its inventory of smart devices. The system should be able to serialize product data into JSON for storage and later convert it back into a JavaScript object for processing.  **Write a JavaScript program** to perform the following tasks:   1. Create an java script object named smartDevice with the following properties:    * deviceName: "Smartwatch X100"    * deviceId: 102    * category: "Wearables"    * specs: ["Heart Rate Monitor", "GPS", "Water Resistant"]    * available: false    * price: 14999.99 2. Convert the smartDevice object into a JSON string (Serialization) 3. Print the serialized JSON string to the console or web page. 4. Convert the JSON string back into a JavaScript object (Deserialization) 5. Print the deserialized object and display the following:    * deviceId    * The **second spec** in the specs array    * Display "Over Priced" if the price is above 10000 otherwise "Normal Price" | | CO2 | A | 12 |
|  |  | |  |  |  |
| 23. | A hospital is building a Patient Management System using MongoDB to store and manage patient records. Each patient entry should include the following fields:   * patientID * name * age * department (e.g., Cardiology, Neurology) * admissionDate * dischargeDate * status (e.g., admitted, discharged, under observation)   **Illustrate the following** **MongoDB shell operations** to manage this patient database:   1. Create a database named hospitalDB. 2. Create a collection named patients. 3. Insert 3 patient records with unique patientIDs and different departments. 4. Retrieve a patient’s details using their patientID. 5. Delete a patient record based on their patientID. 6. List all patients admitted to the "Cardiology" department. 7. Add a new field insuranceProvider to all patients, setting it to "Not Provided" by default. 8. Update the status of a patient using their patientID. 9. Retrieve and display the name, department, and status of all patients sorted by admissionDate in descending order. 10. Count the number of patients currently marked as "admitted". | | CO5 | A | 12 |
|  |  | |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. | A university wants to build a Student Record Management System using **Node.js, Express.js, and MongoDB** to store and retrieve student details. Each student record should include:   * Student Name * Department * CGPA   The system must support the following operations:   1. Add a new student record to the database 2. Fetch and display all student records 3. Prevent duplicate entries based on student name and return an appropriate message if a duplicate is detected   **Develop a** **Node.js Express server program** that connects to a MongoDB database and performs the above operations.  Write RESTful APIs for:   * POST /api/addStudent – to add a new student * GET /api/viewAllStudents – to fetch all student records   Ensure proper error handling and validation to avoid duplicate student names. | | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Identify the basic elements and styles required to design an attractive web page |
| **CO2** | Select client-side technologies for creating interactive data driven websites |
| **CO3** | Apply dynamic actions and effects to create interactive and visually appealing web experiences |
| **CO4** | Employ web development framework for designing attractive web pages |
| **CO5** | Infer data management in web application development. |
| **CO6** | Establish dynamic web applications using server - side technologies integrated with the database |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2051** | **Duration** | **3hrs** |
| **Course Title** | **ANN AND MACHINE LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Recall the benefit of performing feature selection before modeling the data. | | CO1 | R | 1 |
| 2. | State down the range of Pearson's correlation coefficient. | | CO1 | R | 1 |
| 3. | Identify the algorithm commonly used to train multi-layer neural networks. | | CO2 | R | 1 |
| 4. | Write the full form of ANN. | | CO2 | R | 1 |
| 5. | Determine the use of machine learning in Mechanical Engineering. | | CO3 | A | 1 |
| 6. | Define the term overfitting. | | CO3 | R | 1 |
| 7. | State an use case of Naïve Bayes Algorithm. | | CO4 | U | 1 |
| 8. | State the algorithm suitable for weather forecasting. | | CO4 | R | 1 |
| 9. | Categorize Classification as a type of machine learning algorithm. | | CO5 | An | 1 |
| 10. | Recall the formula for accuracy from confusion matrix. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the mean, median and mode of the given data:  1,1,2,3,4,5,6,6,6,6,7,8,8,9. | | CO1 | An | 3 |
| 12. | State three differences between single and multi layered neural networks. | | CO2 | U | 3 |
| 13. | Compare supervised and unsupervised learning. | | CO3 | E | 3 |
| 14. | Outline Linear SVM with a suitable diagram. | | CO4 | U | 3 |
| 15. | List out the three types of points derived after a DBSCAN clustering is complete. | | CO5 | R | 3 |
| 16. | State 3 differences between Training Dataset and Test Dataset. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Separate the following values by using the given bin methods.  15,21,8,25,34,28,4,21,21.  i) Equal frequency bins.  ii) Smoothing by bin means.  iii) Smoothing by bin boundaries. | CO1 | An | 6 |
|  | b. | A company has collected the following data about employee performance.   |  |  |  | | --- | --- | --- | | Employee | Salary (₹) | Performance Score | | A | 25,000 | 60 | | B | 40,000 | 75 | | C | 60,000 | 85 | | D | 80,000 | 90 |   Solve the following using Min-Max Normalization:  i) Scale Salary between 0 and 1.  ii) Scale Performance Score between 0 and 10. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | The given dataset contains information about different types of vehicles.   |  |  |  | | --- | --- | --- | | Vehicle | Fuel Type | Transmission | | Car | Petrol | Manual | | Bike | Petrol | Automatic | | Truck | Diesel | Manual | | Bus | Diesel | Automatic | | Scooter | Electric | Automatic |   Perform the following tasks:  i) Apply Label Encoding for the “Vehicle” and “Fuel Type” columns.  ii) Apply One-Hot Encoding for the “Transmission” column. | CO1 | A | 6 |
|  | b. | Explain about the various layers of Neural Network. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Explore the concept of the Bias–Variance Tradeoff using a suitable diagram. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | A bank tracks whether customers approve a loan based on Income, Credit Score, and Employment Status. The historical dataset is given in the following table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | No. | Income | Credit Score | Employment | Loan Approved | | 1 | High | Good | Salaried | Yes | | 2 | Low | Poor | Self-Employed | No | | 3 | Medium | Fair | Salaried | Yes | | 4 | Low | Poor | Salaried | No | | 5 | High | Good | Self-Employed | Yes | | 6 | Medium | Fair | Self-Employed | Yes | | 7 | Low | Poor | Salaried | No | | 8 | Medium | Poor | Self-Employed | No | | 9 | High | Fair | Salaried | Yes | | 10 | Low | Poor | Self-Employed | No | | 11 | Medium | Good | Salaried | Yes | | 12 | High | Good | Self-Employed | Yes | | 13 | Medium | Fair | Salaried | Yes | | 14 | Low | Poor | Self-Employed | No | | 15 | High | Fair | Salaried | Yes | | 16 | Medium | Poor | Salaried | No | | 17 | High | Good | Salaried | Yes | | 18 | Low | Fair | Self-Employed | No | | 19 | Medium | Good | Salaried | Yes | | 20 | High | Fair | Self-Employed | Yes |   Solve the following using Naïve Bayes Classifier:  a) Compute the likelihood probabilities for each attribute (Income, Credit Score, Employment, Loan Approved).  b) For a new applicant , calculate and using Bayes’ theorem.  c) Predict whether the loan should be approved or not. Give a reason based on the computed probabilities. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Given the number of hours spent practicing coding per week (X) and the corresponding programming test scores (Y) for 5 students:   |  |  | | --- | --- | | Practice Hours (X) | Test Score (Y) | | 1 | 40 | | 3 | 55 | | 5 | 65 | | 7 | 75 | | 9 | 90 |   Solve the following using Linear Regression: a) Find the regression coefficients and . b) Write the regression equation. c) Predict the test score for a student who practices 6 hours per week. | CO1 | A | 6 |
|  | b | State the differences between clustering, classification, and regression. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 22. |  | A company collects data on advertising spend X and monthly sales revenue Y for 5 branches:   |  |  |  | | --- | --- | --- | | Branch | Advertising (X) | Sales Revenue (Y) | | B1 | 5 | 50 | | B2 | 8 | 65 | | B3 | 6 | 55 | | B4 | 12 | 80 | | B5 | 10 | 75 |   Solve the following using Hierarchical Clustering: a) Compute the Euclidean distance matrix for all branches. b) Perform hierarchical clustering step by step using single linkage until one cluster remains. c) Draw the dendrogram showing the cluster hierarchy. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | A researcher wants to test whether there is an association between gender and preference for online courses. The observed data from a survey of 50 students is given:   |  |  |  |  | | --- | --- | --- | --- | | Gender | Likes Online Courses | Dislikes Online Courses | Total | | Male | 12 | 8 | 20 | | Female | 18 | 12 | 30 | | Total | 30 | 20 | 50 |   Solve the following using Chi Square Test:  a) State the null and alternative hypotheses for this test.  b) Compute the expected frequencies for each cell.  c) Calculate the Chi-Square statistic () and determine whether there is a significant association or not. | CO1 | A | 6 |
|  | b. | Given the following dataset of 5 stores with their monthly sales (X) and customer satisfaction score (Y):   |  |  |  | | --- | --- | --- | | Store | Sales (X) | Satisfaction (Y) | | S1 | 10 | 8 | | S2 | 15 | 12 | | S3 | 12 | 10 | | S4 | 20 | 18 | | S5 | 18 | 15 |   Tasks: a) Construct the distance matrix for all stores using Euclidean distance.  b) Perform hierarchical clustering step by step until all stores are merged into a single cluster. c) Draw the dendrogram representing the cluster hierarchy. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | The following table shows the actual and predicted class data for 10 samples   |  |  |  | | --- | --- | --- | | Sample | Actual Class | Predicted Class | | 1 | 1 | 1 | | 2 | 0 | 0 | | 3 | 1 | 0 | | 4 | 0 | 0 | | 5 | 1 | 1 | | 6 | 0 | 1 | | 7 | 1 | 1 | | 8 | 0 | 0 | | 9 | 1 | 1 | | 10 | 0 | 0 |   Evaluate the various evaluation metrics for the classification models | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Enumerate the technical operation of artificial neural networks. |
| **CO2** | Describe the various neural network architectures and algorithms. |
| **CO3** | Outline the basic principles of machine learning techniques. |
| **CO4** | Analyze various machine learning algorithms. |
| **CO5** | Discover the various engineering applications using ml techniques. |
| **CO6** | Construct and compare the performance of different models. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS3001** | **Duration** | **3hrs** |
| **Course Title** | **BLOCKCHAIN TECHNOLOGIES AND APPLICATIONS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Maria, a data engineer at an e-commerce company, is handling a 500 GB dataset consisting of user clickstream data collected from various online platforms. The organization wants to store and analyze this data using a Hadoop cluster to gain insights into user behaviour.  Apply the understanding of the Hadoop Distributed File System (HDFS) and explain how the data will be stored, replicated, and accessed in the cluster to ensure fault tolerance and high availability. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Bob is a blockchain engineer maintaining a custom Bitcoin test network for a financial research project. Bob’s job is to validate that each new block added to the test chain adheres to the Bitcoin consensus rules. During a routine check, he discovers an anomaly: the header of the most recent block shows a mismatch — the previous block hash doesn’t correspond to the actual hash of the preceding block, and the Merkle root in the header fails to match the set of transactions recorded in the block.  Analyze the possible causes of the discrepancy in the Bitcoin block structure, particularly the mismatch between the previous block hash and the Merkle root, for the scenario described above. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | A programmer is assigned to design a distributed application for an online retail platform that needs to handle large amounts of data and serve users from multiple locations. The application must be efficient, scalable, and fault-tolerant. Explain the architecture of the distributed application that the programmer designs for this platform. Include a suitable diagram to illustrate how its components interact and ensure performance, reliability, and scalability. | CO3 | A | 10 |
|  | b. | Explain the various Ethereum addresses and accounts used while dealing with an Ethereum wallet. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | A university plans to implement a blockchain-based scholarship distribution system using Solidity smart contracts. Eligible students automatically receive scholarship tokens based on their academic performance, and the system's development and testing are carried out in the Remix IDE.  Describe the Solidity smart contract to manage scholarship payments, and explain how Remix IDE assists in compiling, debugging, and testing the contract. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | An organization is developing a Hyperledger Fabric-based business network to manage digital identities and contracts among multiple enterprises.  Explain the modular design of Hyperledger Fabric that could be customized to meet the business and security requirements of this network. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain how the Ethereum Virtual Machine (EVM) executes smart contracts and manages gas consumption. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 7. |  | Explain the Digital Signature Algorithm (DSA) to use private and public keys to generate, attach, and verify digital signatures. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | A blockchain solutions architect for a health insurance company that wants to automate claims processing using blockchain. Claims submitted by hospitals are validated and automatically reimbursed through smart contracts if policy conditions are met.  Illustrate how a blockchain-based insurance platform can improve claims verification, reduce fraud, and enhance transparency. | CO6 | A | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | A fintech company launches a mobile payment app that allows users to send and receive money across borders instantly. To ensure compliance with financial regulations and prevent fraudulent activities, the company requires all new users to complete Know Your Customer (KYC) verification before they can access full transaction features. While this step helps maintain a secure platform, some users are frustrated by the need to upload personal identification documents, and others experience delays due to manual review processes.  Explain the purpose of KYC in financial and blockchain-based systems. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Examine the significance of blockchain technology and its real world use cases. |
| CO2 | Illustrate the working principle of cryptocurrency and bitcoin. |
| CO3 | Develop applications using the solidity programming language for ethereum. |
| CO4 | Examine the functionalities and the working model of hyperledger. |
| CO5 | Formulate privacy using channels and private data collections. |
| CO6 | Design end to end business flow of a hyperledger application. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS2001** | **Duration** | **3hrs** |
| **Course Title** | **AI IN TELEMEDICINE AND HEALTHCARE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Infer the primary modes of communication used to send casualty lists and order supplies during the American Civil War between 1840 and 1920. | | CO1 | U | 1 |
| 2. | List any three applications of AI technologies in healthcare. | | CO1 | R | 1 |
| 3. | List the Core Components of RPM Systems. | | CO2 | R | 1 |
| 4. | Define dendrogram and its use in hierarchical clustering. | | CO2 | R | 1 |
| 5. | Identify the virtual assistant of the AI- driven conversational platform ‘sensely’. | | CO3 | U | 1 |
| 6. | List any two virtual tools available for Skin Cancer Detection using Dermatoscopic Image Analysis. | | CO3 | R | 1 |
| 7. | List any three advantages of Real-Time Data Analysis and Decision Support using AI Algorithms. | | CO4 | R | 1 |
| 8. | Infer the use of AI in chronic disease management. | | CO4 | R | 1 |
| 9. | List the emerging technologies used for data privacy and security in telemedicine. | | CO5 | U | 1 |
| 10. | Define Telerobotics. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain AI-Enabled telemedicine platform with an example. | | CO1 | U | 3 |
| 12. | Distinguish agglomerative clustering and divisive clustering. | | CO2 | An | 3 |
| 13. | Compare the effectiveness of deep learning techniques in medical imaging with traditional image processing methods. | | CO3 | An | 3 |
| 14. | Explain how AI-driven chatbots and virtual assistants are integrated into teleconsultations to enhance healthcare services. | | CO4 | U | 3 |
| 15. | Define Data Anonymization. | | CO5 | U | 3 |
| 16. | Explain any two emerging trends and advancements in AI-driven telemedicine technologies. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the various tools and platforms that integrate AI with telemedicine to improve diagnosis, patient monitoring, and healthcare delivery. | CO1 | An | 6 |
|  | b. | Examine with examples the role of AI in telemedicine and the AI technologies used in healthcare. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the various sensors and IoT devices used in remote patient monitoring. | CO3 | U | 6 |
|  | b. | Explain any four supervised learning algorithms used for Remote Patient Monitoring. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | A 58-year-old patient with congestive heart failure (CHF) is being monitored through a remote system that tracks weight, blood pressure, and peripheral edema severity. Over 48 hours, the patient's data shows:  • Weight increased by 3.2 kg  • Blood pressure elevated from 120/80 to 138/92 mmHg  • Edema severity score increased from 1+ to 3+  Apply four supervised learning algorithms to predict the likelihood of acute decompensated heart failure (ADHF) requiring hospitalization within the next 72 hours. Explain the process each algorithm uses to generate a risk prediction from the patient's data. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the various common imaging modalities for Medical Imaging Interpretation. | CO4 | U | 6 |
|  | b. | Analyze the following case studies on AI-Enhanced Diagnostic Tools in Telemedicine  a)AI in Point-of-Care Ultrasound (POCUS  b)AI in COVID-19 Diagnosis & Remote Monitoring  c) AI in Ophthalmology – AI-Powered Eye Disease Detection. | CO4 | An | 2  2  2 |
|  |  |  |  |  |  |
| 21. |  | Illustrate a conceptual framework for detecting early signs of mental health issues, such as anxiety or depression. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Describe the below regulatory frameworks governing telemedicine and AI applications  i) HIPAA (Health Insurance Portability and Accountability Act)  ii) GDPR (General Data Protection Regulation)  iii) FDA (Food and Drug Administration)  iv) WHO (World Health Organization) | CO2 | U | 3  3  3  3 |
|  |  |  |  |  |  |
| 23. |  | Sketch the Integration of AI-Driven Chatbots and Virtual Assistants in Pre-Consultation and Post-Consultation Healthcare Workflows. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Interpret how VR-based surgical simulators enhance clinical skill development and error reduction in remote medical training, and compare their outcomes with traditional cadaver-based learning. | CO6 | A | 6 |
|  | b. | A trauma patient is brought to a rural emergency unit with multiple fractures. The facility has a 5G-based telepresence robot connected to an orthopedic surgeon in a city hospital.  Apply how telerobotic surgery assistance and remote imaging systems can be used to stabilize the patient and plan immediate intervention. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Summarize key concepts and technologies related to AI in telemedicine and healthcare. |
| **CO2** | Demonstrate an understanding of the benefits, challenges, and ethical considerations associated with AI  adoption in telemedicine. |
| **CO3** | Apply AI algorithms and tools to develop telemedicine applications for remote patient monitoring and  diagnosis. |
| **CO4** | Comprehend the integration of AI with telemedicine platforms for real-time data analysis and decision  support. |
| **CO5** | Interpret research findings and case studies showcasing successful implementations of AI in telemedicine  and healthcare. |
| **CO6** | Develop practical skills in designing and evaluating AI-enabled telemedicine systems for  diverse healthcare scenarios. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2014** | **Duration** | **3hrs** |
| **Course Title** | **BIG DATA ANALYTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the classification of digital data. | | CO1 | R | 1 |
| 2. | Identify the reason for an email placed in the “unstructured category”. | | CO1 | R | 1 |
| 3. | A user wants to upload a file named report.pdf from their local system to the /user/reports directory in HDFS. Identify an appropriate HDFS command to perform this action. | | CO2 | R | 1 |
| 4. | List the three main elements of YARN's architecture. | | CO2 | R | 1 |
| 5. | **State** the consequence when the mapper output key-value types differ from the reducer input. | | CO3 | R | 1 |
| 6. | **Identify** the main responsibility of the JobTracker during MapReduce execution. | | CO3 | R | 1 |
| 7. | Identify the syntax to **create a table** in Hive. | | CO4 | R | 1 |
| 8. | Identify the syntax for **deleting records** in Hive. | | CO4 | R | 1 |
| 9. | Define “Capped Collections” in MongoDB. | | CO5 | U | 1 |
| 10. | Mention any three **CQL data types** used in Cassandra. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate Hadoop v1 and Hadoop v2 with respect to resource management. | | CO1 | An | 3 |
| 12. | Suppose there is a file having size of 514MB stored in the Hadoop (Hadoop 2.x) by using the default size-configuration of block. Calculate the number of blocks that will be created in total and identify the size of each block. | | CO2 | A | 3 |
| 13. | A 500 MB file is to be processed with the default HDFS block size of 128 MB. Calculate the number of map tasks that will be created. | | CO3 | A | 3 |
| 14. | Interpret the way to **load data from a local file system into a Hive table.** | | CO4 | U | 3 |
| 15. | Differentiate RDBMS and MongoDB, highlighting their key features with appropriate examples. | | CO5 | An | 3 |
| 16. | Explain the **insert, update, and delete operations** in Cassandra with CQL syntax. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe in detail the various types of Big Data Analytics and their significance. | CO1 | U | 6 |
|  | b. | Explain the big data technologies that help to meet the challenges posed by big data. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the various components of Hadoop ecosystem in detail. | CO2 | U | 6 |
|  | b. | Explain the architecture of HDFS in big data processing. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Apply MapReduce to count the frequency of each word in an input text, “Hello everyone” . | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Interpret the architecture of Apache Hadoop MapReduce approach. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Interpret the architecture of Apache PIG. | CO4 | U | 8 |
|  | b. | Write a sub query in Hive to count occurrence of similar words in a file. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Interpret the Apache Hive architecture with the diagram. | CO4 | U | 6 |
|  | b. | Explain the concept of **partitioning** in Hive with suitable examples. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Interpret the different types of No-SQL database. | CO5 | U | 6 |
|  | b. | Develop a set of **MongoDB queries** to manage a healthcare database which includes operations for creating, querying, updating, and deleting patient records with indexing for optimization. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Create a keyspace named ecommerce and a table orders in Cassandra to manage online purchases. Apply the following operations:   * Create the keyspace with appropriate replication settings(3 marks) * Create the Orders table using columns order\_id, customer\_name, item, quantity, and price(3 marks) * Insert three records(3 marks) * Retrieve all orders where quantity > 2 (3 marks) | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the concepts, sources, phases, and characteristics of big data and analytics |
| **CO2** | Examine the importance of utilizing the Hadoop framework for big data analytics |
| **CO3** | Implement the MapReduce programming model to process big data |
| **CO4** | Demonstrate the use of Pig and Hive for application development |
| **CO5** | Distinguish the different types of NoSQL databases |
| **CO6** | Develop applications with MongoDB and Cassandra |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS2015** | **Duration** | **3hrs** |
| **Course Title** | **BLOCKCHAIN TECHNOLOGIES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1 | Define Distributed Ledger Technology (DLT) and its role in maintaining transparency in blockchain networks. | | CO5 | R | 1 |
| 2 | Identify the function of Merkle Trees and describe how they support data verification in blockchain systems. | | CO5 | U | 1 |
| 3 | Describe the concept of Unspent Transaction Output (UTXO) in Bitcoin. | | CO3 | U | 1 |
| 4 | Identify the role of private and public keys in securing Bitcoin transactions. | | CO3 | R | 1 |
| 5 | Distinguish between Externally Owned Accounts (EOAs) and Smart Contract Accounts in Ethereum | | CO4 | U | 1 |
| 6 | State two functions of Ethereum clients like MetaMask or Geth for interacting with smart contracts. | | CO6 | R | 1 |
| 7 | Summarize the life cycle of a smart contract with an example of deployment and execution in Ethereum. | | CO4 | U | 1 |
| 8 | Identify common security risks and antipatterns in Solidity smart contracts and suggest best practices to mitigate them. | | CO4 | U | 1 |
| 9 | Enumerate the key components and working architecture of a Decentralized Application (DApp). | | CO1 | R | 1 |
| 10 | Illustrate the channel function to isolate transaction data between participants in Hyperledger Fabric. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11 | Discuss the architecture of a blockchain system and explain the function of its key components using a neat diagram. | | CO2 | U | 3 |
| 12 | Explain the process of transaction validation and block formation in Bitcoin. | | CO3 | U | 3 |
| 13 | Determine the steps involved in deploying a smart contract on the Ethereum blockchain. | | CO4 | A | 3 |
| 14 | Examine the role of Gas and Ether in executing smart contracts and maintaining network efficiency. | | CO4 | R | 3 |
| 15 | Illustrate the ways Decentralized Applications (DApps) differ from traditional applications in terms of architecture and control. | | CO1 | A | 3 |
| 16 | Explain how Hyperledger Fabric handles identity management, access control, and transaction validation. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the architecture of HDFS | CO1 | U | 6 |
|  | b. | Evaluate the distributed ledger and Merkle trees to ensure data integrity and transparency. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the complete life cycle of a Bitcoin transaction from creation to confirmation in a block. | CO2 | A | 6 |
|  | b. | Illustrate the process of mining to achieve consensus and prevent double spending in the Bitcoin network. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Discuss in detail the architecture of Ethereum and the role of Ether currency units. | CO3 | U | 6 |
|  | b. | Illustrate the process of creating and deploying a smart contract on the Ethereum blockchain using MetaMask or Geth. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Develop a simple Solidity smart contract for a voting or student-record system and explain its key components. | CO4 | A | 6 |
|  | b. | Examine common security risks in Solidity smart contracts and outline best practices to prevent vulnerabilities. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the essential components of a Decentralized Application (DApp) and its advantages over traditional applications. | CO5 | U | 6 |
|  | b. | Analyze the architecture of Hyperledger Fabric and describe how identity and access control are managed. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the transaction flow in Hyperledger Fabric from proposal to validation and commitment. | CO6 | U | 6 |
|  | b. | Compare Hyperledger Fabric with Ethereum in terms of consensus, privacy, and scalability. | CO6 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Design a blockchain-based healthcare or supply-chain application using DApps and smart contracts. | CO4 | C | 6 |
|  | b. | Evaluate how security, transparency, and scalability are achieved in your proposed system. | CO6 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Devise a blockchain-based solution for healthcare data management ensuring data integrity, patient privacy, and secure access. Justify your design choices. | CO5 | An | 6 |
|  | b. | Explain how your proposed solution can be extended to IoT or Food Industry applications, highlighting security, transparency, and efficiency benefits. | CO5 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Implement the basic decentralized applications (DApps) using platforms like Ethereum and Hyperledger. |
| **CO2** | Demonstrate the architecture of blockchain systems, including consensus mechanisms, and the structure of Bitcoin and Ethereum. |
| **CO3** | Assess the security and efficiency of blockchain applications, focusing on smart contract implementation, transaction validation, and mining. |
| **CO4** | Develop secure and optimized smart contracts using Solidity for real-world use cases and design DApps with decentralized storage. |
| **CO5** | Develop blockchain concepts, such as Merkle Trees and distributed ledgers, to solve problems in industries like healthcare, IoT, and supply chain. |
| **CO6** | Distinguish between various blockchain platforms, tools, and technologies to identify suitable use cases and applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS2018** | **Duration** | **3hrs** |
| **Course Title** | **DevOps** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the role of a proxy microservice or API gateway. | | CO1 | U | 1 |
| 2. | State the drawbacks monolithic applications. | | CO1 | R | 1 |
| 3. | Define a playbook in Ansible. | | CO2 | R | 1 |
| 4. | What is the first step in a deployment pipeline? | | CO2 | R | 1 |
| 5. | Name one continuous integration tool used in DevOps. | | CO3 | U | 1 |
| 6. | Define Jenkins in the context of CI/CD. | | CO3 | R | 1 |
| 7. | State the application of Docker Swarm. | | CO4 | U | 1 |
| 8. | Define clustering in the context of DevOps. | | CO4 | R | 1 |
| 9. | Name a container orchestration tool. | | CO5 | U | 1 |
| 10. | What is a self-healing system? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare monolithic and microservices architecture in terms of deployment. | | CO1 | An | 3 |
| 12. | Describe the initial stages of the deployment pipeline. | | CO2 | U | 3 |
| 13. | Compare service discovery tools with proxy services. | | CO3 | An | 3 |
| 14. | Outline the procedure for configuring Docker Swarm. | | CO4 | U | 3 |
| 15. | Explain the container life cycle. | | CO5 | An | 3 |
| 16. | Describe how Jenkins can automate health checks. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the benefits and challenges of implementing continuous integration and continuous delivery in a software project. | CO1 | An | 6 |
|  | b. | Describe the improvements in scalability offered by microservices compared to monolithic applications. | CO | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Design a workflow to automate deployment from development to production using Docker and Ansible. | CO2 | C | 6 |
|  | b. | Explain how configuration management is handled in Docker using Ansible. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Create a CI/CD pipeline using Jenkins for a microservices application and explain its stages. | CO3 | C | 6 |
|  | b. | Explain the intermediate stages of deploying containers to a production server. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate a case study where scaling services prevented system downtime during peak load. | CO4 | E | 6 |
|  | b. | Demonstrate the use of Ansible to automate deployment with Docker Swarm. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the advantages of container orchestration over traditional deployment methods. | CO5 | An | 6 |
|  | b. | Explain the way Kubernetes handles resource allocation for containers. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Examine the advantages of using Ansible for production environment configuration | CO2 | An | 6 |
|  | b. | Evaluate the effectiveness of Ansible in production environment setup. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Investigate a scenario where automating the deployment pipeline reduces manual errors and enhances productivity. | CO3 | An | 6 |
|  | b. | Demonstrate the automation of deployment pipelines with Jenkins. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate a self-healing architecture for a web application using Docker and Jenkins. | CO6 | A | 6 |
|  | b. | Explain the different levels of self-healing systems. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Illustrate the fundamentals of DevOps. |
| **CO2** | Demonstrate the ability to write Ansible playbooks for infrastructure provisioning and version control. |
| **CO3** | Automate tasks using Git, Docker, Ansible, Jenkins, and Kubernetes. |
| **CO4** | Compare the tools used to develop a robust DevOps pipeline that enhances collaboration and automates workflows. |
| **CO5** | Integrate Kubernetes with Jenkins using CI/CD practices. |
| **CO6** | Demonstrate self-healing mechanisms on the overall system performance. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS2022** | **Duration** | **3hrs** |
| **Course Title** | **PROMPT ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name any two applications of Large Language Models (LLMs) in real-world technology. | | CO1 | R | 1 |
| 2. | Define few-shot learning with a simple example. | | CO1 | R | 1 |
| 3. | Calculate the estimated probability of the sequence "green forest" using a bigram model without applying any smoothing technique. Use count("the green") = 100, count("green forest") = 30, count("green") = 200, count("forest") = 120. | | CO2 | A | 1 |
| 4. | Identify the component in a Recurrent Neural Network (RNN) that helps it preserve information over time steps. | | CO3 | U | 1 |
| 5. | Define a token in the context of a transformer model. | | CO4 | R | 1 |
| 6. | Recognize one key difference between the encoder and decoder in a transformer model. | | CO4 | R | 1 |
| 7. | State the effect of a conversational agent’s defined persona on the nature and tone of its responses. | | CO5 | R | 1 |
| 8. | Enumerate the core components of the Reinforcement Learning from Human Feedback (RLHF) model. | | CO5 | R | 1 |
| 9. | Name the evaluation technique that relies on pre-collected, static datasets. | | CO6 | R | 1 |
| 10. | Identify a prompt evaluation tool that supports multi-model A/B testing. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between a unigram, a bigram, and a 1-skip-2-gram model in statistical language processing using the sentence “AI is transforming industries rapidly”. | | CO1 | An | 3 |
| 12. | Explain positional encoding in transformers using a simple example. | | CO2 | A | 3 |
| 13. | Describe the functions of the top-p and top-k API parameters in LLM text generation, providing suitable illustrations. | | CO3 | U | 3 |
| 14. | Apply the Chat Completion API to simulate the following conversation. Include the Python code and the expected assistant response for the given prompt.  User: “Explain the concepts of LLM”. | | CO4 | A | 3 |
| 15. | Summarize the differences between instruct and chat models. | | CO5 | U | 3 |
| 16. | Calculate the perplexity for the given word sequence using the provided probabilities, and explain the significance of the obtained value.  Sentence: “A man is on the tree”  Probability of each word, given the preceding words: [0.2, 0.1, 0.3, 0.25, 0.15, 0.1] | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the evolution of prompt engineering from traditional Natural Language Processing (NLP) approaches to statistical and neural language models, and evaluate the influence of LLMs on real-world applications. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Compare the capabilities of RNNs and LSTMs in mitigating the vanishing gradient problem. Illustrate the architecture of a standard RNN and describe its operational flow. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Describe the Generative Pre-trained Transformer (GPT) architecture, emphasizing its decoder-only transformer design, self-attention mechanism, positional encoding, and the strategies of pre-training and fine-tuning, supported by a labeled diagram. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Evaluate the influence of role, persona, and context on coherence, tone, and adaptability in multi-turn Chat Completion API conversations, illustrating with a health advice chatbot example. | CO1 | An | 8 |
|  | b. | Differentiate between the human thought process and LLM operations, analyzing their respective challenges and effects. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Examine the RLHF workflow in language model training, highlighting the contribution of human feedback, reward modeling, and policy optimization to model alignment. | CO5 | A | 6 |
|  | b. | Analyze the role of the ReAct framework in combining reasoning and action for effective multi-step problem-solving, with an example. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. |  | Construct a conversational AI system using few-shot learning, CoT reasoning, and RAG for dynamic responses, and justify the design choices with examples. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Analyze various metrics used for evaluating LLMs. Explain the insights each metric offers into model performance, the contexts in which they are most appropriate, and their respective advantages and limitations. | CO1 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the impact of bias in training data on LLM outputs and suggest prompt engineering techniques to minimize such bias. | CO6 | U | 6 |
|  | b. | Apply the principles of role-playing, specificity, and formatting to design effective prompts that improve LLM response quality. Provide examples. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the fundamental concepts of Large Language Models and its various applications in technology. |
| **CO2** | Evaluate various language models, including statistical (N-Grams) and contextual models, for effective implementation. |
| **CO3** | Assess the role of neural networks, including Feedforward, RNNs, LSTM, and GRUs, in NLP tasks. |
| **CO4** | Illustrate the architecture and functionality of Generative Pre-trained Transformers (GPT) and their evolution. |
| **CO5** | Examine key mechanisms of language models, including tokenization strategies, sampling methods, and common challenges. |
| **CO6** | Assess the effectiveness of prompt engineering practices and their industry applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3001** | **Duration** | **3hrs** |
| **Course Title** | **ADVANCED COMPUTER NETWORKS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Discuss the four dimensions of transport layer services for network applications. | CO1 | U | 8 |
|  | b. | You are the network administrator for a small company. The company's network uses a router that performs Network Address Translation (NAT). The router's public IP address is 203.0.113.1. Three internal workstations with the following IP addresses are simultaneously accessing resources on the internet:  Workstation A: 192.168.1.10 → browsing a web server at 93.184.216.34 on port 80 (HTTP).  Workstation B: 192.168.1.11 → also browsing a web server at 93.184.216.34 on port 80 (HTTP).  Workstation C: 192.168.1.12 → using SSH to connect to a server at 198.51.100.5 on port 22.  Prepare the NAT Table.   | Internal IP & Port | NAT Public IP & Port | External IP & Port | | --- | --- | --- | | CO2 | A | 8 |
|  |  |  |  |  |  |
| 2. |  | Explain the working of Higher layer protocols in connecting core network. | CO3 | R | 16 |
|  |  |  |  |  |  |
| 3. | a. | Differentiate the working of 4G and 5G networks. | CO4 | U | 8 |
|  | b. | Explain the architecture of Wireless LAN | CO4 | U | 8 |
|  |  |  |  |  |  |
| 4. |  | Illustrate the working of IoT Layer security with suitable example. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Alice wants to send confidential e-mail, m, to Bob. Analyze various security threats in the conversation. | CO5 | An | 8 |
|  | b. | Employ suitable mitigation technique to secure the email conversation. | CO5 | A | 8 |
|  |  |  |  |  |  |
| 6. |  | The Johnson family uses a Wi-Fi baby monitor that streams video directly to their phones. A tech-savvy neighbor discovers they can easily view the video feed using a simple network scanning tool on their own laptop, which is connected to the same public Wi-Fi at their apartment complex. Analyze various security breaches of the baby monitor and suggest suitable solutions. | CO5 | An | 16 |
|  |  |  |  |  |  |
| 7. | a. | Compare Fog and Edge computing. | CO6 | U | 8 |
|  | b. | Discuss about Edge computing Architecture | CO6 | R | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | Apply the Convergence of recent networking Technologies to design smart city applications. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Recognize different addressing schemes in ipv4 and ipv6 and explain their significance in network communication. |
| CO2 | Identify the key components and functionalities of sdn and its role in modern network architectures. |
| CO3 | Recall the operation and significance of control plane protocols. |
| CO4 | Explain the principles of wireless and mobile networks. |
| CO5 | Apply cryptographic techniques to ensure secure communication and data integrity in computer networks. |
| CO6 | Identify edge computing principles to design and deploy iot solutions effectively. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3007** | **Duration** | **3hrs** |
| **Course Title** | **ADVANCED IMAGE AND VIDEO PROCESSING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Illustrate spatial resolution and intensity resolution in digital images, and examine how reducing each of these parameters affects the overall image quality and perception. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Apply the Discrete Wavelet Transform (DWT) in image processing by developing the mathematical expression for 2D DWT and illustrate its usefulness in image decomposition and reconstruction. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. |  | Explain image smoothing technique achieved in the frequency domain using high-frequency attenuation, and state the characteristics, formulation, and comparative performance of Ideal, Butterworth, and Gaussian lowpass filters used for this purpose. | CO2 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Describe various edge models used in image processing and mention the models that form the basis for edge detection techniques that segment images based on abrupt intensity changes. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | Illustrate the following image compression techniques with suitable examples:  (i) Huffman Coding  (ii) LZW Coding | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain image compression techniques that can be achieved using Predictive Coding and Wavelet Coding, and illustrate their roles in reducing redundancy while preserving image quality. | CO3 | A | 20 |
|  |  |  |  |  |  |
| 7. |  | Differentiate between various motion estimation techniques such as block-based, region-based, mesh-based approaches, and state their advantages, limitations, and applications in modern video coding systems. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain in detail about the following 3D models:   * Geometric Image Formation * Photometric Image Formation | CO6 | U | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | A dataset containing medical images of skin lesions is to be classified into benign and malignant categories. The research team considers using Decision Trees, Support Vector Machines (SVM), and Logistic Regression for building the classification model. Analyze how each of these machine learning approaches handles the classification task, compare their strengths and weaknesses in terms of accuracy, interpretability, and computational efficiency, and deduce which technique would be most suitable for this medical imaging scenario. | CO5 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply image and video processing techniques for real-time applications. |
| CO2 | Analyze various image processing techniques. |
| CO3 | Demonstrate image compression techniques for efficient transmission. |
| CO4 | Relate various coding techniques for 2D estimation. |
| CO5 | Justify the usage of machine learning in image processing. |
| CO6 | Examine the image and video processing algorithms to real time problems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3008** | **Duration** | **3hrs** |
| **Course Title** | **PATTERN RECOGNITION AND MACHINE LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | **List and describe** the major types of probability distributions, classifying them into discrete and continuous distributions. Provide two examples for each category. | CO1 | R | 10 |
|  | b. | **Calculate and solve** an optimization problem using the **Lagrangian Multiplier Method** to find the maximum or minimum value of f (x, y) = x2 + y2 subject to the constraint x + 2y = 6. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | **Differentiate** between **Maximum Likelihood Estimation (MLE)** and **Maximum a Posteriori (MAP)** methods in parameter estimation, providing suitable mathematical formulations and interpretations. | CO2 | U | 10 |
|  | b. | **Analyze the effects of the regularization parameter λ in both Ridge and Lasso regression. Differentiate between their solutions by distinguishing how Ridge shrinks coefficients while Lasso can lead to sparse models with exact zero coefficients. Relate this sparsity property to the concept of feature selection.** | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | **Summarize the core principle behind the Parzen-window method for non-parametric density estimation. Interpret the effect of a large window width 'h' on the resulting density estimate.** | CO3 | U | 10 |
|  | b. | Consider the following labelled dataset in a two-dimensional feature space:  Training Data:   | Point | x₁ | x₂ | Class | | --- | --- | --- | --- | | P₁ | 1 | 1 | Red | | P₂ | 2 | 3 | Red | | P₃ | 3 | 2 | Blue | | P₄ | 4 | 5 | Blue | | P₅ | 5 | 3 | Red | | P₆ | 6 | 6 | Blue |   A new query point ‘Q’ has coordinates (4, 3).   1. Calculate the class label for point Q using the k-NN algorithm with k=3. Show all steps, including the calculation of distances and the final vote count. 2. Illustrate the concept of the Voronoi cell for the instance P3(3,2) under the 1-NN rule (k=1). Describe the properties of this cell and explain its significance for the 1-NN classifier's decision boundary. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the role of the Error Backpropagation method in training a Multilayer Feedforward Neural Network. Describe how the gradient descent algorithm is used in the Error Backpropagation method to minimize loss functions in a Multilayer Feedforward Neural Network | CO4 | R | 10 |
|  | b. | Analyze the fundamental differences between Logistic Regression and the Perceptron algorithm. Compare their activation functions and contrast their resulting loss functions and training behavior, especially concerning the handling of misclassified examples. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Summarize the core idea behind the Gradient Boosting algorithm. Explain the difference between Gradient Boosting and a simple boosting method by describing the target each subsequent model in the sequence is built to predict. | CO5 | U | 10 |
|  | b. | Determine the first two levels of a Decision Tree using the Gini Index as the splitting criterion for the following dataset with features X1​ and X2 and a binary class label.   |  |  |  | | --- | --- | --- | | F1 | F2 | Class | | 3 | 7 | 0 | | 8 | 2 | 1 | | 2 | 5 | 0 | | 9 | 3 | 1 | | 4 | 8 | 0 | | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Define the CART algorithm in the context of building a decision tree. List the two primary steps involved in constructing a tree using CART and state the purpose of ensemble methods like bagging and boosting in classification. | CO6 | R | 10 |
|  | b. | Build a Bagging ensemble to classify whether an individual will "Go Out" (Yes or No) based on a single feature, "Weather" for the given training dataset. The base classifier for the ensemble is a Decision Stump (a decision tree with a depth of one).   | Instance | Weather | Go\_Out | | --- | --- | --- | | 1 | Sunny | Yes | | 2 | Sunny | Yes | | 3 | Rainy | No | | 4 | Rainy | No | | 5 | Sunny | No |   A new test instance to classify is: Weather = Sunny   1. Demonstrate the creation of two different bootstrap training sets (D1 and D2) by performing random sampling with replacement from the original dataset. Each set must contain 5 instances. Show the composition of each bootstrap set. 2. Apply the Decision Stump base classifier to each bootstrap set.    * For each set (D1 and D2), determine the most frequent class for each weather type and state the resulting classification rule.    * Show the prediction that each stump makes for the test instance (Weather = Sunny). 3. Show how the final ensemble prediction is produced by aggregating the predictions from the two stumps using majority voting. | CO6 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the following linear algebra terms with suitable examples: (i) Vector (ii) Inner Product (iii) Outer Product (iv) Inverse of a Matrix (v) Eigenvalue and Eigenvector. | CO1 | U | 10 |
|  | b. | Given a simple linear regression model y=𝞈0+𝞈1x and the following small dataset:   | x | y | | | --- | --- | --- | | 1 | 1 | | 2 | 3 | | 3 | 3 | | 4 | 5 |   Employ the principle of Maximum Likelihood Estimation to derive the log-likelihood function, assuming the noise is normally distributed with a mean of zero and constant variance σ². | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the working principle of the Naïve Bayes Classifier. State the rule for minimum error-rate classification. List the three main components required to build a Hidden Markov Model. | CO3 | R | 10 |
|  | b. | Consider a simple two-class problem in a two-dimensional feature space:  **Class ω₁ (Label: +1):**   * **x₁** = (2, 3)ᵀ * **x₂** = (3, 4)ᵀ * **x₃** = (4, 3)ᵀ   **Class ω₂ (Label: -1):**   * **x₄** = (6, 6)ᵀ * **x₅** = (7, 7)ᵀ * **x₆** = (8, 6)ᵀ  1. **Calculate** the within-class scatter matrix, **S\_W**, for this dataset. Show all steps, including the computation of the class means. 2. Based on the objective of FDA, **illustrate** the direction of the optimal projection vector, w, that maximizes the separation between the two classes. | CO4 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the concept of a Decision Tree in the context of classification. List the three common impurity measures used in algorithms like CART for selecting splits, and state the ultimate goal of the boosting technique in ensemble methods. | CO5 | R | 10 |
|  | b. | For the given datapoints, (160, 55), (175, 70), (165, 60), (180, 80), (170, 65), (185, 85) apply the K-Means clustering algorithm to partition the data. Experiment with k = 2 and use the Elbow Method to determine the optimal number of clusters. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Solve complex problems in engineering applications using advanced mathematical concepts. |
| CO2 | Apply function approximation methods to minimize bias-variance trade-offs. |
| CO3 | Examine probabilistic models for effective pattern recognition and decision-making in various applications. |
| CO4 | Apply advanced machine learning techniques and dimensionality reduction methods to solve complex problems. |
| CO5 | Assess non-metric classification methods for classification problems. |
| CO6 | Distinguish clustering techniques based on appropriate validation criteria. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3009** | **Duration** | **3hrs** |
| **Course Title** | **EXPLAINABLE AI** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Differentiate interpretability & explainability and elaborate on the concept of surrogate models as a specific technique used for post-hoc explanation. | CO1 | An | 10 |
|  | b. | Describe the different types of explanations and identify at least three distinct explainability consumers, explaining why their explanatory needs differ. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Analyze the restrictive parametric assumptions of Linear Regression and detail the conceptual advancements offered by Generalized Linear Models (GLMs) and Generalized Additive Models (GAMs) to rectify these issues. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. |  | Analyze and contrast the three popular model-agnostic techniques: Partial Dependence Plots (PDPs), Individual Conditional Expectation Plots (ICEs), and Accumulated Local Effects (ALE) Plots. | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | A medical AI system analyzes chest X-rays to detect pneumonia but mistakenly classifies a healthy lung as infected. Doctors need to understand which parts of the X-ray led to this incorrect diagnosis. Examine the suitability of Gradient-weighted Class Activation Mapping (Grad-CAM) and Guided Grad-CAM for interpreting model predictions and detecting influential misclassification features. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain the fundamental steps involved in preparing text data for machine learning models, specifically mentioning tokenization and word embeddings. | CO5 | U | 10 |
|  | b. | Describe the "Gradient x Input" explainability method and its insight, particularly in the transition from linear to nonlinear models. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Examine the mathematical foundations and operational procedures of Layer-Wise Relevance Propagation (LRP) as a deep learning explainability technique. | CO5 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain the main purpose of AI and describe significant challenges it faces. | CO1 | U | 10 |
|  | b. | Discuss the approaches and optimization strategies employed in Generating counterfactual explanations. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate SHAP's theoretical foundation for unifying local and global model explanations. Also, discuss its principal advantages over conventional feature importance methodologies. | CO3 | U | 10 |
|  | b. | Discuss the saliency maps generated by DeConvNets and Guided Backpropagation. | CO4 | U | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Analyze the methodological integration required for explainability techniques to successfully interpret models trained on multimodal data. | CO6 | An | 10 |
|  | b. | Discuss the major common pitfalls in using explainability and their practical implications for model deployment. | CO6 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Examine the significance of explainable AI (XAI) in various applications. |
| CO2 | Implement interpretable models using regression, classification, and rule - based techniques. |
| CO3 | Evaluate XAI techniques for tabular data using dependence plots. |
| CO4 | Illustrate advanced methods to generate and improve explanations for AI models for image input. |
| CO5 | Apply XAI techniques for handling text data. |
| CO6 | Analyze alternative XAI techniques in the decision - making process of AI models. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3010** | **Duration** | **3hrs** |
| **Course Title** | **ADVANCED DATA STRUCTURES AND ALGORITHMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | A university database administrator needs to store 12 student records in a hash table of size 13 using the hash function h(key) = key mod 13. The student IDs to be inserted are: 15, 28, 41, 36, 49, 62, 77, 53, 91, 104, 117, 68.   1. Explain linear probing and quadratic probing collision resolution methods with their formulas. 2. Construct the hash table using linear probing for the given sequence. 3. Construct the hash table using quadratic probing showing step-by-step insertion. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 2. | a. | A task scheduling system needs to process jobs with priorities: 40, 20, 35, 10, 30, 15, 45, 25. Construct a MaxHeap by inserting elements one by one and show the heap after each insertion that causes a swap. | CO2 | A | 8 |
|  | b. | A database indexing system needs to maintain balanced search operations by constructing an AVL tree. Insert the keys: 30, 20, 40, 10, 25, 50, 5, 35, 45, 15 in the given order. Show the tree after each insertion and perform all necessary rotations to maintain AVL balance. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. |  | A cryptographer is designing a secure key exchange protocol that uses the Chinese Remainder Theorem for efficient computation. The system uses three coprime moduli for redundancy and error detection. Solve the following system of congruences:  𝑥 ≡ 2 (mod 3)  𝑥 ≡ 3 (mod 4)  𝑥 ≡ 1 (mod 5)   1. Compute the solution 𝑥 for the given system using the step-by-step method. Show all intermediate calculations. 2. Verify your solution satisfies all three congruences. | CO4 | An | 16 |
|  |  |  |  |  |  |
| 4. |  | A software engineer is developing a Boyer-Moore String Matching algorithm to locate patterns in a given text file. Consider the text: "ABABABABA" and the pattern: "ABA".   1. Write the algorithm for the Boyer-Moore String Matching method. 2. Trace the algorithm step-by-step to identify all occurrences of the pattern "ABA" in the given text. 3. Illustrate the number of character comparisons performed during the matching process. | CO6 | An | 16 |
|  |  |  |  |  |  |
| 5. |  | A municipal water distribution network has the following pipeline capacities (in 1000s of gallons/hour):  ford_fulkerson1   1. Explain the Ford-Fulkerson algorithm and its key concepts (residual graph, augmenting paths). 2. Analyze the algorithm step-by-step to find the maximum flow from source 0 to sink 5. Show each augmenting path and the residual graph. 3. Identify the minimum cut and verify the max-flow min-cut theorem. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 6. | a. | A data compression engineer is encoding characters A, B, C, D with frequencies 7, 5, 2, 4. Construct the Huffman tree and determine the Huffman codes for each character. | CO1 | A | 8 |
|  | b. | Explain Standard trie, Compressed trie, and Suffix trie. Illustrate each type with suitable examples. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 7. |  | A telecommunications company needs to design a minimum-cost fiber optic network connecting 7 major city nodes. The connection costs (in $ millions) between nodes are given in the following graph:     1. Apply Prim's algorithm starting from node A to construct the Minimum Spanning Tree. Show the step-by-step process including the priority queue/min-heap states. 2. Calculate the total cost of the MST and draw the final tree structure. 3. Compare Prim's algorithm with Kruskal's algorithm in terms of the method used. | CO5 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | A financial analyst at Wealth Manage Corp needs to select investments from 6 available options to exactly meet a client's target allocation of $15 million. The investment amounts (in millions) are: {2, 3, 5, 7, 8, 10}.   1. Draw the backtracking decision tree that shows how the algorithm explores options and prunes unnecessary paths 2. Find all possible investment combinations that sum to exactly $15 million using backtracking. | CO3 | A | 10 |
|  | b. | A warehouse manager needs to pack items of sizes {8, 5, 7, 6, 2, 4, 3, 5, 1} into bins of capacity 15.  (i) Apply First-Fit Algorithm and show bin packing step-by-step  (ii) Apply Best-Fit Algorithm and compare the results | CO3 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate appropriate design techniques for finding solution to a problem. |
| CO2 | Design algorithms using Greedy and Dynamic programming techniques |
| CO3 | Formulate solutions using backtracking, and branch - and - bound techniques. |
| CO4 | Analyze the efficiency of various algorithms and estimate its complexity in asymptotic notation. |
| CO5 | Solve problems using fundamental graph algorithms. |
| CO6 | Apply appropriate data structures and algorithms for real life problems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3012** | **Duration** | **3hrs** |
| **Course Title** | **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Illustrate the fundamental concept behind informed and uninformed search strategies with examples. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Describe alpha–beta pruning with an example. Show the game tree up to the third ply. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | A medical diagnosis expert system is designed to identify diseases based on symptoms such as fever, cough, sore throat, and fatigue. The system uses rules like ‘If the patient has fever and sore throat, then the disease might be flu.’ Describe the application of forward chaining and backward chaining in diagnosing the patient’s illness. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | In a weather prediction system that estimates the likelihood of rain based on humidity, temperature, and cloud cover, demonstrate the use of Bayesian Networks and Markov Models for probabilistic reasoning. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 5. |  | A dataset containing labeled images of fruits is used for classification, while another dataset without labels is analyzed to find natural groupings. Compare the learning approaches used in both cases and explain the role of Support Vector Machines (SVMs) in the classification task. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | A supermarket wants to analyze customer transactions to find products frequently bought together. Describe the application of Apriori and Eclat algorithms in identifying these associations. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 7. |  | Examine the role of Convolutional Neural Networks (CNNs) in image processing and Recurrent Neural Networks (RNNs) in time series analysis and natural language processing. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | A data analytics team prefers interpretable machine learning models for making business decisions. Describe the use of glass-box models like Decision Trees and Linear Models in this context. | CO5 | U | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | A hospital plans to implement an AI-based system for detecting tumors in MRI scans. Describe the role of Artificial Intelligence techniques in medical imaging and diagnosis for this application. | CO6 | A | 10 |
|  | b. | An automobile company is developing a self-driving car equipped with sensors and AI-based control systems. Describe the application of Artificial Intelligence in the functioning of this autonomous system. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Examine the basic AI concepts, mathematical background, applicability, limitations and Industry tools. |
| CO2 | Distinguish between different supervised, unsupervised, semi-supervised and reinforcement machine learning algorithms in addressing problems. |
| CO3 | Demonstrate AI based search algorithms, heuristics, logic systems, and reasoning techniques. |
| CO4 | Implement deep learning architectures to handle sequential and unsupervised datasets. |
| CO5 | Evaluate advanced deep learning architectures in solving practical applications in various domains. |
| CO6 | Analyze recent AI and ML trends in healthcare, agriculture, retail, finance, and manufacturing. |



**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3013** | **Duration** | **3hrs** |
| **Course Title** | **CLOUD COMPUTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the concept of Cloud Delivery Models with suitable examples. | CO1 | U | 8 |
|  | b. | Describe the goals and benefits of Cloud Computing in modern IT environments. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | Describe the risks and challenges that affect the adoption of cloud computing. | CO2 | A | 8 |
|  | b. | Illustrate the role and boundaries of cloud providers and consumers with an architecture. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 3 |  | Describe various containerization technologies and their advantages in cloud deployment. | CO3 | R | 16 |
|  |  |  |  |  |  |
| 4. |  | Apply the architecture of Resource Cluster, Load Balancer, and Automated Scaling Listener to handle a sudden increase in workload efficiently in a cloud environment. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Apply Cloud SLA Management System to ensure efficient resource allocation and service reliability in a real-time cloud application scenario. | CO4 | A | 8 |
|  | b. | Describe the Elastic Disk Provisioning Architecture with an example scenario. | CO4 | R | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain the concept of Resource Pooling Architecture with a neat sketch. | CO4 | U | 8 |
|  | b. | Describe Zero Downtime Architecture and its importance in business continuity. | CO5 | R | 8 |
|  |  |  |  |  |  |
| 7. | a. | Describe the working of Load Balanced Virtual Server Instances Architecture. | CO5 | R | 8 |
|  | b. | Explain Elastic Network Capacity Architecture and its real-world applications. | CO5 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | Describe a real-world scenario where an organization wants to deploy a private cloud using OpenStack. Apply OpenStack components and architecting principles to design a deployment pipeline for efficient cloud management. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the deployment models of cloud and its characteristics. |
| CO2 | Demonstrate the networking techniques, virtualization, and containers in cloud computing. |
| CO3 | Assess and mitigate risks related to cloud security and cybersecurity threats. |
| CO4 | Apply cloud computing mechanisms like resource replication, and automated scaling. |
| CO5 | Implement scalable and load balanced cloud architectures. |
| CO6 | Develop real-world applications with cloud service models using platforms like OpenStack. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3013** | **Duration** | **3hrs** |
| **Course Title** | **CLOUD COMPUTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the concept of Cloud Delivery Models with suitable examples. | CO1 | U | 8 |
|  | b. | Describe the goals and benefits of Cloud Computing in modern IT environments. | CO1 | R | 8 |
|  |  |  |  |  |  |
| 2. | a. | Describe the risks and challenges that affect the adoption of cloud computing. | CO2 | A | 8 |
|  | b. | Illustrate the role and boundaries of cloud providers and consumers with an architecture. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 3 |  | Describe the various containerization technologies and their advantages in cloud deployment. | CO3 | R | 16 |
|  |  |  |  |  |  |
| 4. |  | Apply the architecture of Resource Cluster, Load Balancer, and Automated Scaling Listener to handle a sudden increase in workload efficiently in a cloud environment. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Apply Cloud SLA(Service Level Agreement) Management System to ensure efficient resource allocation and service reliability in a real-time cloud application scenario. | CO4 | A | 8 |
|  | b. | Describe the Elastic Disk Provisioning Architecture with an example scenario. | CO4 | R | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain the concept of Resource Pooling Architecture with a neat sketch. | CO4 | U | 8 |
|  | b. | Describe Zero Downtime Architecture and its importance in business continuity. | CO5 | R | 8 |
|  |  |  |  |  |  |
| 7. | a. | Describe the working of Load Balanced Virtual Server Instances Architecture. | CO5 | R | 8 |
|  | b. | Explain Elastic Network Capacity Architecture and its real-world applications. | CO5 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | Describe a real-world scenario where an organization wants to deploy a private cloud using OpenStack. Apply OpenStack components and architecting principles to design a deployment pipeline for efficient cloud management. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the deployment models of cloud and its characteristics. |
| CO2 | Demonstrate the networking techniques, virtualization, and containers in cloud computing. |
| CO3 | Assess and mitigate risks related to cloud security and cybersecurity threats. |
| CO4 | Apply cloud computing mechanisms like resource replication, and automated scaling. |
| CO5 | Implement scalable and load balanced cloud architectures. |
| CO6 | Develop real-world applications with cloud service models using platforms like OpenStack. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3014** | **Duration** | **3hrs** |
| **Course Title** | **CYBER PHYSICAL SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Interpret the key features of Cyber Physical Systems highlighting their integration of computational and physical components. | CO1 | An | 10 |
|  | b. | Develop a synchronous model for a cruise control system showing the timing, input–output relations, and state transitions. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Examine the challenges faced in synchronous CPS designs and suggest synchronization strategies to maintain determinism. | CO1 | A | 10 |
|  | b. | Construct a block diagram for a real-time CPS illustrating synchronous interactions between sensors, controllers, and actuators. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Distinguish between asynchronous design primitives and coordination protocols with suitable CPS examples. | CO2 | U | 10 |
|  | b. | Illustrate an asynchronous communication mechanism for a distributed sensor network CPS. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Examine appropriate asynchronous coordination models for multi-agent CPS applications. | CO2 | A | 10 |
|  | b. | Develop an event-driven control model for an asynchronous washing machine CPS. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Construct a hybrid automaton to represent the motion and collision of two particles with reset maps. | CO3 | A | 10 |
|  | b. | Determine the conditions leading to Zeno behavior in hybrid systems and propose a mitigation method. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Interpret the concept of zero-crossing detection and its significance in modeling elastic collisions in CPS. | CO3 | U | 10 |
|  | b. | Explain the working of DAC in controlling an actuator’s speed in a robotic arm CPS. Illustrate the process flow from sensor input to mechanical actuation. | CO5 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Develop a proportional feedback control model to stabilize a temperature control CPS. | CO4 | A | 10 |
|  | b. | Examine the impact of rationality and independence on decision strategies in CPS design using game theory concepts. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate the role of symmetry between LEDs and photovoltaic cells in a CPS environment for both energy harvesting and signaling operations. | CO5 | An | 10 |
|  | b. | Analyze the layered security architecture in a Cyber Physical System designed for industrial automation, highlighting real-time threat detection mechanisms. | CO6 | An | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Develop a detailed CPS application for healthcare that integrates sensing, actuation, and data-driven control. | CO6 | A | 10 |
|  | b. | Analyze design considerations for energy and security CPS to ensure reliability, resilience, and safety in real-time operation. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Analyze key features of cyber - physical system design. |
| CO2 | Distinguish asynchronous design primitives and coordination protocols in CPS. |
| CO3 | Analyze hybrid systems for elastic collision dynamics. |
| CO4 | Evaluate the use of control and game theory in the design of Cyber Physical Systems. |
| CO5 | Demonstrate various sensing and actuation techniques in CPS. |
| CO6 | Develop CPS applications in critical domains like healthcare, energy, and security. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3014** | **Duration** | **3hrs** |
| **Course Title** | **CYBER PHYSICAL SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Discuss the key features of Cyber Physical Systems and how synchronous design ensures predictable timing behavior. | CO1 | U | 8 |
|  | b. | Explain the working of a Cruise Control System as an example of a synchronous model. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | A warehouse automation system employs several robots that pick and pack items independently, communicating only when sharing a corridor or storage area.  Explain how asynchronous communication helps avoid collisions and ensures smooth task allocation, focusing on handshake signaling and local decision-making without global synchronization. | CO2 | A | 8 |
|  | b. | Examine how asynchronous coordination protocols enhance communication reliability. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | A bouncing ball simulation exhibits gradually decreasing bounce heights until the motion nearly ceases, even though multiple bounces occur in a short duration.  Employ the concept of Zeno behavior as observed in such hybrid systems, and discuss its importance in accurately modeling physical phenomena involving infinite discrete transitions within finite time. | CO3 | A | 8 |
|  | b. | Examine Zero crossing and describe its implications in modeling elastic collisions. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | An autonomous drone maintains its flight altitude by adjusting motor thrust based on altitude sensor feedback.  Illustrate the working of a proportional feedback control system for this drone using a block diagram, emphasizing how feedback minimizes altitude error and ensures flight stability. | CO4 | A | 8 |
|  | b. | Interpret the role of Game Theory in CPS design involving rational and independent strategies. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Summarize various sensing and actuation mechanisms used in CPS applications | CO5 | U | 8 |
|  | b. | Show how ADC and DAC conversions facilitate data acquisition in CPS. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | Contrast the applications of CPS in medical and energy domains in terms of scalability and reliability. | CO6 | An | 8 |
|  | b. | Examine the significance of security in energy-based CPS deployments | CO6 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | In intelligent transportation networks, autonomous vehicles share real-time traffic data to reduce congestion. Evaluate how Non-cooperative Game Theory principles can be applied to model individual vehicle decisions that collectively improve global traffic flow. | CO4 | An | 8 |
|  | b. | In a smart manufacturing CPS, multiple robotic arms share a common workspace. Each arm must decide its movement path rationally while avoiding collision and minimizing energy use.  Analyze the rationality and dominance principles that influence the decision-making of each robotic arm, and explain how identifying strictly dominant strategies can enhance cooperative task execution. | CO4 | An | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Explain a CPS application for smart healthcare monitoring along with its core components. | CO6 | A | 10 |
|  | b. | A city’s smart grid CPS coordinates multiple distributed energy resources (DERs) and consumers to balance energy supply and demand.  Explain how control theory and feedback mechanisms are applied in Energy CPS to ensure system stability, minimize losses, and maintain voltage frequency balance. | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Apply synchronous design principles in Cyber Physical Systems. |
| CO2 | Develop asynchronous system models using design primitives and coordination protocols. |
| CO3 | Analyze hybrid systems using models such as hybrid automata and understand Zeno behavior. |
| CO4 | Evaluate and justify the use of control theory and game theory in the design of Cyber Physical Systems. |
| CO5 | Demonstrate various sensing and actuation techniques used in CPS. |
| CO6 | Design CPS applications in critical domains like healthcare, energy, and security. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3015** | **Duration** | **3hrs** |
| **Course Title** | **DATA SCIENCE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | A rapidly growing e-commerce platform is facing scalability issues with its existing relational database system. The application needs to handle a massive amount of user-generated data such as product reviews, browsing history, and real-time inventory updates across multiple regions. The company decides to migrate to a NoSQL-based architecture to improve performance, availability, and scalability.  Develop a suitable NoSQL data architecture pattern for this e-commerce platform. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 2. | a. | Describe the process of collecting and integrating data from diverse sources using APIs, and discuss the potential challenges in ensuring data quality, consistency and privacy. | CO2 | R | 10 |
|  | b. | The following data represents the number of goals scored by a football team in 10 matches: 2, 3, 1, 4, 2, 3, 2, 5, 3, 2  i) Calculate the measures of central tendency.  ii) Find the range, upper and lower quartiles .  iii) Compute the variance and standard deviation. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. |  | A major tech support center is trying to quantify the effect of additional training on its employees' weekly productivity score (a normalized metric from 0 to 100). Data was collected from a sample of 10 employees, measuring the total extra training hours received in the quarter () and their average weekly productivity score ().   |  |  |  | | --- | --- | --- | | **Employee** | **Extra Training Hours (X)** | **Productivity Score (Y)** | | 1 | 2 | 55 | | 2 | 5 | 62 | | 3 | 7 | 68 | | 4 | 8 | 70 | | 5 | 10 | 75 | | 6 | 12 | 80 |   i) Calculate the Ypredicted value of all employees.  ii) Find the Residual error between Y and Ypredicted.  iii) Plot the Linear regression graph for the Y and Ypredicted values. | CO3 | A | 16 |
|  |  |  |  |  |  |
| 4. |  | A company wants to visualize its annual sales data across different regions and product categories using various chart types.  i) Explain the significance of visual encoding in data visualization.  ii) Classify any four types of visual encoding channels with example.  iii) Recommend the most appropriate chart type and visual encoding strategy to represent the data effectively in the given dataset . Justify your choices.   |  |  |  | | --- | --- | --- | | **Region** | **Product Category** | **Sales**  **(in ₹ Lakhs)** | | North | Electronics | 120 | | South | Furniture | 95 | | East | Clothing | 75 | | West | Electronics | 110 | | North | Furniture | 80 | | South | Clothing | 60 | | CO4 | An | 16 |
|  |  |  |  |  |  |
| 5. |  | Raju tasked with building an executive dashboard in Power BI for a logistics company to monitor delivery performance across regions. The dataset includes delivery time, distance, vehicle type, fuel cost, and delivery status.  i) Develop a data model suitable for this scenario.  ii) Examine the process involved in transforming and cleaning data within Power Query.  iii) List appropriate visualizations and filters suitable for enhancing interactivity and insightfulness in a dashboard.  iv) Provide justification for selected design elements based on principles of usability and their contribution to business decision-making. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 6. | a. | Explain the major stages of the Data Science Pipeline and discuss the significance of each stage in transforming raw data into actionable insights. | CO1 | U | 10 |
|  | b. | Illustrate the importance of data cleaning and preprocessing in data science. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 7. | a. | Describe the K-means clustering algorithm for the segmentation of data points. | CO3 | R | 10 |
|  | b. | Explain the concept of customer segmentation and its importance in data-driven marketing. | CO6 | U | 6 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | A financial institution has been experiencing a surge in fraudulent transactions across its digital banking platforms. The fraud includes identity theft, abnormal transaction patterns, and unauthorized access. The organization has collected large volumes of transactional data, customer profiles, login logs, and device metadata. A data science team has been assigned to develop a fraud detection system that can identify suspicious behavior in real time and prevent financial losses.  Determine a preventive measure, which can be implemented alongside the detection system to strengthen fraud management. | CO6 | A | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Examine the data science life cycle and various data sources. |
| CO2 | Apply various statistical measures to describe datasets. |
| CO3 | Analyze supervised and unsupervised learning algorithms. |
| CO4 | Illustrate interactive data visualization plots for data insights. |
| CO5 | Design interactive dashboards using Power BI components effectively. |
| CO6 | Develop innovative data - driven solutions for real - world applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3017** | **Duration** | **3hrs** |
| **Course Title** | **SENSOR NETWORKS AND INTERNET OF THINGS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | **Describe** the heterogeneous IoT network topologies be optimized to ensure fault tolerance and scalability in a smart transportation system. | CO1 | U | 10 |
|  | b. | **Justify** the selection of a specific addressing strategy (e.g., IPv6, 6LoWPAN) for an IoT-based urban surveillance network considering latency, scalability, and energy constraints. | CO1 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | **Compare** the efficiency and reliability of MQTT, AMQP, and CoAP protocols for data delivery in a multi-layered industrial automation IoT setup. | CO2 | U | 10 |
|  | b. | **Evaluate** the semantic and identification protocols that can enhance interoperability and device discovery in large-scale healthcare IoT deployments. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | **Describe** a hybrid IoT prototype using Raspberry Pi and Arduino that performs real-time energy management through cloud-based analytics and edge decision making. | CO3 | U | 10 |
|  | b. | **Construct a** MicroPython-based embedded systems that can be leveraged to implement predictive maintenance in manufacturing IoT environments. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | **Assess** the effectiveness of layered attacker models in mitigating multi-vector cyberattacks across IoT healthcare and smart-grid systems. | CO4 | E | 10 |
|  | b. | **Design** a secure access control framework integrating identity management and encrypted message communication for an IoT-enabled smart home ecosystem. | CO4 | C | 10 |
|  |  |  |  |  |  |
| 5. | a. | **Predict** the impact of integrating fog, edge, and cloud computing architectures on the latency and scalability of real-time autonomous vehicle coordination systems. | CO5 | A | 10 |
|  | b. | **Propose** an IoT analytics framework that uses wireless sensor networks and virtualization to optimize resource allocation in precision agriculture. | CO5 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | **Explain**  IoT sensing and actuation mechanisms thatcan be coordinated to create an adaptive traffic signal control system in a smart city. | CO1 | U | 10 |
|  | b. | **Design** an IoT architecture integrating multiple addressing schemes to manage billions of devices in a nationwide smart energy grid. | CO1 | C | 10 |
|  |  |  |  |  |  |
| 7. | a. | **Analyze** the data and discovery protocols can be optimized to minimize communication overhead in a large-scale environmental monitoring system. | CO2 | An | 10 |
|  | b. | **Justify** the selection of a specific IoT connectivity technology (e.g., LoRaWAN, NB-IoT, or ZigBee) for implementing a city-wide waste management solution. | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | **Explain** an IoT prototype using Arduino and cloud APIs to detect anomalies in industrial machinery and trigger automated maintenance alerts. | CO3 | U | 10 |
|  | b. | **Predict** the performance trade-offs between Raspberry Pi-based and microcontroller-based IoT systems when deployed for continuous air-quality monitoring. | CO3 | A | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Identify an IoT-based integrated framework that combines smart irrigation, vehicular IoT, and healthcare IoT systems to enhance emergency medical response in rural agricultural regions. Explain the data interoperability and real-time analytics that can be achieved across these domains. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | implement the knowledge of sensors and wireless communication in designing IoT systems. |
| CO2 | analyze the different network protocols and architectures used in IoT. |
| CO3 | implement IoT solutions using microcontrollers and cloud services. |
| CO4 | evaluate IoT systems based on performance metrics like latency, energy efficiency, and scalability. |
| CO5 | design and prototype real - world IoT applications using sensors and networking protocols. |
| CO6 | create solutions integrating sensor data with cloud and mobile applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3019** | **Duration** | **3hrs** |
| **Course Title** | **DATA ANALYTICS AND VISUALIZATION** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | A healthcare startup is collecting patient data from wearables, clinical trials, and manual entries. Explain the data analytics lifecycle they should follow to derive insights for personalized treatment plans. | CO1 | U | 10 |
|  | b. | An e-commerce company containing customer demographics, purchase history, and web browsing logs. Examine descriptive, predictive, and prescriptive analytics to this data to solve a specific business problem | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Discuss in detail about the various statistical analysis and encoding techniques with example. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Compare and contrast the various regression techniques with relevant performance indicators. | CO3 | U | 10 |
|  | b. | A reputed bank wants to develop a credit card transaction system. A model is trained to detect fraudulent credit card transactions. Analyze the performance metrics and visualizations suitable for the trained model. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Sketch the following plots from the given data and explain the inferences.   1. Box plot for Age 2. Bar Chart for Gender 3. Scatter plot between Age and Salary 4. Analyze the trend in salary for each person  |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Name** | **Age** | **Gender** | **City** | **Salary** | | John | 35 | Male | New York | 75000 | | Alice | 27 | Female | San Francisco | 65000 | | Mark | 42 | Male | Chicago | 85000 | | Emily | 31 | Female | Los Angeles | 70000 | | David | 28 | Male | Boston | 60000 | | Lisa | 39 | Female | Seattle | 90000 | | Edward | 40 | Male | Washington | 80000 | | Rose | 34 | Female | California | 100000 | | CO4 | A | 12 |
|  | b. | Explain in detail about Multidimensional data visualization. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 5. |  | A major healthcare institution is planning to develop an AI-powered diagnostic system using millions of medical images (X-rays, CT scans, MRIs). The system needs to handle large-scale image processing, model training, and real-time inference while maintaining data security and compliance with medical regulations. Illustrate the following big data frameworks utilized in this medical imaging project, specifying the specific role and advantage of each framework.   * Apache Spark * **Apache Hadoop HDFS** * Google Cloud * NLP Tools | CO5 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain in detail about the Principal Component Analysis in dimensionality reduction. | CO2 | U | 10 |
|  | b. | "The quality of the data is more important than the complexity of the algorithm." Analyze this statement in the context of the data preprocessing stage. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | A binary classification model for spam email detection was evaluated on a test set of 2,000 emails. The confusion matrix obtained is shown below   |  |  |  | | --- | --- | --- | |  | Predicted: Spam | Predicted: Not Spam | | Actual: Spam | 320 | 80 | | Actual:Not Spam | 45 | 1555 |   Calculate the following performance metrics:   * + Accuracy   + Precision   + Recall   + Specificity   + F1-Score | CO3 | A | 10 |
|  | b. | Sonali is tasked with showing the sales trend over 12 months, the market share of 5 products, and the correlation between advertising spend and sales. Examine the most appropriate type of chart for each of these three. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the techniques used for handling unstructured data in social media platform. | CO5 | U | 10 |
|  | b. | Analyze the potential of Federated Learning for training machine learning models in the mobile phone industry. What are the key benefits and challenges compared to traditional centralized training? | CO6 | An | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | A financial institution uses a complex AI model for credit scoring but is facing regulatory pressure to explain its decisions. Analyze a strategy to integrate Explainable AI (XAI) techniques into their existing work flow and how the explanations would be visualized and presented to both regulators and customers. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Analyze datasets through descriptive and exploratory data analytics techniques. |
| CO2 | Apply statistical analysis and transformation techniques to preprocess the data to explore useful insights. |
| CO3 | Assess the performance of machine learning techniques for data analysis. |
| CO4 | Create dynamic visualizations using appropriate visualization tools. |
| CO5 | Examine unstructured data using big data frameworks. |
| CO6 | Evaluate the effectiveness of advanced AI techniques in real - time analytics. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3028** | **Duration** | **3hrs** |
| **Course Title** | **DEEP LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Create a neural network that integrates both batch normalization and dropout for efficient training. | CO1 | C | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Apply suitable activation functions, loss functions, and optimizers to design and train a neural network model for image classification. Explain the role of each selected component in enhancing the model’s learning performance. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the importance of pooling layers in reducing the computational complexity of CNNs. | CO3 | U | 10 |
|  | b. | Explain the advantages of CNN over traditional Neural Networks for image data. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Compare the relationship between model complexity and computational efficiency in deep learning architectures. | CO2 | U | 10 |
|  | b. | Describe the advantages of ReLU compared to sigmoid functions. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 5. |  | Describe how RNNs handle sequential data and explain their differences from feed-forward networks. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the design of a novel deep learning model that integrates Long Short-Term Memory (LSTM) networks with attention mechanisms to improve the accuracy of time-series forecasting. | CO4 | R | 20 |
|  |  |  |  |  |  |
| 7. | a. | Evaluate the effectiveness of GANs for image synthesis compared to traditional image generation methods. | CO5 | E | 10 |
|  | b. | Justify the use of VAEs over standard autoencoders for generative tasks. | CO5 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Describe the process of token classification in BERT with sample code. | CO6 | U | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain the concept of "search space" in Neural Architecture Search (NAS) and describe how Efficient NAS (ENAS) reduces search time. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Illustrate the fundamentals of neural networks. |
| CO2 | Implement and Train deep learning Models. |
| CO3 | Apply Convolutional Neural Networks (CNNs) for Image Processing. |
| CO4 | Analyze Recurrent Neural Networks (RNNs) and Sequence Models. |
| CO5 | Evaluate Generative Adversarial Networks (GANs) in data augmentation and deepfake generation. |
| CO6 | Apply advanced deep learning techniques to solve real-world problems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3039** | **Duration** | **3hrs** |
| **Course Title** | **SOFTWARE DEFINED NETWORKING AND NETWORK AUTOMATION** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | A startup is building a private cloud. Explain the ways in which SDN simplifies network management compared to traditional VLAN-based segmentation. | CO1 | U | 8 |
|  | b. | Describe the role of the control plane in SDN with an example of a flow setup. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 2. | a. | A company needs to opt between ONOS and OpenDaylight. Choose the best option based on the comparison of their features, for a high-availability environment. | CO2 | A | 8 |
|  | b. | Compare SDN via APIs and SDN via Hypervisor based Overlays. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Explain the implications of Software-Defined Networking with respect to traditional networking for research and innovation. | CO1 | An | 8 |
|  | b. | Explain the core modules and interfaces of an SDN controller. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 4. | a. | Appraise the ways in which modular SDN architecture could help resolve bottlenecks in a large enterprise deployment. | CO3 | An | 8 |
|  | b. | Given a scenario where multiple tenants share a data center. Infer the ways that the SDN has to ensure isolation and QoS. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | A telecom operator wants to deploy SDN in 5G. Explain the role of SDN in improving service agility and slicing. | CO4 | U | 8 |
|  | b. | Compare SDN deployment in optical vs mobile networks in terms of latency and programmability. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | **Employ** the concept of NFV architecture to design a virtualized network service chain for a telecom operator replacing traditional hardware firewalls and load balancers. | CO5 | A | 8 |
|  | b. | **Illustrate** the steps involved for NFV to be implemented a use case such as Virtual Customer Premises Equipment (vCPE) or Virtual Evolved Packet Core (vEPC). | CO5 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | Demonstrate the ways in which Software-Defined Networking (SDN) can be applied to improve the design and management of an optical network. | CO4 | A | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | A global enterprise is migrating to an SDN-NFV-based infrastructure. Analyze the integration challenges, propose a phased migration plan, and justify the use of automation tools in each phase. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Examine basic packet-switching and SDN principles and their impact on modern data center operations. |
| CO2 | Assessthe role of SDN controllers, distinguishing them based on their specific functionalities. |
| CO3 | Develop a scalable SDN architecture that incorporates automation strategies to meet data center demands. |
| CO4 | Compare the implications of SDN across diverse networking environments. |
| CO5 | Assess the challenges and limitations associated with NFV deployments. |
| CO6 | Develop network programmability techniques to automate network tasks. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **25CS201** | **Duration** | **3hrs** |
| **Course Title** | **LINEAR ALGEBRA AND CALCULUS FOR COMPUTER SCIENCE** | **Max. Marks** | **100** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | **LUO** | **RBT Level** | **Related CO** |
| **PART – A (10 X 2 = 20 MARKS)** | | | | |
| 1. | If the eigenvalues of covariance matrix A are 1, 2, 4, then *list* the eigenvalues of A2 and A3 are\_\_\_\_\_ | 1b | R | 1 |
| 2. | In a **machine learning model,** two interacting features are represented by the quadratic form Q(x) =xTAx with A=. *Express* the quadratic form expression. | 1d | U | 1 |
| 3. | *List* the steps involving decomposition of A using LU decomposition. | 2a | R | 2 |
| 4. | Using **Cholesky decomposition,** *compute* the lower triangular matrix L for such that A=LLT. | 2b | U | 2 |
| 5. | ***Calculate***the derivative of the execution time function T(n)=2n2+3n+5 to determine how the processing time changes as the input size n increases. | 3a | U | 3 |
| 6. | ***Calculate***the execution time T(n) for a program where a loop runs n times with each iteration taking 4 milliseconds, and determine the execution time for n=5 | 3a | R | 3 |
| 7. | ***Calculate***the expected decay time of the exotic particle by evaluating the integral using gamma function. | 4e | U | 4 |
| 8. | ***Compute*** the integral for the total screen brightness  using the definition of the beta function. | 4e | R | 4 |
| 9. | ***Solve***the second-order linear differential equation to model the long-term exponential trend in data forecasting. | 5a | U | 5 |
| 10. | The differential equation for forecasting time series data trend is: . ***Determine*** the order and degree of this model. | 5a | R | 5 |
| **PART – B (5 X 6 = 30 MARKS)** | | | | |
| 11. | Computethe bilinear pooling result z=xTWy using the vectors and the weight matrix. | 1d | A | 1 |
| 12. | ***Compute***the singular values of the user-movie rating matrix using Singular Value Decomposition (SVD) to identify the key latent features for a movie recommendation system. | 2d | A | 2 |
| 13. | ***Calculate***the divergence and curl of the network traffic flow field and **evaluate** both quantities at the monitoring point (1,0,2). | 3f | A | 3 |
| 14. | ***Calculate*** the total brightness across the video game menu scan line by evaluating the integral of  from, and determine the average brightness per unit length to assess the gradient's visual intensity. | 4b | A | 4 |
| 15. | *Solve* the given differential equation for **predicting stock price behavior over time** | 5c | A | 5 |
| **PART – C (5 X 10 = 50 MARKS)** | | | | |
| 16 | ***Calculate***the eigenvalues of the RGB intensity covariance matrix  , and **identify** the principal component that captures the highest variance for compressing digital images | 1a | A | 1 |
| **(OR)** | | | | |
| 17 | ***Construct***the link matrix L for the news portal where:  P1 links to P3  P2 links to P3  P3 links to P1, P2, and P3  **Apply** the PageRank algorithm to compute the eigenvalues and eigenvectors of L and **interpret**the page rank vector to determine the most authoritative page. | 1b | U | 1 |
|  | | | | |
| 18 | ***Apply***the LU decomposition method to solve the CPU task scheduling system: and **determine**the optimal resource weights x1,x2,x3  for processes P1, P2 and P3​. | 2a | A | 2 |
| **(OR)** | | | | |
| 19 | ***Determine*** the internal force distribution in a bridge truss by solving the linear system Ax=b using Cholesky decomposition, where  , and **identify** the member forces x1,x2andx3 | 2b | A | 2 |
|  | | | | |
| 20 | ***Determine***the optimal allocation of CPU power (x) and memory usage (y) that minimizes the energy consumption E(x,y)=x2+y2 while maintaining the performance constraint x+2y=8 using Lagrange multipliers. | 3d | A | 3 |
| **(OR)** | | | | |
| 21 | **a)*Compute*** the second-order partial derivatives of the image enhancement function  used in computer vision, and evaluate fx(2,1) and fy(2,1) to analyze feature sensitivity.  b)*Compute* the Hessian matrix of the energy function f(x,y)=3x2+2xy+4y2 for stability analysis in robotics path planning. | 3c | A | 3 |
|  | | | | |
| 22 | a) ***Apply***integration by parts to compute the total reflected light along the laser scanning path using the brightness function  over the interval .  b) ***Compute***the total laser intensity on the surface by evaluating the integral of  from x=0 to x=2 using the substitution method | 4c | A | 4 |
| **(OR)** | | | | |
| 23 | a) *Calculate* the total surface brightness of the rectangular screen for the light intensity function  where  and cm.  b)*Calculate* the total volume brightness inside the cube for the intensity function  over the region . | 4f | A | 4 |
| **Compulsory Question:** | | | | |
| 24 | ***Solve***the second-order differential equation with initial conditions y(0)=100 and y′(0)=250  to determine the company's monthly sales forecast model. Use the resulting model to predict the sales for month 2. | 5a | A | 5 |

+

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **25CS205** | **Duration** | **3hrs** |
| **Course Title** | **DIGITAL SYSTEM DESIGN** | **Max. Marks** | **100** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | **LUO** | **RBT Level** | **Related CO** |
| **PART – A (10 X 2 = 20 MARKS)** | | | | |
| 1. | Imagine a sensor in an IoT (Internet of Things) device that measures temperature. The sensor records a temperature of 123°C (in decimal). Before transmitting this data wirelessly to a microcontroller or cloud server, it must encode the value into binary, since digital communication protocols transmit data as streams of 0s and 1s. | 1a | U | 1 |
| 2. | Identify the 2’s complement of (111100)2. | 1e | R | 1 |
| 3. | In a digital position encoder that measures the angular position of a rotating shaft, the sensor produces a binary output of (111001)₂. To avoid reading errors caused by simultaneous bit changes during rotation, the system should convert this binary value into a non-weighted Gray code. | 2a | U | 2 |
| 4. | Determine the expression and truth table of two-bit subtraction. | 2c | A | 2 |
| 5. | List the two types of sequential circuits with proper definition. | 3a | R | 3 |
| 6. | Write the excitation table for SR (NAND) latch. | 3e | A | 3 |
| 7. | Differentiate state table and state diagram. | 4a | U | 4 |
| 8. | State the use of a Mod-n counter in digital systems. | 4d | R | 4 |
| 9. | Define a race condition in asynchronous sequential circuits. | 5a | R | 5 |
| 10. | Write the syntax of a module declaration in Verilog HDL. | 5b | A | 5 |
| **PART – B (5 X 6 = 30 MARKS)** | | | | |
| 11. | Write the truth table and draw the circuit diagram for the expression: F=AB’C’+A’BC+A’C’ | 1c | A | 1 |
| 12. | Construct the logic circuit and truth table for a 4-to-2 encoder. | 2d | A | 2 |
| 13. | Construct a 2-bit up counter(Ripple) using T flip-flops and provide the corresponding truth table | 3d | A | 3 |
| 14. | Compute the next state and the output of the given state diagram: | 4h | A | 4 |
| 15. | Write the Verilog HDL code and the corresponding truth table for an SR flip-flop. | 5e | A | 5 |
| **PART – C (5 X 10 = 50 MARKS)** | | | | |
| 16 | Determine the minimized form of the following Boolean function using a 4-variable K-map including the don’t care conditions: F(A, B, C, D) = Ʃ(0,1,2,5,8,9,10) + d(3,11,15) | 1g | A | 1 |
| **(OR)** | | | | |
| 17 | Change the following Boolean function into canonical Product of Sum(POS)  F(A, B, C, D) = (A+B’)(C’+D)(A’+C+D’) | 1d | A | 1 |
| 18 | Explain the method used by a BCD adder to detect when the binary sum exceeds the decimal value of 9 (1001)2. | 2h | U | 2 |
| **(OR)** | | | | |
| 19 | In a traffic control system, eight lanes need to be controlled one at a time using three control inputs. Analyze how a 3-to-8 Decoder can be used to select which lane gets a green signal based on the input code. Illustrate with a logic diagram and truth table for the above application. | 2d | U | 2 |
| 20 | In an automated packaging system, each cycle starts with 15 items and counts down to 0 as items are packed. Develop a 4-bit synchronous down counter using JK flip-flops to monitor the remaining items. Draw the circuit diagram, truth table, and compute how each clock pulse decreases the count by one. | 3f | A | 3 |
| **(OR)** | | | | |
| 21 | An industrial motor uses a JK flip-flop as a start/stop toggle switch, when the clock pulse arrives, the output changes from OFF (0) to ON (1) or vice versa depending on input values. Explain the following from the above scenario:   1. The characteristic table and characteristic equation of the JK flip-flop. 2. The excitation table showing input conditions for each transition. | 3d | U | 3 |
| 22 | Consider the given below state diagram and illustrate the following in detail:   1. State table 2. Reduced state table 3. Reduced state diagram 4. State assignment | 4h | U | 4 |
| **(OR)** | | | | |
| 23 | A wireless receiver module receives serial data from a transmitter and must convert it to parallel form for microprocessor input. This operation is achieved using a SIPO shift register. Construct the following from the above scenario:   1. Design a 4-bit Serial-In Parallel-Out shift register using D flip-flops. 2. Construct a truth table for the input data 0110. | 4b | A | 4 |
| **Compulsory Question:** | | | | |
| 24 | Discuss the basic components of Algorithmic State Machine (ASM): state box, decision box, and conditional output box and construct the ASM chart for the below state diagram: | 5c | U | 5 |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **25CS207** | **Duration** | **3hrs** |
| **Course Title** | **PROGRAMMING FOR PROBLEM SOLVING IN ‘C’** | **Max. Marks** | **100** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | **LUO** | **RBT Level** | **Related CO** |
| **PART – A (10 X 2 = 20 MARKS)** | | | | |
| 1. | *Define* a constant in ‘C’ with an example. | 1a | R | 1 |
| 2. | *Identify* any two logical operators and describe their purpose in a decision-making expression. | 1b | R | 1 |
| 3. | *List* the steps involved in performing a bubble sort operation. | 2a | U | 2 |
| 4. | *Describe* the process of linear searching in an array. | 2b | U | 2 |
| 5. | *Label* the parts of a function prototype and explain their roles. | 3a | R | 3 |
| 6. | *Identify* two benefits of using recursion in modular programming. | 3b | R | 3 |
| 7. | *Define* a pointer and describe its use in passing arguments to functions. | 4a | U | 4 |
| 8. | *Describe* the significance of pre-processor directives in a ‘C’ program. | 4b | U | 4 |
| 9. | *Identify* the components required to design a 2D game interface. | 5a | A | 5 |
| 10. | *List* the uses of structures and unions in game data management. | 5b | A | 5 |
| **PART – B (5 X 6 = 30 MARKS)** | | | | |
| 11. | *Write* a program to determine the largest of three numbers using nested if-else structures. | 1b | A | 1 |
| 12. | *Correlate* a scenario where student marks are stored in an array and write a ‘C’ code to find the average marks, also use bubble sort for ranking. | 2a | An | 2 |
| 13. | *Develop* a modular program using functions to calculate the factorial of a given number. | 3a | A | 3 |
| 14. | *Infer* the use of pointers and dynamic memory allocation to manage employee salary records. | 4c | An | 4 |
| 15. | *Write* a ‘C’ program to develop a simple 2D game menu using structures and switch-case statements. | 5c | A | 5 |
| **PART – C (5 X 10 = 50 MARKS)** | | | | |
| 16 | *Develop* a ‘C’ program using control structures to simulate an **Electricity Bill Calculation System.** The program should take the number of units consumed as input and calculate the total bill based on given slab rates. Display the customer details and the computed bill amount in a formatted manner. | 1d | A | 1 |
| **(OR)** | | | | |
| 17 | *Design* a modular ‘C’ program to create a **Student Grade Evaluation System**. The program should provide the following functionalities:   * Accept marks for five subjects from multiple students with proper input validation (0–100 range). * Calculate the total and average marks for each student and assign grades based on predefined criteria. * Display a summarized report showing the student’s name, total, average, and grade. * Implement modularity using user-defined functions for input, computation, and display to ensure code clarity and reusability. | 1d | An | 1 |
|  |  |  |  |  |
| 18 | *Construct* a ‘C’ program that demonstrates the use of **arrays and string manipulation** to manage employee records. The program should store employee names, IDs, and designations, and allow searching by ID. Display the details of the matching employee. | 2d | A | 2 |
| **(OR)** | | | | |
| 19 | *Develop* a ‘C’ program that performs **matrix operations**(addition, subtraction, and multiplication) using functions. Allow the user to choose the operation and input matrix elements dynamically. Display the result in a well-formatted matrix form. | 2d | An | 2 |
|  |  |  |  |  |
| 20 | *Construct* a ‘C’ program that demonstrates pointer-based array operations. The program should allow the user to input an array of integers, use pointer arithmetic to find the largest and smallest elements, and display the results. | 3d | A | 3 |
| **(OR)** | | | | |
| 21 | *Develop* a ‘C’ program using **dynamic memory allocation** to simulate a **Library Book Management System.** The program should allow adding, deleting, and displaying book records stored dynamically using malloc() and free(). | 3d | A | 3 |
|  |  |  |  |  |
| 22 | *Design* a **modular ‘C’ program** that uses **file handling** to maintain a **simple Bank Account Management System.** The program should include **user-defined functions** for:   * Creating a new bank account * Depositing and withdrawing amounts * Displaying individual and all account details All account data should be **stored and retrieved from a file** to ensure persistence. | 4d | A | 4 |
| **(OR)** | | | | |
| 23 | Design a modular ‘C’ program that uses structures and file handling to implement a Student Result Analyzer. The program should provide the following functionalities:   * Record student details such as Name, Roll Number, and Marks * Compute average marks and assign grades based on predefined criteria   Store student results in a file and retrieve them for display when required. | 4d | A | 4 |
|  |  |  |  |  |
| **Compulsory Question:** | | | | |
| 24 | Design a simple **2D mini gaming application in ‘C’**using graphics or ASCII characters. The program should simulate object movement (like a bouncing ball or a moving character) and handle user input for direction control. Ensure modularity using functions and proper use of loops and conditions. | 5d | A | 5 |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – NOV / DEC 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **25CS208** | **Duration** | **3hrs** |
| **Course Title** | **WEB TECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | **LUO** | **RBT Level** | **Related CO** |
| **PART – A (10 X 2 = 20 MARKS)** | | | | |
| 1. | Write a HTML snippet to create a hyperlink that redirects to **karunya.edu.** | 1a | A | 1 |
| 2. | Write a HTML snippet for the given list. | 1b | A | 1 |
| 3. | Differentiate ‘child selector’ from ‘descendant selector’. | 2a | U | 2 |
| 4. | Write a CSS property to make an element appear on top of all other elements. | 2h | A | 2 |
| 5. | Identify the purpose of breakpoints in CSS. | 3a | R | 3 |
| 6. | Write the CSS syntax to apply a hover effect that changes the text color in a div tag from black to red. | 3g | A | 3 |
| 7. | Write the JavaScript syntax to display the message “Welcome to JavaScript” in a popup box. | 4a | A | 4 |
| 8. | Write a JavaScript code to add two numbers on clicking add button. | 4b | A | 4 |
| 9. | Compare synchronous and asynchronous CRUD operations in JavaScript. | 5a | U | 5 |
| 10. | Name the different data types available in JavaScript. | 5b | R | 5 |
| **PART – B (5 X 6 = 30 MARKS)** | | | | |
| 11. | Write a HTML code for the following contents using formatting elements. | 1c | A | 1 |
| 12. | Explain the different types of positioning available in CSS. | 2g | U | 2 |
| 13. | Design a webpage that changes background color and text color when the device orientation changes. | 2a | A | 3 |
| 14. | Explain the two different functions used in Java Script with an example. | 4b | A | 4 |
| 15. | Write the difference between ‘setTimeout()’ and ‘setInterval()’ in JavaScript | 5b | U | 5 |
| **PART – C (5 X 10 = 50 MARKS)** | | | | |
| 16 | Design a **HTML registration form** for a college event that collects the following details from participants: Full Name, Email Address, Department (choose from a dropdown list), Gender (select one), Hobbies (select multiple options), Upload ID proof (file upload), Submit and Reset buttons. | 1g | A | 1 |
| **(OR)** | | | | |
| 17 | Design the following table using HTML elements | 1b | A | 1 |
| 18 | Use CSS border properties to achieve the following output. | 2b | A | 2 |
| **(OR)** | | | | |
| 19 | Design a **photo gallery webpage** using **CSS Grid** with the following requirements:   * Display **12 images** in a grid layout. * The grid should have **four columns** and **three rows.** * Add a **10px gap** between the images. * Each image should be **responsive** and scale to fit its grid cell. * Highlight the first image to span **two columns and two rows.** | 2c | A | 2 |
| 20 | Name and explainany two DevOp tools commonly used in frontend projects. | 3e | U | 3 |
| **(OR)** | | | | |
| 21 | A ball needs to move from left to right continuously across the screen. Identifythe suitable CSS property and keyframe to animate. | 3h | A | 3 |
| 22 | Write an HTML page with embedded JavaScript to calculate the electricity bill based on units consumed. Use the following non-commercial slab rates:   * ₹0–100 units: ₹0/unit * 101–200 units: ₹2.25/unit * 201–400 units: ₹4.50/unit * 401–500 units: ₹6.00/unit * Above 500 units: ₹8.00/unit   Include:   * Input field for units consumed * Button to calculate * Display area for total bill | 4c | A | 4 |
| **(OR)** | | | | |
| 23 | Demonstratethe use of **HTTP form methods** in form handling and illustrate it with a simple HTML form example. | 4d | A | 4 |
| **Compulsory Question:** | | | | |
| 24 | Design an interactive **webpage** that simulates a simple **cricket score tracker**. The webpage should display the **current live score**, and it must update automatically whenever a user clicks one of the scoring buttons - **“Single”**, **“Four”**, or **“Six”**. | 5h | A | 5 |