A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18CS3053** | **Duration** | **3hrs** |
| **Course Title** | **INTERNET OF THINGS SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Consider a manufacturing company wants to implement an IoT-based predictive maintenance solution. The system consists of machine sensors, local gateways, cloud-based analytics, and real-time monitoring dashboards. Analyze the role of M2M communication in this setup. How do devices, gateways, and networking components interact to enable predictive maintenance? Explain with neat flow diagrams. | CO1 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the key security requirements in IoT architecture. How do these requirements address common vulnerabilities such as data breaches and device exploitation? | CO2 | A | 10 |
|  | b. | Evaluate the security risks present in this smart home scenario. Based on your evaluation, propose at least three key security requirements or measures that should be implemented to protect the IoT ecosystem. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Evaluate the effectiveness of authentication and authorization mechanisms for smart devices. What are the key challenges in implementing strong authentication in IoT environments? Explain with necessary diagrams. | CO3 | An | 12 |
|  | b. | Explain about the Transport Encryption in security access control. | CO3 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Consider a smart home security system uses IoT-enabled door locks and surveillance cameras. The system relies on encrypted communication between devices and the cloud to prevent unauthorized access. Evaluate the role of cryptographic primitives in securing this smart home system. Discuss how encryption, decryption, and digital signatures enhance the security of device communications. | CO4 | E | 20 |
|  |  |  |  |  |  |
| 5. |  | Consider a healthcare organization is setting up an IoT Identity and Access Management (IAM) infrastructure to manage authentication credentials for medical IoT devices. The system must prevent unauthorized access while ensuring ease of access for medical professionals. Design a secure IoT IAM infrastructure for this healthcare environment. Justify your approach by considering authentication lifecycle management, credential storage, and trust models that ensure patient data security. | CO5 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Analyze the key offerings provided by cloud service providers for IoT applications. How do these offerings enhance the scalability, efficiency, and management of IoT ecosystems? Explain with neat flow diagrams. | CO6 | An | 10 |
|  | b. | Explain the security controls implemented in cloud-based IoT environments. | CO6 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the role of transport encryption in securing IoT communications. How does it help in mitigating attacks specific to IoT, such as eavesdropping and man-in-the-middle attacks? | CO3 | A | 10 |
|  | b. | Describe the importance of node authentication in an IoT network. How does it help in preventing unauthorized devices from communicating within the network, and what are some commonly used methods for authenticating IoT nodes? | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain how access control mechanisms can be used to prevent unauthorized access in an IoT system. What role do authentication and authorization play in securing connected devices? | CO5 | A | 10 |
|  | b. | Analyze the need for lightweight yet robust privacy protection schemes in IoT environments. How do these schemes balance limited device resources with the demand for strong privacy? | CO5 | An | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Consider a financial institution is implementing an IoT security system that relies on cloud computing to store and analyze real-time security camera footage, biometric authentication logs, and access control data. Given the sensitivity of the data, the institution needs robust cloud security architecture. Design enterprise IoT cloud security architecture for this financial institution. Justify your approach by addressing encryption, identity management, network security, and compliance with security regulations. | CO6 | E | 20 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate knowledge and understanding of the security and ethical issues of the internet of  things |
| CO2 | Conceptually identify vulnerabilities, including recent attacks, involving the internet of things |
| CO3 | Describe countermeasures for internet of things devices and security threats. |
| CO4 | Analyze the societal impact of IOT security events |
| CO5 | Develop critical thinking skills |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18CS3056** | **Duration** | **3hrs** |
| **Course Title** | **IoT APPLICATION AND COMMUNICATION PROTOCOL** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Analyze the evolution of sensor networks from legacy to modern systems, focusing on maintenance, cost, and pricing structure.  i. Compare the development of sensor electronics in IoT-based systems versus legacy sensor networks.  ii. Discuss the role of open-source PCB design styles compared to traditional PCB design methods. | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain the IoT communication protocols, with a focus on Zigbee and Z-Wave. Discuss the advantages of low-power mesh networking in IoT applications and how it enhances connectivity and efficiency. Elaborate on the concept of long-distance Zigbee and its potential applications. | CO2 | R | 20 |
|  |  |  |  |  |  |
| 3. |  | Compare PCB, FPGA, and ASIC design in IoT. Differentiate prototyping vs. production electronics. | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Discuss mobile app platforms for IoT, focusing on their protocol stack and mobile-to-server integration. Explain the key challenges, technologies, and best practices in ensuring seamless communication and data exchange in IoT applications. | CO4 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | Evaluate the differences between SQL and NoSQL databases in the context of cloud-based IoT platforms. Discuss the advantages and limitations of both open-source and licensed database solutions for IoT applications. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Illustrate the various protocols used in sensor communication, such as Modbus, Relay, Zigbee, Zwave, X10, Bluetooth, and ANT. | CO1 | A | 10 |
|  | b. | Discuss major Bluetooth vendors, Piconet in wireless communication, and the packet structure of BLE and Zigbee. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Examine the protocol stack used in mobile applications for IoT. | CO3 | A | 10 |
|  | b. | Analyze the features, functionality, and significance of the Linkafy mobile app in IoT applications. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Compare and contrast the CISCO and Google M2M platforms. Discuss their features, applications, and impact on IoT and machine-to-machine communication. | CO5 | An | 10 |
|  | b. | Explain the working principle, applications, and advantages of iBeacon technology in iOS. | CO4 | R | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Develop a smart home automation system, ensuring the following aspects are incorporated:  i. Sensors operate on energy-efficient protocols to optimize power consumption.  ii. Data collected by the sensors is securely stored and analyzed using cloud-based solutions.  iii. A mobile application facilitates the seamless control and management of smart appliances.  iv. IoT-locks ensure controlled and secure access to the home, enabling remote locking/unlocking. | CO6 | A | 20 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | understand the architecture and various components of IoT. |
| CO2 | describe the working principles of IoT protocols. |
| CO3 | determine the Market perspective of IoT. |
| CO4 | recognize merging technological options, platforms and case studies of IoT implementation in home & city automation. |
| CO5 | relate IoT applications to solve problems of humanity |
| CO6 | design IoT based smart applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19CS2012** | **Duration** | **3hrs** |
| **Course Title** | **ARTIFICIAL INTELLIGENCE FOR BIOTECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the search strategy for blind search. | | CO1 | R | 1 |
| 2. | List any two informed search algorithms. | | CO1 | R | 1 |
| 3. | Construct the declarative knowledge for the given FOL.  ∀x : fruit(x) ۸ black (x) → poisonousfruit(x) | | CO2 | A | 1 |
| 4. | Change the given sentence into predicate logic. “Everyone is loyal to someone” | | CO2 | A | 1 |
| 5. | List the types of data obtained from soft tissues in human body. | | CO3 | R | 1 |
| 6. | Define toxic genome. | | CO3 | R | 1 |
| 7. | List any two popular AI models used in managing groundwater quality. | | CO4 | R | 1 |
| 8. | Identify the traditional methods involved in crop and weed discrimination. | | CO5 | U | 1 |
| 9. | Give an example of AI model in pest detection. | | CO5 | U | 1 |
| 10. | List any two industrial applications of AI. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Review the steps involved in the process of problem formulation. | | CO1 | U | 3 |
| 12. | Change the given sentence into Predicate Logic  1. Marcus was a man.  2. Marcus was a Pompeian.  3. All Pompeians were either loyal to Caesar or hated him. | | CO2 | A | 3 |
| 13. | Differentiate between Supervised learning and Unsupervised learning. | | CO3 | U | 3 |
| 14. | Discuss the classification models in heavy metal prediction. | | CO4 | U | 3 |
| 15. | Illustrate the impact of AI in pest and plant disease classification. | | CO5 | U | 3 |
| 16. | Appraise the applications of AI in pharmaceutical industry. | | 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. | Apply the Depth first search technique to determine the order of traversal from the initial node ‘A’.  Depth-first search Example Advantages and Disadvantages - VTUPulse.com | CO1 | A | 10 |
|  | b. | Differentiate between informed and uninformed search. | CO1 | R | 2 |
|  |  |  |  |  |  |
| 18. | a. | Describe the types of knowledge representation with an example. | CO2 | R | 10 |
|  | b. | Discuss the steps involved in resolution method. | CO2 | U | 2 |
|  |  |  |  |  |  |
| 19. | a. | Classify the Disease Prediction models of AI. | CO3 | U | 4 |
|  | b. | Examine the process of Cancer Genomic Profiling with AI. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the AI based techniques involved in the treatment of groundwater. | CO4 | A | 6 |
|  | b. | According to Central Pollution Control Board, Maharashtra along with 2 other states, contribute 80% of hazardous waste generated in India including heavy metals. As a biotechnologist, criticize about heavy metals and dissect the treatment methods and AI models to be used for the treatment. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain about the AI models and methods used in media optimization. | CO5 | A | 6 |
|  | b. | Explain the different types of AI models and preprocessing techniques used in plant disease identification. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Apply the Best first search technique to determine the path of the Goal node ‘G’ from the initial node ‘S’ by providing a step-by-step process. | CO1 | A | 6 |
|  | b. | Explain the impact of AI in genomic medicine. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | i) Write notes on working of A\* search.  ii) Construct the best route from point A to point J for the given graph using A\* algorithm. | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the steps involved for the application of artificial intelligence in food industries. | CO6 | A | 6 |
|  | b. | Explain the role of AI in Biocontrol and discuss about the significance. | CO6 | U | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Define al 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 healthcare applications |
| **CO4** | Analyze energy and environmental issues and discover ai based solutions |
| **CO5** | Inspect the challenges on agriculture and suggest solutions for plant disease identification and discrimination |
| **CO6** | Propose ai based solutions for industrial applications |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY/JUNE 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. | Name the different types of programming languages. | | CO1 | R | 1 |
| 2. | List the steps to develop a C program. | | CO1 | R | 1 |
| 3. | Identify the data type that can store the value 5.0 in C programming. | | CO2 | U | 1 |
| 4. | List any two special operators in C. | | CO2 | R | 1 |
| 5. | Identify the looping statement that get executed at least once even when the condition fails. | | CO3 | U | 1 |
| 6. | Give examples and syntax of the switch-case statement. | | CO3 | U | 1 |
| 7. | Write the syntax for two-dimensional array declaration with an example. | | CO4 | U | 1 |
| 8. | Predict the value of arr[1] from the following line of code:  int arr[]={9,6,4,2,3,5,1,7,8}; | | CO4 | U | 1 |
| 9. | Identify the operator used to access the members of the structure. | | CO5 | U | 1 |
| 10. | Identify the operator used to represent a pointer variable in C. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the console input and output functions. | | CO1 | U | 3 |
| 12. | Identify the output of the following code:  int main()  {  int sum = 2 + 4 / 2 + 6 \* 2;  printf(“%d” , sum);  return 0;  } | | CO2 | R | 3 |
| 13. | Write a C program to print the first ‘n’ whole numbers using for loop. | | CO3 | A | 3 |
| 14. | Determine the length of the string in the following code:  #include <stdio.h>  #include <string.h>  int main() {  char str[] = "Hello, World!";  printf("Length of the string is: %lu\n", strlen(str));  return 0;  } | | CO4 | A | 3 |
| 15. | Write a C program to find the factorial of a user defined number using recursion. | | CO5 | A | 3 |
| 16. | State the use of pointers in C. | | 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. | List the type of errors in C programming. | CO1 | U | 4 |
|  | b. | Explain the software development lifecycle. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 18. |  | Explain the different types of Operators used in C with suitable examples. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate a C program using function to compute the grade of 60 students in the batch B1 by reading the marks for four subjects S1, S2, S3, S4 each for 100 marks. The criteria for pass is 40 and above. The category of grade is :  Grade A : Average >=90  Grade B : Average >80 && <90  Grade C: Average >=50 && <80  Fail: < 50. | CO3 | An | 8 |
|  | b. | State the difference between entry control and exit control loop. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. |  | Apply bubble sorting technique for the array [33, 22, 55, 11, 44, 77, 32, 26, 48, 12, 5, 78, 34, 46, 39] and display the results after each pass and write the appropriate C program. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Develop a C program to find the area of triangle, circle and square using functions. | CO5 | A | 8 |
|  | b. | Define recursion with an example. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | **Analyze** the concept of pointer declaration and use it with one-dimensional arrays, with an example. | CO6 | An | 8 |
|  | b. | Differentiate between static and dynamic memory allocation with example. | CO6 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Analyze the various string functions to   * find the length of two strings * compare two strings * concatenate two strings | CO4 | An | 8 |
|  | b. | Write the three function components of C with their syntax. | CO4 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the role of self-referential structures in C. | CO6 | An | 6 |
|  | b. | Write a C program to implement an array of structures for employee details. | CO6 | A | 6 |

**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 the 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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS1002** | **Duration** | **3hrs** |
| **Course Title** | **PYTHON PROGRAMMING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the operator that is used for exponentiation in python. | | CO1 | U | 1 |
| 2. | Predict the output for the following code:  x=”python”  print(x[::-1] | | CO1 | U | 1 |
| 3. | Name the method that removes spaces from the beginning and end of a string. | | CO2 | R | 1 |
| 4. | Identify the method that reads all lines of a file into a list. | | CO2 | U | 1 |
| 5. | Predict the output for the following code:  class A:  def\_\_add\_\_(self, other):  return ”Addition overloaded”  a1=A()  a2=A()  print(a1+a2) | | CO3 | U | 1 |
| 6. | State the module that is used for object serialization in python. | | CO3 | R | 1 |
| 7. | Identify the function that sets a background color in turtle graphics. | | CO4 | U | 1 |
| 8. | Name the library that is used for image processing in python. | | CO4 | R | 1 |
| 9. | Identify the method that is used to load an image in tkinter. | | CO5 | U | 1 |
| 10. | Enumerate any two functions used for displaying pop-up message. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write a python program to find the sum of ‘n’ natural numbers. | | CO1 | A | 3 |
| 12. | Compare the mutability of lists and tuples in python. | | CO2 | U | 3 |
| 13. | Explain the use of \_\_str\_\_method with suitable example. | | CO3 | U | 3 |
| 14. | Write a turtle program to draw a circle. | | CO4 | A | 3 |
| 15. | Write a program to display the image properties. | | CO5 | A | 3 |
| 16. | Differentiate between process-based multitasking and thread-based multitasking. | | 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 python program to generate Fibonacci series of ‘n‘ terms. | CO1 | A | 6 |
|  | b. | Illustrate the break, continue and pass statement in python with suitable examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the following string functions with examples.   1. join() 2. split() 3. find() | CO2 | U | 6 |
|  | b. | Write a python program to perform the following operations on the given ‘fruits’ tuple.  fruits=[“Apple”, “Banana”, “Cherry”, “Dates”]   1. Iterate through the tuple and print each fruit 2. Access and display the third item using indexing 3. Add item “grapes” to the tuple 4. Remove duplicate elements from the tuple | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Write a python program to overload the binary ‘+’ operator to perform the sum of two numbers. | CO3 | A | 6 |
|  | b. | Explain any 3 types of inheritance with suitable example. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Write a turtle graphics program for drawing the following image. | CO4 | A | 6 |
|  | b. | Write a python program to implement the following operations:   1. Blur the image to a radius of 15 2. Flip an image left to right 3. Find the edges of a image | CO4 | A | 6 |
| 21. | a. | Design a GUI application to design a registration form as given below: | CO5 | A | 7 |
|  | b. | Explain the various layout managers in GUI. | CO5 | U | 5 |
|  |  |  |  |  |  |
| 22. |  | Describe any 6 methods to perform list operations with suitable examples. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the concept of object serialization and deserialization with suitable python program. | CO4 | U | 12 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Write a python program to create a two-way chat application using socket programming. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand, write, compile, and run Python programs. |
| **CO2** | Analyze Python structures that implement decisions, loops, and store arrays and use these structures in a well designed, OOP program. |
| **CO3** | Create Python programs that make use of various modules and packages |
| **CO4** | Understand regular expressions and extract required information from file and databases. |
| **CO5** | Relate and arrange information from multiple files |
| **CO6** | Apply the principles of object-oriented programming and well-documented programs in the Python language, including use of the Bio-python packages in big data analytics |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2010** | **Duration** | **3hrs** |
| **Course Title** | **CRYPTOGRAPHY & NETWORK SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the three conditions to be met in using one time pad effectively. | | CO1 | R | 1 |
| 2. | Define Stream Ciphers in Symmetric Key Cryptography. | | CO1 | R | 1 |
| 3. | Recall the abbreviation "MAC" in the context of cryptography? | | CO2 | R | 1 |
| 4. | Select the block size (in bits) that SHA-512 divides the message into for hash computation. a) 1024 b) 512 c) 256 d) 1248 | | CO2 | R | 1 |
| 5. | Identify the main mathematical operation used in Diffie-Hellman key exchange for generating a shared secret key. | | CO3 | R | 1 |
| 6. | Compare the security of RSA and ElGamal encryption in terms of key generation and computational complexity. | | CO3 | An | 1 |
| 7. | State the primary purpose of a digital signature in cryptographic applications. | | CO4 | R | 1 |
| 8. | Identify any two common digital signature schemes used in cryptography. | | CO4 | R | 1 |
| 9. | Name the various SSL protocols used in Web security. | | CO5 | R | 1 |
| 10. | Compare the key difference of shor’s and grover’s algorithm. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Recognize the ciphertext using Railfence cipher given the plaintext and the key.  Plaintext:HELLOWORLD  Key:2 | | CO1 | R | 3 |
| 12. | Correlate the type of attack from the following image and state it. | | CO2 | An | 3 |
| 13. | Recall and draw the construction of Triple DES encryption. | | CO3 | R | 3 |
| 14. | Identify the key steps involved in the DSA-based digital signing process and summarize it. | | CO4 | R | 3 |
| 15. | Recall the Two protocols in IP Security. | | CO5 | R | 3 |
| 16. | Analyze the advantages of quantum cryptography with modern cryptography. | | 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. | Describe Advanced Encryption Standard with a suitable diagram. | CO1 | U | 6 |
|  | b. | Identify the Ciphertext using RC4 Stream Cipher given the following inputs.  Assume we use a 4 x 3-bit key of K = [1 2 3 6] and a plaintext P = [1 2 2 2]  S = [0 1 2 3 4 5 6 7]  T = [1 2 3 6 1 2 3 6] | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the process of authentication in HMAC and how it prevents attacks. | CO2 | U | 6 |
|  | b. | Explain the role of a Key Distribution Center (KDC) in cryptographic systems. with its application such as Kerberos v4 protocol. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the RSA encryption algorithm. How do the key generation, encryption, and decryption processes work? Illustrate with an example | CO3 | U | 6 |
|  | b. | Solve the following scenario here, Users A and B use the Diffie-Hellman key exchange technique with a common prime q=71 and a  a. primitive root α=7.  b. If user A has private key Xa = 5, what is A’s public key Ya ?  c. If user B has private key Xb=12, what is B’s public key Yb ?  d. What is the shared secret key? | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the importance of X.509 certificates in cryptography also examine the certificate issuing and revocation process too. | CO4 | U | 6 |
|  | b. | Consider a Digital Signature Scheme, Compute the digital signature values r r and s using the given parameters Prime numbers: p=23, q=11, Generator: g=7, Private Key: x=6, Public Key: y=g^x mod  p, Random value: k=9, Hash of the message: SHA(M)=15 | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe the issues in web security with examples. | CO5 | U | 6 |
|  | b. | Analyze the various attacks in email and provide enhancement techniques in Email security using PGP. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the role of Transport Layer Security (TLS) in web security. How do they ensure secure communication over the internet? | CO5 | U | 6 |
|  | b. | Demonstrate how Encapsulating Security Payload (ESP) in IP Security is used to provide authentication and encryption in IP packets in a network. with necessary illustrative diagrams | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain cryptocurrency in block chain elaborately. | CO6 | U | 6 |
|  | b. | Explain the various attacks of Cyber Security. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the difference of private key and public key cryptography in quantum cryptography. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Interpret the security issues and the need for cryptographic algorithms. |
| **CO2** | Apply the various algorithms to achieve confidentiality, integrity and availability. |
| **CO3** | Recognize the importance of network security based on the attacks. |
| **CO4** | Examine the cryptographic algorithms for securing the network. |
| **CO5** | Interpret the security issues and the need for cryptographic algorithms. |
| **CO6** | Apply the various algorithms to achieve confidentiality, integrity and availability. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **20CS2024** | **Duration** | **3hrs** |
| **Course Title** | **ETHICS IN INFORMATION TECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the steps in a decision-making process. | | CO1 | R | 1 |
| 2. | State the purpose of root cause analysis in continuous improvement. | | CO1 | R | 1 |
| 3. | Define transformational leadership style. | | CO2 | R | 1 |
| 4. | Enumerate the essential requisites of leadership. | | CO2 | R | 1 |
| 5. | Describe phishing in the context of cyber-crime. | | CO3 | R | 1 |
| 6. | List the types of attacks targeting computers and smartphones. | | CO3 | R | 1 |
| 7. | Define intellectual property and provide an example. | | CO4 | R | 1 |
| 8. | Enumerate three types of works that can be copyrighted. | | CO4 | R | 1 |
| 9. | Define cyberstalking. | | CO5 | R | 1 |
| 10. | List the benefits of information security audit. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between micro-ethics and macro-ethics in engineering. | | CO1 | U | 3 |
| 12. | Summarize the processes that influence participative management. | | CO2 | U | 3 |
| 13. | Explain the relationships between IT workers and Employers. | | CO3 | U | 3 |
| 14. | Discuss the role of IT in bridging the digital divide and its impact on economic development. | | CO4 | U | 3 |
| 15. | Compare the ethical implications of using contingent workers versus full-time employees in terms of job security, benefits, and loyalty. | | CO5 | U | 3 |
| 16. | Summarize the roles and responsibilities in information asset management. | | 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. | Examine the benefits that emotional intelligence offers to engineers transitioning into managerial roles. | CO1 | A | 6 |
|  | b. | Illustrate the role of the PDCA cycle in supporting continuous improvement within an engineering project. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Analyze the following Scenario: “A newly appointed manager is leading a diverse engineering team composed of senior engineers, recent graduates, and technicians from varied cultural backgrounds. Initially, a transactional leadership style is adopted to maintain control and meet tight project deadlines. Over time, the team begins to show signs of reduced motivation and weakened collaboration”.  Address the following points:   1. Analyze the drawbacks of continuing with a transactional leadership style in a diverse and dynamic team setting. 2. Apply a more appropriate leadership style or a combination of styles that would be effective in enhancing team engagement and performance. 3. Explain the potential impact of adopting transformational, participative, or situational leadership styles on team morale and project outcomes. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Sketch the process of digital signature to ensure authenticity through asymmetric cryptography with a neat diagram. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Examine the ethical and legal challenges of software copyright infringement in the digital age. | CO4 | A | 6 |
|  | b. | Write short notes on the importance of User Acceptance Testing in software development and its impact on product success. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the ethical challenges of green computing in the electronics industry. Sketch the strategies, an IT organization can use to minimize environmental impact while maintaining profitability. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the top threats to the business continuity. | CO6 | A | 6 |
|  | b. | Illustrate the requirements of ISO 27001. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write short notes on the commission of cyber-crime under IT Act 2000. | CO3 | A | 6 |
|  | b. | Sketch the CIA security triad and discuss how it is implemented in network level, application level and end user level. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate the standards for information security management with a neat flowchart. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand professional ethics and organizational culture conduct in information technology. |
| **CO2** | Choose various leadership styles and the suitability for the specific organization |
| **CO3** | Identify the possible Computer crimes and the rules and regulations for protection. |
| **CO4** | Describe the various types of IPR and the procedures for obtaining IPR. |
| **CO5** | Explain the various types of Social Networking and issues. |
| **CO6** | Relate to the different national and international organizational models with intellectual ability. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 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. | IIlustrate the role of things and the Internet in IoT. | | CO1 | R | 1 |
| 2. | Identify the impact of an actuator. | | CO1 | R | 1 |
| 3. | List any two examples of neurological diseases. | | CO2 | R | 1 |
| 4. | Quote the need for an IFTTT applet. | | CO2 | U | 1 |
| 5. | Name any two examples of inertial sensors. | | CO3 | U | 1 |
| 6. | Identify a sensor commonly used in fitness trackers to monitor physical activity. | | CO3 | R | 1 |
| 7. | Compare IoT with traditional embedded systems. | | CO4 | U | 1 |
| 8. | Describe the common security risks in IoT networks. | | CO4 | R | 1 |
| 9. | **List any** two benefits of using Node MCU for smart farming automation. | | CO5 | R | 1 |
| 10. | Summarize the key challenges in finding an optimal drone path. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Distinguish between radio frequency identification and near field communication. | | CO1 | U | 3 |
| 12. | List any three smart wearables and mention their application. | | CO2 | U | 3 |
| 13. | Summarize smart medical devices needed for remote health monitoring. | | CO3 | U | 3 |
| 14. | Enumerate the system design steps for sample collection in wearable chemical and biochemical sensors. | | CO4 | R | 3 |
| 15. | List any three advantages of MATLAB based data loggers. | | CO5 | R | 3 |
| 16. | Differentiate between types of drones based on body structure. | | 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. | Sketch the architecture of IoT and explain it. | CO1 | U | 6 |
|  | b. | Illustrate the technology of connected devices in IoT. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | **Interpret the step-by-step process of transforming a traditional home into a smart home.** | CO2 | A | 8 |
|  | b. | List any four components of a System Interconnection Kit. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. |  | Determine a scenario in which a patient is not safe in the environment, and eventually becomes inevitable for at least one caregiver to be with him all the time for Parkinson's disease. It’s an emergency for the caregiver, and he has to leave for a day. How will IoT help the caregiver in such a critical time? Explain in detail. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the process of parsing sensor data on import into the Raspberry Pi system. | CO4 | A | 6 |
|  | b. | **Summarize** the constrained application protocol and its application in healthcare IoT systems. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. |  | Explain the concept of smart control in site-specific management of a fixed irrigation system. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe the assistive devices for individuals with severe paralysis. | CO5 | A | 8 |
|  | b. | Explain the hardware specifications of the Raspberry Pi. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Describe the procedure to assemble the drone with suitable diagrams. | CO6 | U | 8 |
|  | b. | Discuss the basic requirements needed for a drone delivery system in rural areas. | C06 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design an IoT-based smart home system. Explain the following modules in detail:  i. Sensor module  ii. Actuator module  iii. Communication module | CO6 | A | 4  4  4 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the 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 – MAY / JUNE 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 components of MLOps. | | CO1 | R | 1 |
| 2. | List the steps that are involved in data ingestion. | | CO1 | R | 1 |
| 3. | Tabulate any five principles of source code management for Machine Learning (ML) operation. | | CO2 | R | 1 |
| 4. | Identify the steps involved in transition to operations phase of a ML model. | | CO2 | U | 1 |
| 5. | Name the performance metric used in binary classification tasks to measure the ability of a model to correctly identify all relevant instances of the positive class. | | CO3 | R | 1 |
| 6. | Define Silhouette Coefficient. | | CO3 | R | 1 |
| 7. | State the main purpose of CI/CD pipeline. | | CO4 | R | 1 |
| 8. | Describe the ways Azure Container Instances (ACI) simplifies containerized application management and evaluate its impact on operational efficiency in cloud environments. | | CO4 | U | 1 |
| 9. | Identify the data factors monitored in data cataloging. | | CO5 | U | 1 |
| 10. | Define model drift. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Sketch the architecture of ML solution development process and explain each step. | | CO1 | A | 3 |
| 12. | Explain the concept of version control in Git with a suitable example. | | CO2 | U | 3 |
| 13. | Describe the methodology and significance of implementing k equal-sized folds in data partitioning. | | CO3 | U | 3 |
| 14. | Compare and contrast Continuous Delivery (CD) and Continuous Deployment (CD) in terms of their level of automation and human intervention. | | CO4 | U | 3 |
| 15. | Develop a framework to secure the ML lifecycle and address the key area. | | CO5 | A | 3 |
| 16. | State the potential errors in ML applications. | | 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. |  | Analyze the different types of ML models and discuss about how each type that may be applied to different aspects of the recommendation system. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Imagine being part of a data analytics team working for an educational institution, tasked with developing a predictive model to identify students at risk of dropping out based on their academic and behavioral data.  Illustrate the steps taken and stages of the pipeline that contributes to achieving the desired outcome. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the various metrics and methodologies utilized in model evaluation and interpretation, outlining their relevance and adaptability across a wide range of business challenges. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Examine different types of pipeline execution triggers in a CI/CD pipeline. Discuss the enhancement of flexibility and functionality in the pipeline process. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | A team is developing a ML solution for a financial institution. Given the sensitive nature of financial transactions, security is a top priority. During model deployment, concerns arise about adversarial attacks, data poisoning, and model inversion threats. The team needs to ensure the robustness and reliability of the ML system against these security threats. Illustrate various testing methodologies that can be applied to secure the ML solution in this scenario. | CO5 | A | 6 |
|  | b. | Describe the categories of attacks on ML systems and evaluate each kind of attack that affects ML models. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Determine the various stages of build workflow in ML pipeline. | CO1 | A | 6 |
|  | b. | Evaluate the ten key principles of source code management for ML operation. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Analyze the various methods of deploying ML models and evaluate their impact on performance, scalability, and real-world application across different environments. | CO3 | An | 6 |
|  | b. | Sketch the architecture of microservice vs monolithic service for the car repair facility model. | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate the principles of monitoring an ML system and assess their significance in ensuring model performance. | CO6 | An | 6 |
|  | b. | Examine the case study on Explainable AI and assess the different techniques to improve trust, accountability and decision-making in AI systems. | CO6 | A | 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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21CS3006** | **Duration** | **3hrs** |
| **Course Title** | **CYBER FORENSICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | An e-commerce company faced a data breach where customer credit card details were exposed. Forensic investigators must analyze logs and network activity to determine how the breach occurred. Explain the steps involved in conducting a forensic investigation to trace unauthorized access in a data breach. | CO1 | An | 16 |
|  |  |  |  |  |  |
| 2. |  | A leading financial institution recently detected unusual network activity, including unauthorized login attempts and data transfers. The internal cybersecurity team suspects that an external attacker has used hacking tools to gather information before attempting a breach. Illustrate how port scanners, vulnerability scanners, rootkits, and packet sniffers could have been used in the attack and describe forensic methods to detect and mitigate the threat. | CO2 | U | 16 |
|  |  |  |  |  |  |
| 3. | a. | Explain the fundamental concepts of mobile forensics, including its importance, challenges, and forensic approaches. | CO3 | U | 8 |
|  | b. | A digital forensic team is tasked with investigating a compromised Android device suspected of data tampering. Apply appropriate tools, configurations, and best practices to set up an effective forensic environment for conducting a thorough investigation. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | A security breach in an e-commerce platform led to unauthorized user access. Investigators suspect that attackers exploited slack space to hide malicious code. Describe forensic techniques used to analyze hidden data in slack space and how this evidence can be recovered. | CO4 | U | 8 |
|  | b. | Evaluate the strengths and limitations of EnCase and FTK tools in handling large-scale digital forensic investigations. | CO4 | E | 8 |
|  |  |  |  |  |  |
| 5. | a. | A software development company is outsourcing its cloud infrastructure management to a third-party vendor. The company’s leadership is unsure about the importance of signing a nondisclosure agreement (NDA) before sharing sensitive operational data. Explain the significance of an NDA in outsourcing and its role in protecting business confidentiality. | CO5 | AN | 8 |
|  | b. | A technology startup plans to outsource its cybersecurity operations to an external security firm. Before finalizing the contract, the company’s legal team wants to ensure that strong security measures are integrated into the Service level agreements (SLA) to protect critical business assets. Explain security principles used to structure an SLA that includes key security components for an outsourced cybersecurity service. | CO5 | A | 8 |
|  |  |  |  |  |  |
| 6. | a. | Explain the approach used in categorizing mobile forensic tools based on their capabilities and effectiveness. | CO4 | U | 10 |
|  | b. | Summarize the types of potential evidence that can be retrieved from mobile devices. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 7. | a. | A multinational corporation experienced repeated network intrusions despite having a firewall and antivirus software in place. Security analysts suggest adopting a multi-layered security approach to prevent hacking attempts. Explain various hacking prevention techniques that organizations can implement to enhance cybersecurity. | CO2 | A | 8 |
|  | b. | An international bank reported a large-scale distributed denial-of-service (DDoS) attack, suspected to be linked to a cyber terrorist group. Explain defensive strategies by analyzing the attack patterns and proposing countermeasures to mitigate future threats. | CO1 | A | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | A social media influencer was falsely accused of spreading misinformation online. The police conducted a digital forensic investigation but failed to follow proper electronic evidence collection protocols. Explain how the IT Act 2000 and its 2008 amendment regulate digital evidence handling and admissibility in Indian courts, ensuring fairness in cybercrime cases. | CO6 | U | 10 |
|  | b. | A financial institution was targeted by a phishing attack, resulting in fraudulent transactions. The bank argues that weak cybersecurity laws prevented timely legal action. Analyze the gaps in the IT Act 2000 and its amendments in addressing financial cybercrimes. Recommend legal reforms to strengthen digital banking security. | CO6 | An | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Identify the effect of cybercrime in forensic computing |
| CO2 | Infer digital forensic evidences and investigate the contents |
| CO3 | Choose and apply current computer forensics tools. |
| CO4 | Analyze the nature of cyber terrorism and its effects |
| CO5 | Devise basic computer and network forensic analysis |
| CO6 | Summarize the technical and legal aspects related to cyber crime |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23AI2004** | **Duration** | **3hrs** |
| **Course Title** | **CONVERSATIONAL ARTIFICIAL INTELLIGENCE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the different modes of engagement for humans. | | CO1 | U | 1 |
| 2. | Name any two applications of AI in messaging platforms. | | CO1 | U | 1 |
| 3. | Define utterance in the context of chatbots. | | CO2 | R | 1 |
| 4. | Recall the primary purpose of WordNet and VerbNet in NLP. | | CO2 | R | 1 |
| 5. | State the role of NLG in Conversational AI. | | CO3 | U | 1 |
| 6. | Mention any two widely used Conversational Design Tools. | | CO3 | R | 1 |
| 7. | Specify the primary goal of information extraction in conversational AI. | | CO4 | U | 1 |
| 8. | Identify the AI technique that is commonly used for language translation. | | CO4 | U | 1 |
| 9. | Define the term Virtual Agent. | | CO5 | R | 1 |
| 10. | Expand XR in XR technologies. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State how AI enhances the capabilities of smart speakers like Alexa and Google Home. | | CO1 | U | 3 |
| 12. | Categorize different types of chatbot intents. Specify the purpose of each intent. | | CO2 | U | 3 |
| 13. | Is ChatGPT a conversational AI? Justify your answer with key features and functionalities. | | CO3 | An | 3 |
| 14. | Point out the key challenges in training Machine Learning models for Conversational AI. | | CO4 | U | 3 |
| 15. | Specify the ethical challenge associated with conversational AI in contact centers. | | CO5 | U | 3 |
| 16. | Highlight the significance of conversational analytics in AI-driven communication. | | 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 the underlying mechanisms of Text-to-Speech (TTS) and Speech-to-Text (STT) technologies with real-world applications. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Explore the phases of Natural Language Processing (NLP) in detail with a neat block diagram | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Elaborate on Dialogue Management Strategies in Conversational AI by highlighting their advantages, challenges, and real-world applications. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain in detail the working of Automatic Speech Recognition (ASR) systems and its role. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | Outline how conversational AI systems, through the use of assistants, improve customer support in contact centers. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Perform POS tagging and dependency parsing for the following sentence:  "The quick brown fox jumps over the lazy dog." | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | A leading e-commerce company implements an AI-powered chatbot with advanced dialog management to handle customer queries. Analyze how the chatbot can manage multi-turn conversations, context retention, and ambiguity resolution to enhance user experience. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A retail company integrates Augmented Reality (AR) into its mobile app, allowing customers to visualize furniture in their homes before purchasing. Analyze how this XR-based commerce innovation improves customer engagement and decision-making. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Represent the fundamentals of conversational Artificial Intelligence |
| **CO2** | Recognize the basic building components for programming for intelligent systems |
| **CO3** | Analyze the natural language processing techniques to develop conversational applications |
| **CO4** | Create and implement conversational intelligence systems and chatbots |
| **CO5** | Examine the importance of intelligent techniques in conversational technologies |
| **CO6** | Predict the performance metrics to carry out analytics on conversational systems |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23AI2006** | **Duration** | **3hrs** |
| **Course Title** | **CYBER THREAT INTELLIGENCE AND ANALYTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the primary purpose of Cyber Threat Intelligence. | | CO1 | R | 1 |
| 2. | Name the steps involved in developing Cyber Threat Intelligence. | | CO1 | R | 1 |
| 3. | Identify the phase in the cyber kill chain where attackers gain unauthorized access | | CO2 | R | 1 |
| 4. | Classify the threats based on intent and activity using the ISO/IEC 7498-2:1989 model. | | CO2 | U | 1 |
| 5. | Identify a challenge that affects situational awareness in cybersecurity. | | CO3 | R | 1 |
| 6. | List any three core principles of goal-oriented security based on the CIA triad. | | CO3 | R | 1 |
| 7. | State the levels of the Knowledge Pyramid in ascending order. | | CO4 | R | 1 |
| 8. | Describe the primary focus of tactical threat intelligence reports. | | CO4 | U | 1 |
| 9. | Recognize one metric that is used to assess the value of shared intelligence. | | CO5 | R | 1 |
| 10. | Indicate the importance of continuous improvement in the intelligence process. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the impact of private sector intelligence sharing on the evolution of cyber threat intelligence. | | CO1 | An | 3 |
| 12. | Distinguish between targeted and untargeted cyber attacks with reference to ransomware. | | CO2 | U | 3 |
| 13. | Analyze the impact of intelligence metrics in improving the effectiveness of threat intelligence programs. | | CO3 | An | 3 |
| 14. | Discuss the benefits and limitations of active intelligence gathering. | | CO4 | U | 3 |
| 15. | Examine the processing steps involved in F3EAD Cycle. | | CO5 | An | 3 |
| 16. | Classify various activities under legal and ethical responsibilities in the cyber security profession. | | 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. |  | Analyze the utility of cyber threat intelligence in improving cybersecurity. Explain its role in supporting risk management, guiding resource allocation, and responding to evolving threats with examples. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Evaluate a cyber attack on a financial institution where attackers installed a backdoor and stole customer data after unusual outbound network traffic was detected. Logs showed multiple failed login attempts, and staff received phishing emails before the breach. Consider the likely type of threat actor involved, the possible attack vectors used, and justify which method of entry was most likely exploited. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the steps of the Threat Intelligence Cycle and describe how each step helps in turning raw data into useful intelligence. Include examples to show how planning, collection, analysis, sharing, and review work in real cybersecurity situations. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the hierarchical structure of the Knowledge Management Pyramid, examining the role of each component and assessing its significance in transforming data into actionable intelligence | CO4 | An | 6 |
|  | b. | Explain the Traffic Light Protocol and how it guides information sharing in cybersecurity. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. |  | Apply the D3A Cycle (Decide, Detect, Deliver, Assess) to a situation where a government agency is targeted by a cyber threat against its critical infrastructure. Explain how each stage of the cycle can be used to manage and respond to the threat effectively. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the framework of ATT&CK model in cyber security. | CO2 | U | 6 |
|  | b. | Differentiate between targeted and untargeted attacks by analyzing this scenario: A company is hit by Trojan horse delivered through a mass email campaign sent to many random recipients. Determine the type of attack and give reason. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe the Bank of England’s Maturity Model and explain how it helps a company to check the threat intelligence. | CO3 | U | 8 |
|  | b. | Distinguish between threat intelligence and security. | CO3 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Estimate the strength of evidence in a cyber attack where a government agency faces a data breach, with sensitive data leaked online. Custom malware and regional clues suggest a known threat actor. Using the Q Model of Attribution, analyze technical, operational, and strategic evidence and estimate how confidently the attack can be attributed. Explain the limitations of attribution in this scenario. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Represent cyber threat intelligence and improvement from antiquity to the present day |
| **CO2** | Examine how threat intelligence helps to manage risks and how a threat actor goes about attempting to achieve their desired goal. |
| **CO3** | Describe the threat intelligence cycle and elements that comprise the threat intelligence program |
| **CO4** | Summarize the issues that affect the suitability of sources of intelligence for inclusion in a threat intelligence program |
| **CO5** | Analyze the linking of a cyber incident to a specific threat actor |
| **CO6** | Interpret the practice of transforming information into intelligence |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23AI2009** | **Duration** | **3hrs** |
| **Course Title** | **ESSENTIALS OF GENERATIVE ARTIFICIAL INTELLIGENCE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define a Probabilistic Generative Model. | | CO1 | U | 1 |
| 2. | Name the algorithm that is commonly used to train Generative Adversarial Networks (GANs). | | CO1 | R | 1 |
| 3. | Identify the use of an autoencoder. | | CO2 | U | 1 |
| 4. | Name one application of Variational Autoencoders. | | CO2 | R | 1 |
| 5. | Name one variation of GANs used to improve training stability. | | CO3 | R | 1 |
| 6. | Interpret the working of the discriminator in a GAN. | | CO3 | U | 1 |
| 7. | Define a Gated Recurrent Unit (GRU). | | CO4 | R | 1 |
| 8. | Name one application of LSTM in sequence generation. | | CO4 | R | 1 |
| 9. | Describe a policy in Reinforcement Learning. | | CO5 | U | 1 |
| 10. | Identify one ethical concern in Generative AI. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Infer the importance of Generative Models in AI research. | | CO1 | An | 3 |
| 12. | Why do VAEs use the reparameterization trick? | | CO2 | U | 3 |
| 13. | Differentiate a Conditional GAN (CGAN) and a standard GAN. | | CO3 | An | 3 |
| 14. | Explain the role of the encoder-decoder model in sequence generation. | | CO4 | U | 3 |
| 15. | Explain the role of reward functions in reinforcement learning. | | CO5 | U | 3 |
| 16. | Deduce the importance of self-attention mechanism in Self-Attention GANs (SAGAN) | | 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. | Compare generative models with discriminative models.Give examples. | CO1 | An | 6 |
|  | b. | Identify and elaborate the major challenges of Generative AI models. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Explain the use of VAE in medical domain with respect to the following parameters.   1. Data generation for rare cases 2. Data compression and storage 3. Anomaly detection | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Interpret the use of Generative Adversarial Networks (GANs) in enhancing low-resolution medical scans like MRIs or CT images involved with the following parameters.   1. Generator network 2. Discriminator network 3. MRI Scan Resolution Enhancement 4. CT and PET Imaging | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Compare LSTMs, GRUs, and standard RNNs in terms of working, efficiency and performance for generative AI. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain Generative Adversarial Imitation Learning (GAIL) and its working principle. | CO5 | U | 6 |
|  | b. | Justify the statement “In game-playing applications, a Reinforcement Learning agent outperform a human player” by giving at least 4 reasons. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Infer the benefits of using bidirectional LSTM cells in sentiment analysis applications, and differentiate it with unidirectional models in terms of accuracy and context comprehension. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the real-world applications of Generative AI in various industries. | CO3 | A | 6 |
|  | b. | Identify the key applications of Variational Autoencoders (VAEs). | CO2 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the ethical challenges of Generative AI and possible solutions. | CO6 | U | 6 |
|  | b. | Assess the application of Transfer Learning in Generative AI and infer their advantages. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Represent the basic principles and concepts of generative artificial intelligence |
| **CO2** | Explore different types of generative models and their underlying architectures |
| **CO3** | Design a generative adversarial network for image synthesis and style transfer applications |
| **CO4** | Select the appropriate reinforcement learning model for generative tasks |
| **CO5** | Apply generative AI techniques to generate realistic images, texts, and other types of data |
| **CO6** | Analyze ethical considerations and challenges related to generative AICreate a bot to develop the UiPath and establish the workflow structures |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23AI2011** | **Duration** | **3hrs** |
| **Course Title** | **SOFTWARE ENGINEERING FOR ARTIFICIAL INTELLIGENCE SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the software process model unsuitable for accommodating any changes during the development cycle. | | CO1 | U | 1 |
| 2. | List any two evolutionary process models. | | CO1 | R | 1 |
| 3. | Enumerate the types of software requirements. | | CO2 | R | 1 |
| 4. | Illustrate the primary purpose of requirement analysis in software development. | | CO2 | U | 1 |
| 5. | Identify the type of design principle that aims to reduce dependencies between modules. | | CO3 | U | 1 |
| 6. | Identify the type of UML diagram that shows the relationship between different classes in a system. | | CO3 | U | 1 |
| 7. | Name the architectural style that follows a layered approach in software design. | | CO4 | R | 1 |
| 8. | List the elements of architectural style. | | CO4 | R | 1 |
| 9. | Represent the formula to calculate the cyclomatic complexity of the program. | | CO5 | U | 1 |
| 10. | List any one tool that is used for Continuous Integration (CI) in DevOps. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the different phases of the incremental software process model. | | CO1 | U | 3 |
| 12. | Differentiate the functional and non-functional requirements of the software. | | CO2 | An | 3 |
| 13. | Explain the role of design patterns in improving software reusability and maintainability. | | CO3 | U | 3 |
| 14. | Explain the key principles of user interface analysis and design. | | CO4 | U | 3 |
| 15. | Differentiate between verification and validation in software testing. | | CO5 | An | 3 |
| 16. | Compare Agile methodologies with traditional AI project management strategies. | | 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. |  | Relate a startup company that wants to develop a mobile application for food delivery using the Agile process model. The app should allow users to browse restaurants, place orders, track deliveries in real-time, and make payments online. The company wants frequent updates and feedback from customers to improve the app continuously. The development team follows Scrum, with short iterations and regular sprint reviews.   1. Explain the suitability of the Agile process model for this project. 2. Identify the Agile principles that apply to the above scenario and justify your answer. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | A university wants to develop an online student portal where students can register for courses, view their grades, access study materials, and communicate with professors. The system should allow administrators to manage student records, course schedules, and faculty assignments. Security and user authentication are critical requirements to ensure that only authorized users access the system.   1. Identify and classify the functional and non-functional requirements of the system. 2. Sketch a use case diagram to represent the key interactions within the system. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the importance of modularity and abstraction in software design. | CO3 | U | 6 |
|  | b. | Discuss the impact of cohesion and coupling on software maintainability and flexibility. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Describe the different architectural styles in software engineering with examples. | CO4 | U | 6 |
|  | b. | Explain the process of designing class-based components in object-oriented software development. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the different Object-Oriented Testing strategies and how they differ from traditional testing approaches. | CO5 | U | 6 |
|  | b. | Describe different types of testing involved in the web applications. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the elements of Software Quality Assurance. | CO6 | U | 6 |
|  | b. | Compare Six Sigma with ISO 9000 in terms of software quality management. | CO6 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Examine a web development team that is working on a large e-commerce platform with multiple developers making frequent updates to codebase. One day, after a deployment, the website crashed due to a missing configuration file.   1. Justify the importance of Software Configuration Managementin web engineering. 2. Explain how version control and configuration management practices help prevent such issues in web development. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the Agile AI approach in businesses today. | CO6 | U | 6 |
|  | b. | Explain the key steps in developing a machine learning project and illustrate the impact of data preprocessing and feature engineering on model performance. | CO6 | U | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Design an effective software engineering process to develop AI based 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 the various architectural design methods |
| **CO5** | Evaluate the system using various testing strategies |
| **CO6** | Develop AI based software system with quality measures |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1003** | **Duration** | **3hrs** |
| **Course Title** | **MICROPROCESSOR AND MICROCONTROLLER** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the maximum clock speed of the 8086 microprocessor. | | CO1 | R | 1 |
| 2. | Describe the purpose of segment registers in 8086. | | CO1 | U | 1 |
| 3. | Examine the mode of 8086, when the pin is connected to Vcc (5V). | | CO2 | A | 1 |
| 4. | Identify the addressing mode of the instruction MOV BX, [SI] in 8086. | | CO2 | U | 1 |
| 5. | List the modes of operation present in the 8254 Timer IC. | | CO3 | R | 1 |
| 6. | Identify the number of ports available in the 8255 PPI. | | CO3 | R | 1 |
| 7. | Identify the function of the TCON register in 8051. | | CO4 | U | 1 |
| 8. | Describe the function of ALE in 8051. | | CO4 | U | 1 |
| 9. | Interpret the function of the RS pin in an alphanumeric LCD module. | | CO5 | U | 1 |
| 10. | Name one processor that follows the RISC architecture. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the functions of the BIU in 8086. | | CO1 | U | 3 |
| 12. | Sketch the block diagram of a Co-Processor coupled configuration. | | CO2 | A | 3 |
| 13. | Illustrate the control word format of 8254 Timer. | | CO3 | A | 3 |
| 14. | Write a ‘C’ program to swap the contents of two registers in 8051. | | CO4 | A | 3 |
| 15. | Compare and contrast the modes of Timer 0 and Timer 1 in 8051. | | CO5 | An | 3 |
| 16. | List any three advantages of RISC architecture over CISC. | | 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 various types of addressing modes in the 8086 microprocessor with examples. | CO1 | An | 8 |
|  | b. | Compute the physical address, if the segment register in 8086 is set to 4000H and the offset is 2000H. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the minimum mode configuration of the 8086 microprocessor and describe its operation. | CO2 | A | 8 |
|  | b. | List any two assembler directives and their uses in 8086. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. |  | Explain the function of 8255 Programmable Peripheral Interface (PPI) with its block diagram. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the internal architecture of the 8051 microcontroller with a neat diagram. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Construct the interfacing of an LCD with 8051 microcontrollers. | CO5 | A | 8 |
|  | b. | Sketch the interface diagram of 4x4 keypad with 8051 microcontroller. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Classify the different types of instructions available in the 8086 microprocessor and explain with examples. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Sketch and explain the closely and loosely coupled multiprocessor configuration. Discuss its advantages, disadvantages, and applications. | CO2 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Discuss briefly the internal architecture of the Pentium processor with a block diagram. | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Construct assembly language programs using 8086 microprocessor. |
| **CO2** | Apply interfacing techniques for various applications. |
| **CO3** | Explain the 8051 architecture and interfacing techniques. |
| **CO4** | Develop microprocessor and microcontroller-based systems. |
| **CO5** | Select microprocessors and microcontrollers for various applications. |
| **CO6** | Evaluate advanced microprocessors and microcontrollers. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION –** **MAY / JUNE 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 output of the following C language code is?  #include <stdio.h>  int main ()  {  int a = 5;  printf("%d", --a);  return 0;  } | | CO1 | U | 1 |
| 2. | Sketch the symbol that is used to indicate a decision point in a flowchart. | | CO1 | R | 1 |
| 3. | Name the loop that guaranteed its execution at least once, regardless of the condition. | | CO2 | R | 1 |
| 4. | Identify the output of the following code.  #include<stdio.h>  int main(){  int i = 0;  while (i < 4)  {  printf("%d ", i);  i++;  }  return 0;  } | | CO2 | U | 1 |
| 5. | Find the output of the following C Program.  #include <stdio.h>  int main ()  {  char greeting [6] = {'W', 'o', 'r', 'l', 'd', '\0'};  printf("Greeting message: %s", greeting );  return 0;  } | | CO3 | U | 1 |
| 6. | State the built-in function that is used to copy one string to another. | | CO3 | R | 1 |
| 7. | Define array in C language. | | CO4 | U | 1 |
| 8. | Name any two predefined functions in C. | | CO4 | R | 1 |
| 9. | Write the standard C function used to read a single character from a file. | | CO5 | R | 1 |
| 10. | Select the operator that is used to connect structure name to its member name. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Develop a flowchart to represent the process of finding the largest of three numbers given by the user. | | CO1 | A | 3 |
| 12. | Compare the following branching structures in C: if, if-else, nested if. | | CO2 | U | 3 |
| 13. | State the purpose of strcpy() and strcmp(). | | CO3 | U | 3 |
| 14. | Name the array initializing methods. | | CO4 | U | 3 |
| 15. | Justify the significance of pointers in C language. | | CO5 | U | 3 |
| 16. | Differentiate between structures and unions in C language. | | 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. | Develop a C program to calculate the distance between two points in a 2D space using the distance formula. Accept the coordinates of the two points as input and display the calculated distance. | CO1 | A | 6 |
|  | b. | Explain different data types in C with suitable examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | List the different types of operators with suitable examples. | CO2 | U | 6 |
|  | b. | Develop a C program to calculate the Body Mass Index (BMI) using the formula BMI = weight / (height \* height) where weight is in kilograms and height is in meters. Display the BMI value and classify it as Underweight, Normal, Overweight, or Obese based on standard BMI categories. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Write a C program to search for a specific element in an array of integers using a linear search algorithm. Display an appropriate message if the element is found or not. | CO3 | A | 6 |
|  | b. | Explain about declaration and initialization of array in C. Provide an example for one-dimensional array. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Describe about syntax “function” in C programming with suitable example. | CO4 | U | 6 |
| b. | Write a C-program to add two numbers using call by reference methods. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain about the following arithmetic operations using pointers with suitable example (i) addition (ii) subtraction (iii) increment. | CO5 | A | 6 |
| b. | Illustrate the following File operation in C program (i) open a text file (ii) read the content line by line (iii) displays the lines on the console. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Write a C program to check whether a given number is an Armstrong number or not using a while loop. | CO2 | A | 6 |
| b. | Explain about the use of while loop and do-while loop under different scenarios. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Write an algorithm and C-program to swap two numbers. | CO1 | A | 6 |
| b. | Write a C program to find the factorial of a number using functions, where the number n is entered by user. | CO4 | C | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Define, declare, initialize and access the Structure in C | CO6 | R | 6 |
|  | b | Explain student information system using structures. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Examine the basics of computer programming concepts and write own programs |
| **CO2** | Apply the operators and conditional statements to represent the real time programs |
| **CO3** | Prepare solutions for the problem using arrays and strings |
| **CO4** | Categorize the problem into functions and synthesize a complete program using divide and Conquer approach using functions. |
| **CO5** | Formulate algorithms and simple programs using arrays and pointers |
| **CO6** | Create a new application to solve real world problems using structures and unions. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1007** | **Duration** | **3hrs** |
| **Course Title** | **PYTHON PROGRAMMING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the different data types that can be stored in Python. | | CO1 | U | 1 |
| 2. | Determine the type of x after executing this statement: x = int(4.5) | | CO1 | R | 1 |
| 3. | List any two features of Set in Python. | | CO2 | R | 1 |
| 4. | Name the function used to read an entire file as a single String. | | CO2 | R | 1 |
| 5. | Give an example of a user-defined function. | | CO3 | U | 1 |
| 6. | Identify the special method used for operator overloading of the == operator. | | CO3 | R | 1 |
| 7. | State the purpose of the Python Image Library (PIL). | | CO4 | U | 1 |
| 8. | List three layout managers used in Python GUI programming. | | CO4 | R | 1 |
| 9. | Identify the information conveyed by the argument inside the right() function of the given snippet.  *for \_ in range(5):*  *star.forward(100)*  *star.right(144)* | | CO5 | U | 1 |
| 10. | Identify the purpose of the sleep() function in multithreading. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write a Python program to print 10 natural numbers except 7 using control structures. | | CO1 | A | 3 |
| 12. | Develop a Python program to search for an element in a List and print its index value. | | CO2 | U | 3 |
| 13. | Write a user-defined function that calculates the factorial of a given number using recursion. | | CO3 | A | 3 |
| 14. | Describe the function of edge detection in image processing with sample code. | | CO4 | U | 3 |
| 15. | Write a Python program to create a GUI window with a Button widget and display “Hello” in the message box when the button is clicked. | | CO5 | A | 3 |
| 16. | Sketch the life cycle methods of a Thread. | | 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. | Develop a program that takes a user’s age as input and categorizes them as a child, teenager, adult, or senior citizen using if-elif-else. | CO1 | A | 6 |
|  | b. | Discuss the Bitwise and Relational operators used in Python with necessary sample codes. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Develop a Menu-driven Python program to implement the given operations. Initially, get any five names from the user and store them in a list.  i. Add a new name to the list  ii. Change a name based on its position  iii. Delete a name  iv. Reverse and display a name based on its position | CO2 | A | 6 |
|  | b. | Given the following dictionary:  *inventory = {*  *'gold' : 500,*  *'pouch' : ['flint', 'twine', 'gemstone'],*  *'backpack' : ['xylophone', 'dagger', 'bedroll', 'bread loaf']*  *}*  Write the Python code for the following tasks and display the dictionary after every operation:   * Add a key "shells" to inventory. * Set the value of 'shells' to be a list ['snail shell', 'clam shell', 'tusk shell','rock shell'] * Sort the items in the list stored under the 'backpack' key * Remove 'bedroll' from the list of items stored under the 'backpack' key * Add 45 to the number stored under the 'gold' key. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the following String handling operations with Python code snippet and justifications:  upper(), isalpha(), find(), count(), startswith(), replace(), format(), split() | CO3 | U | 8 |
|  | b. | Give an example of following higher-order function with detailed description.   * map * reduce | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Develop a Python program to generate and manage books in a shop. Create a class called Book with attributes b\_id, b\_name, b\_author, and b\_cost. Demonstrate the class with the necessary object instantiation and implement methods to provide a menu-driven interface with the following options:  1. Add a book  2. Display all books  3. Update book\_cost | CO4 | A | 6 |
|  | b. | Explain object serialization and deserialization with the necessary Python code snippet. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the following types of Inheritance in Python with a suitable program.  i) Single-level ii) Multi-Level iii) Hierarchical | CO5 | U | 6 |
|  | b. | Develop a program to read content from a file and write it into another file. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Write a Python program that performs arithmetic operations on complex numbers using operator overloading. Implement methods to add, subtract, and multiply complex numbers,. | CO4 | A | 6 |
|  | b. | Explain the process of exception handling in Python with suitable examples. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Develop a simple calculator application using a Tkinter GUI application with event handling for button clicks to perform addition, subtraction, multiplication, and division. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop a two-way communication client-server program where the client sends a message and the server responds with a modified version of the message. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Select the basic programming constructs of python suitably. |
| **CO2** | Infer the concepts of string processing, encryption, file i/o, lists and dictionary. |
| **CO3** | Apply modules for reusability and the object-oriented principles for modeling and developing software system. |
| **CO4** | Experiment the power of graphics for processing images. |
| **CO5** | Construct applications with graphical user interface. |
| **CO6** | Develop software solutions using multi-threading, networking and client-server concepts. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 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. | State the purpose of an actuator in IoT. | | CO1 | R | 1 |
| 2. | List any two wearable IoT devices. | | CO1 | R | 1 |
| 3. | Define latency in IoT networks. | | CO2 | R | 1 |
| 4. | State the primary purpose of the IEEE 802.15.4 standard. | | CO2 | R | 1 |
| 5. | Identify the role of cloud storage in IoT. | | CO3 | U | 1 |
| 6. | State the need for optimization for IP. | | CO3 | U | 1 |
| 7. | List key features of a System-on-Chip (SoC). | | CO4 | R | 1 |
| 8. | Define Attack-as-an administration (Aaas). | | CO4 | R | 1 |
| 9. | Define inference engine. | | CO5 | U | 1 |
| 10. | Define federated learning. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Classify and briefly describe types of AI. | | CO1 | U | 3 |
| 12. | Differentiate between a microcontroller and a microprocessor. | | CO2 | U | 3 |
| 13. | Construct the four fundamental building blocks of IoT in system development with examples. | | CO3 | A | 3 |
| 14. | List three IoT applications of Raspberry Pi. | | CO4 | R | 3 |
| 15. | State the different kinds of knowledge representation. | | CO5 | R | 3 |
| 16. | Discuss the security requirements of AI/IOT medical devices. | | 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. |  | Examine a scenario: A leading automotive manufacturer is 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. Discuss the various sensors used for the smart car IOT application. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain MEMS technology with an example. | CO2 | U | 8 |
|  | b. | List key design considerations for Wireless Sensor Networks (WSN). | CO1 | R | 4 |
|  |  |  |  |  |  |
| 19. |  | Explain IEEE 802.15.4G standards (Physical, MAC, Topology, Security). | CO2 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the IoT design methodology by applying its purpose and essential steps. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Summarize IoT architecture and key components. | CO3 | U | 4 |
|  | b. | Describe the functionality of a System-on-Chip (SoC), including its key components and role in modern embedded and IoT systems. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate between SoC and multi-chip modules. | CO4 | U | 4 |
|  | b. | List and explain the types of knowledge in AI. | CO5 | R | 8 |
|  |  |  |  |  |  |
| 23. | a. | Develop and explain the role of key AI technologies in enhancing 5G implementation. | CO6 | A | 8 |
|  | b. | Summarize AI components used in agriculture. | CO6 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the importance of semantic reasoning in IoT. | CO5 | U | 4 |
|  | b. | Employ different AI knowledge representation techniques in real-world scenarios, discussing their advantages and disadvantages. | CO5 | A | 8 |

**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 – MAY / JUNE 2025**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two types of computer architectures. | | CO1 | R | 1 |
| 2. | Identify the three main types of system buses. | | CO1 | R | 1 |
| 3. | Differentiate between MAR and MBR. | | CO1 | U | 1 |
| 4. | Describe the function of DRAM with a suitable circuit diagram. | | CO2 | R | 1 |
| 5. | Define an I/O module. | | CO3 | R | 1 |
| 6. | State the significance of addressing modes. | | CO4 | R | 1 |
| 7. | Examine the 2’s complement subtraction of smaller number (101010) from larger number (111101) | | CO4 | R | 1 |
| 8. | Define pipelining. | | CO4 | R | 1 |
| 9. | List 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. | Differentiate between Von Neumann and Harvard architectures with respect to memory organization and data flow. | | CO1 | R | 3 |
| 12. | List the components of a typical DMA module. | | CO2 | U | 3 |
| 13. | Explain the three types of external device communication. | | CO3 | U | 3 |
| 14. | Consider the following integer values (+10) and (-4), determine 2’s complement addition between above integer values. | | CO4 | A | 3 |
| 15. | Explain the purpose of the following processor registers: Program Counter, Instruction Register, Memory Address Register, and Memory Buffer Register. | | CO5 | U | 3 |
| 16. | Classify the types of data hazards. | | 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 top-level view of computer function and interconnection with a neat diagram. Discuss the role of major components such as CPU, Memory, Input/Output devices, and system buses in a computer system. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain cache memory and its importance in a computer system. Discuss the key elements of cache design with a suitable diagram. | CO2 | U | 8 |
|  | b. | Describe multiple interrupts and explain how they are handled in a computer system. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Compute the following by considering a direct mapped cache of size 512 KB with block size 2 KB and 7 bits in the tag.   1. Size of main memory. 2. Tag directory size. | CO3 | A | 8 |
|  | b. | Describe the various types of mapping techniques between cache memory and main memory. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 20. | a. | Compute the product p x q of the given values using Booth’s algorithm for multiplication. p = 0011, q = 0110. | CO4 | A | 8 |
|  | b. | Compute the subtraction of -2 from -5 using 2’s complement method. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain the following addressing modes with suitable examples.   * Immediate addressing mode * Direct addressing mode * Indirect addressing mode * Register addressing mode | CO4 | U | 8 |
|  | b. | Compute the addition of 8 and -3 using 2’s complement method. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Illustrate DMA controller with standard block diagram and describe its function in facilitating direct data transfer between memory and peripheral devices. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Describe the processor organization with a neat diagram. | CO5 | R | 8 |
|  | b. | Explain the operations of the Instruction Cycle with proper State Diagram. | CO5 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the various stages of pipelining illustrating how the instructions flow through them. Identify the types of hazards and propose suitable solutions to overcome the hazards. | CO6 | U | 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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS1013** | **Duration** | **3hrs** |
| **Course Name** | **ETHICS IN INFORMATION TECHNOLOGY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The \_\_\_\_\_\_\_\_ cycle is a four-step method used for quality control and improvement. | | CO1 | U | 1 |
| 2. | The process of ongoing enhancement in an organization is known as \_\_\_\_\_\_\_\_ improvement. | | CO1 | R | 1 |
| 3. | The three core principles of cybersecurity are Confidentiality, Integrity and \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | 1 |
| 4. | A \_\_\_\_\_\_\_\_ signature is used to authenticate digital documents under the IT Act. | | CO2 | R | 1 |
| 5. | Software Copyrights protect the source code of a program but not its functionality.  (True/False) | | CO3 | U | 1 |
| 6. | Intellectual Property refers only to physical assets like machinery.  (True/False) | | CO3 | R | 1 |
| 7. | Quality software development aims to improve the standard of \_\_\_\_\_\_\_\_ and productivity. | | CO4 | U | 1 |
| 8. | Industry \_\_\_\_\_\_\_\_ standards focus on automation and smart technology in sectors like healthcare and energy. | | CO4 | R | 1 |
| 9. | \_\_\_\_\_\_\_\_ computing focuses on reducing the environmental impact of IT systems. | | CO5 | U | 1 |
| 10. | ISO \_\_\_\_\_\_\_\_ is an international standard for Information Security Management Systems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between transactional and transformational leadership theories in the context of engineers as managers. | | CO1 | An | 3 |
| 12. | Outline the importance of the CIA (Confidentiality, Integrity, Authenticity) triad in maintaining cybersecurity. | | CO2 | U | 3 |
| 13. | Distinguish between patentable and non-patentable software-related products with examples. | | CO3 | An | 3 |
| 14. | Describe the strategies used to engineer quality software in modern IT practices. | | CO4 | U | 3 |
| 15. | Evaluate the role of green computing in addressing ethical challenges in the ICT industry. | | CO5 | An | 3 |
| 16. | Explain the purpose of ISO 27001 in establishing an Information Security Management System (ISMS). | | 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. | A charismatic leader inspires engineers to cut corners to meet client demands. Explain how this leadership style could compromise engineering ethics and organizational climate. | CO1 | U | 6 |
|  | b. | An engineering firm adopts a participative style of management. Discuss how this approach influences the organizational culture and climate in fostering ethical decision-making among engineers. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | An IT company experiences a data breach that compromises client confidentiality. Demonstrate how the company can apply the CIA security triad principles to restore trust and secure its systems. | CO2 | A | 6 |
|  | b. | A hacker uses a phishing attack to steal employee credentials in an organization. Illustrate how the IT workers can use provisions from the Information Technology Act, 2000, to respond legally to this cyberattack. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | A software developer creates an innovative app but finds a competitor has patented a similar concept. Explain how IPR procedures (patent application, examination, awarding) could have protected the developer’s work. | CO3 | U | 6 |
|  | b. | A company debates whether its new algorithm is patentable. Discuss the criteria for patentable software-related products and how they apply to this scenario. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Propose an IT-based solution using Industry 4.0 applications to enhance water management in a drought-prone region. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 21. |  | Design a code of conduct for a social networking website to address key ethical issues like data misuse and online harassment. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Develop a strategy for an IT firm to educate its employees about protecting intellectual property and avoiding infringement during software development. | CO3 | C | 12 |
|  |  |  |  |  |  |
| 23. |  | A rural food distribution system integrates IT solutions from Industry 4.0, improving efficiency. Assess how this impacts the standard of living for the local population. | CO4 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A retail chain is drafting its first information security policy. The Security Forum suggests including strict password protocols, while the Custodian team insists on focusing on data encryption. The management is unsure how to proceed. Discuss how the Security Forum and Custodian team contribute to framing the organization’s security policy and why both suggestions are important for information security. | CO6 | U | 6 |
|  | b. | An IT company conducts its annual information security audit and discovers multiple vulnerabilities in its employee login system. The audit report recommends immediate action to prevent future incidents. Explain the purpose of the information security auditing process in this scenario and how it helps the company address IT security incidents effectively. | CO6 | U | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the big data concepts, data analytics life cycle and applications |
| **CO2** | Illustrate the different eco system components of Hadoop |
| **CO3** | Develop MapReduce programs for real world problems |
| **CO4** | Justify the need of YARN Hadoop2 framework for big data analytics |
| **CO5** | Classify various NoSQL databases |
| **CO6** | Use big data analytics and data visualization techniques to analyze data and to provide business insights. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 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. | List any two types of tokens. | | CO1 | R | 1 |
| 2. | Identify the output of the following  x=10  print(type(x)) | | CO1 | R | 1 |
| 3. | Predict the output for the following.  (2\*\*3)\*\*2 | | CO2 | U | 1 |
| 4. | Identify the output for the following  for count in range(6,1,-1):  print(count,end= “ “) | | CO2 | U | 1 |
| 5. | Predict the output of the following  print("may".upper()) | | CO3 | U | 1 |
| 6. | Identify the output for the following.  for i in range(10):  if(i==5):  continue  print(i) | | CO3 | R | 1 |
| 7. | Compute the output for the following code  thislist = ["apple", "banana", "cherry"] thislist.pop() print(thislist) | | CO4 | U | 1 |
| 8. | Identify the output for the following.  fruits = (‘apple’, ‘banana’, ‘cherry’)  mult = fruits \* 2  print(mult) | | CO4 | R | 1 |
| 9. | Define Object in python. | | CO5 | R | 1 |
| 10. | List out the function which is used to open a file in python. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define literals with example. | | CO1 | R | 3 |
| 12. | Write a Python program to check whether a given number is even or odd. | | CO2 | A | 3 |
| 13. | Write a Python code to check if a given string is a palindrome. | | CO3 | A | 3 |
| 14. | Differentiate between break and continue statements in Python with examples. | | CO4 | U | 3 |
| 15. | Explain the term accessors and mutators with example. | | CO5 | U | 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. | a. | Illustrate string formatting in Python with examples. | CO1 | U | 7 |
|  | b. | Write a Python program that demonstrates various types of operators in Python | CO1 | A | 5 |
|  |  |  |  |  |  |
| 18. | a. | Write a Python program to print Fibonacci series up to n terms. | CO2 | A | 6 |
|  | b. | Explain the logic of “if loop” with example program. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the following string function with example code.  upper()  lower()  strip()  replace()  split()  find() | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Demonstrate different list operations with examples. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Write a Python program to find the factorial of a number using recursion | CO5 | A | 6 |
|  | b. | Write a python program to create class name as student with variable regno, name and cgpa. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Implement a Python function to reverse a list and to find the square of each element in the list. | CO4 | A | 6 |
|  | b. | Write a python program to read a number as input and display number in reverse order using loop. | CO2 | 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 characters, number of words, and number of lines 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 – MAY / JUNE 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 types of network topologies. | | CO1 | R | 1 |
| 2. | Classify the different types of access networks. | | CO1 | U | 1 |
| 3. | Identify the protocol used for secure remote login. | | CO2 | R | 1 |
| 4. | Predict the suitable transport layer protocol for live video streaming. | | CO3 | U | 1 |
| 5. | List the services provided by the transport layer. | | CO3 | R | 1 |
| 6. | Write the compressed form of the given IPv6 address.  1200:2000:0002:0000:0000:0002:0000:0000 | | CO4 | A | 1 |
| 7. | Identify the network management function responsible for detecting and responding to faults in a network. | | CO5 | U | 1 |
| 8. | State the key benefit of Google’s Orion SDN control plane. | | CO5 | R | 1 |
| 9. | Apply even parity to the given data bits and determine the row and column parity values:  1011 0100 1110 0011 | | CO6 | A | 1 |
| 10. | Analyze the cause of increased collisions in an ALOHA-based system when users increase. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate packet switching and circuit switching. | | CO1 | U | 3 |
| 12. | Classify the different types of DNS query resolution methods. | | CO2 | U | 3 |
| 13. | Illustrate the steps of the TCP three-way handshake process with a diagram. | | CO3 | A | 3 |
| 14. | A company sets up a new office with multiple devices requiring IP addresses for network connectivity. Analyze the different types of DHCP messages used in the IP address allocation process. | | CO4 | An | 3 |
| 15. | Summarize the need for a logically centralized control plane. | | CO5 | U | 3 |
| 16. | Sketch and explain the Ethernet header format. | | 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. |  | Compare and contrast the OSI reference model and TCP/IP protocol suite with a neat sketch. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the format of HTTP request and response message. State the different methods and status code of HTTP messages. | CO2 | U | 8 |
|  | b. | A user visits a news website, customizes their homepage by selecting preferred topics, and later returns to find their preferences saved. Illustrate with an example the mechanism that enables this functionality. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 19. | a. | Distinguish between Link State and Distance Vector Routing | CO5 | U | 4 |
|  | b. | Determine an addressing scheme using Variable Length Subnet Masking (VLSM) for the given topology with the network address **192.168.10.0/24**, ensuring it meets the specified requirements.     |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | Subnet Network Address | First Host IP | Last Host IP | Broadcast IP | | Marketing |  |  |  |  | | Research |  |  |  |  | | Management |  |  |  |  | | Serial link |  |  |  |  | | CO4 | A | 8 |
|  |  |  |  |  |  |
| 20. |  | Compute the shortest path in the given topology using Dijkstra’s algorithm with node ‘A’ as the source and write the steps of the algorithm.  https://lh7-rt.googleusercontent.com/docsz/AD_4nXeALc6ysWExH62b8M6n9f3ZHu34CtkwhK-atLxK-20XNQ-3DFSo0WRyXVK21IDfRuAbd3DFsXQsbPjOG9sjJ5QxQW6i8HFnImT3lpGhuzu_Z-ZJoupkpNWz1FktebmcZJ6Cjo03ft8-iqoSlLEDyUc?key=ntEmN6ArH0H2iRGhJoysT5BT | CO5 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | In the given NAT-based network setup, identify the source and destination IP addresses at each step (1 to 4) as a private host (10.0.0.1) communicates with a web server (200.100.10.1) over the internet. | CO4 | U | 6 |
|  | b. | Explain the different types of delays in a computer network. Illustrate with examples the impact of these delays on network performance. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Describe the structure of a **TCP header** with a neat sketch and state the purpose of each field. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 23. | a. | Interpret the given picture by identifying the protocols used at each step. Describe the communication process and the role of each protocol in mail exchange.  https://lh7-rt.googleusercontent.com/docsz/AD_4nXew3aAOikTBRly5RJ2Agnpx-zgG7jZ1Db32SFeYDhB7HJDtvQjWoHHMhXDmC5bu8-kiaz-Vy4CQhAiWodISjQlxQC_oPNf3XRWNq1IqN4uhm-4T8-CX8Ib1e9ZSiUV1_Wgq9zSoG3q-PKgUWmsWvA?key=ntEmN6ArH0H2iRGhJoysT5BT | CO2 | A | 6 |
|  | b. | Illustrate SDN control and data plane with suitable example. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Compute the **CRC bits (R)** for the given **data payload (D) = 10011010** using the **4-bit generator (G) = 1001**, where **r = 3.** Apply the cyclic redundancy check (CRC) division method to determine the remainder. | CO6 | A | 6 |
|  | b. | Compare the various channel partitioning protocols. | CO6 | An | 6 |

**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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2007** | **Duration** | **3hrs** |
| **Course Title** | **CRYPTOGRAPHY AND NETWORK SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Compare symmetric and asymmetric cryptography. | | CO1 | U | 1 |
| 2. | Define Denial of Service with an example. | | CO1 | R | 1 |
| 3. | Define Avalanche Effect in encryption algorithm. | | CO2 | R | 1 |
| 4. | Illustrate the concept of triple DES. | | CO2 | U | 1 |
| 5. | Justify the usage of a 56-bit key in DES instead of the whole 64-bit key. | | CO3 | U | 1 |
| 6. | State the purpose of Message Authentication Code(MAC) in cryptography . | | CO3 | U | 1 |
| 7. | Explain the primary purpose of Secure/Multipurpose Internet Mail Extension (S/MIME) in email security. | | CO4 | U | 1 |
| 8. | Explain transport mode of encapsulating security payload (ESP). | | CO5 | U | 1 |
| 9. | Discuss the Security as a service (SecaaS) categories of service given by the Cloud Security Alliance. | | CO6 | U | 1 |
| 10. | List the components of IoT-Enabled Things. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare and contrast the differences between active and passive attacks with suitable examples. | | CO1 | U | 3 |
| 12. | Show the State matrix after applying the ShiftRows transformation in AES on a given 4×4 matrix. | | CO2 | U | 3 |
| 13. | Explain working of CMAC with a neat sketch. | | CO3 | U | 3 |
| 14. | Explain Merkle’s Simple Secret Key Distribution protocol and its vulnerability to a man-in-the-middle attack. Suggest a mitigation strategy. | | CO4 | U | 3 |
| 15. | Examine any three wireless network threats and explain their impact on network security. | | CO5 | A | 3 |
| 16. | Explain any two security challenges in cloud computing and how they can be mitigated. | | 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. | Describe a substitution (Caesar - shift of 4) and a transposition (Rail Fence cipher - 4 level)) technique used in classical cryptography for the plaintext “DIVISION OF CSE”. | CO1 | A | 8 |
|  | b. | Explain the security services and mechanisms provided by cryptographic techniques for enabling security. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Examine how Triple Data Encryption Standard (3DES) overcomes the limitations of DES. | CO2 | An | 4 |
|  | b. | Users A and B use Diffie-Hellman key exchange with common prime p = 131 and primitive root g = 2.  a) If Alice’s private key is 34, calculate the public key that is transmitted.  b) If Bob’s private key is 92, calculate the public key that is transmitted.  c) Calculate the shared key and prove that it is the same. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 19. |  | Alice chooses q=11, p=23, h=16. Alice wants to transmit her message and signature to Bob with her secret number k = 5.  1. Calculate the global public elements.  2. Find the public key of Alice with her chosen private key x=7.  3. Verify the signature that is received by Bob along with the hash code H(M) = 10.  Prove that the above process provides integrity for the data transferred against modification attacks using Digital Signature Algorithm (DSA). | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Analyze the authentication service provided by the X.509 standard, incorporating the role of certificates, the Certificate Authority hierarchy, certificate revocations, and extensions. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | A university implements Kerberos authentication to secure access to its online library, student portals, and faculty resources. Illustrate how Kerberos Version 5 ensures secure authentication for this environment with a neat diagram. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Compute encryption and decryption using ElGamal CryptoSystems with Plaintext M = 7, g = 11, public key = 6, Random number 'k' = 4. | CO2 | A | 6 |
|  | b. | Analyze the processes involved in remote user authentication using symmetric encryption. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the steps involved in the Data Encryption Standard (DES) algorithm focusing on the operations of a single round. | CO2 | U | 6 |
|  | b. | Explain the components and working of the Internet Mail Architecture. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A university network is experiencing unauthorized access attempts from external sources. The CTC team is considering to implement either a packet filtering firewall or a stateful inspection firewall. Compare these firewall types, analyze their strengths and weaknesses, and evaluate which would be more effective in securing the network. Justify your answer with relevant examples. | CO6 | E | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Interpret the security issues and the need for cryptographic algorithms. |
| **CO2** | Examine the cryptographic algorithms for securing the network. |
| **CO3** | Apply the various algorithms to achieve integrity. |
| **CO4** | Recognize the importance of key management and distribution. |
| **CO5** | Choose the combination of cryptographic algorithms for securing the Web. |
| **CO6** | Analyze the advancements in implementing access controls and cloud security. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2008** | **Duration** | **3hrs** |
| **Course Title** | **DATA VISUALIZATION** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Visualization. | | CO1 | U | 1 |
| 2. | List the steps in the Data Visualization process. | | CO1 | R | 1 |
| 3. | Does human interpretation have any role in the perception of a visualization? | | CO2 | An | 1 |
| 4. | Explain pre-attentive processing with an example | | CO2 | A | 1 |
| 5. | State Hermann grid effect. | | CO3 | U | 1 |
| 6. | List the cognitive issues in Data Visualization. | | CO3 | R | 1 |
| 7. | Write a note on Intuitive Mappings from Data to Visualization. | | CO4 | An | 1 |
| 8. | Define contour plot. | | CO1 | A | 1 |
| 9. | State the importance of Aesthetics in Data Visualization. | | CO6 | U | 1 |
| 10. | Describe how the Layered Grammar defines a plot. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the advantages of visualizing complex data. Elaborate with suitable examples. | | CO1 | U | 3 |
| 12. | Briefly explain any three 2-D univariate data visualization methods. | | CO2 | R | 3 |
| 13. | Explain Benchmarking Procedures in Data Visualization. | | CO3 | An | 3 |
| 14. | Explain on decoding graphs. | | CO4 | A | 3 |
| 15. | Define Faceting. Explain its working. | | CO5 | U | 3 |
| 16. | Elaborate Node-Link graphs. Give the features and various types. | | 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 the role of color maps in data visualization and how they can be used to enhance the understanding of data. | CO2 | U | 6 |
|  | b. | Demonstrate how to create a histogram in R to visualize the distribution of a variable. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the importance of data ethics in the context of data visualization, and provide an example of an ethical consideration when creating visualizations. | CO4 | R | 6 |
|  | b. | Describe a scenario where you might choose to use Tableau for creating dashboards over Plotly, and vice versa. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the purpose of Seaborn functionalities. | CO5 | E | 6 |
|  | b. | Discuss the advantages and disadvantages of using Folium for spatial visualizations compared to using a dedicated GIS software. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 20. | a. | Explain the concept of clustering markers in Folium and provide an example where it might be useful. | CO4 | C | 6 |
|  | b. | Describe the different types of plots that can be created by using seaborn. | CO4 | C | 6 |
|  |  |  |  |  |  |
| 21. | a. | Discuss Graph visualization and explain about Matrix Representation for graphs. | CO6 | A | 6 |
|  | b. | Explain the challenges of interactive visual data analysis. | CO6 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | List the challenges with Text data. Explain why text visualization is necessary and write a note on Visualization of Raw Text. | CO1 | U | 6 |
|  | b. | List and explain the transformation steps for visualizing text. Write about Structured Text Features, Typical Steps of Processing to derive Text Features. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 23. | a. | Examine the importance of intuitive mappings. Explain how one should determine the amount of information to display? | CO3 | R | 6 |
|  | b. | Specify different methods on Geospatial Data on a Map. | CO3 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe Data Visualization Dashboard. List the benefits of using Data Visualization Dashboards. Explain how to build a data visualization dashboard. | CO2 | C | 6 |
|  | b. | Suggest some steps to make users revisit the dashboard frequently.  Also, describe some common dashboard data visualization KPIs with example. | CO2 | C | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | State the visual perception and principles and visualization methods. |
| **CO2** | Demonstrate various visualization techniques for exploratory data analysis. |
| **CO3** | Discuss the process involved in data visualization. |
| **CO4** | Apply different methodologies for interactive data visualization. |
| **CO5** | Illustrate essential visualization techniques for large amounts of data. |
| **CO6** | Design and implement dashboards in various organizational settings and domains. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 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. | State one difference between relational and hierarchical models. | | CO1 | R | 1 |
| 2. | Identify the primary purpose of JDBC. | | CO1 | R | 1 |
| 3. | List the basic set operations in SQL. | | CO1 | R | 1 |
| 4. | Identify the aggregate function used to calculate the total number of rows in a table. | | CO2 | U | 1 |
| 5. | Define functional dependency in the context of normalization. | | CO3 | R | 1 |
| 6. | Show how to represent a weak entity in an E-R diagram. | | CO3 | U | 1 |
| 7. | Differentiate between B tree and B+ tree index. | | CO4 | A | 1 |
| 8. | Indicate the main goal of implementing atomicity in transactions. | | CO5 | U | 1 |
| 9. | Name the two phases in the Two-Phase Locking (2PL) protocol. | | CO5 | R | 1 |
| 10. | State the CAP theorem. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the different levels of abstraction. | | CO1 | R | 3 |
| 12. | Differentiate between simple view and complex view in SQL. | | CO2 | A | 3 |
| 13. | Estimate the minimum number of tables required for the following ER diagram. | | CO3 | An | 3 |
| 14. | Differentiate static hashing and dynamic hashing with an example. | | CO4 | A | 3 |
| 15. | Compare and Contrast shared lock and exclusive lock in terms of concurrency control. | | CO5 | U | 3 |
| 16. | Describe the importance of the CAP theorem in NoSQL databases 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. |  | Discuss the architectural components of a database system, including storage, query processing, and transaction management. Explain how they interact to ensure data integrity and reliability. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the following fundamental operations of Relational Algebra with examples.   * Selection (σ) * Projection (π) * Cartesian Product (×) * Union (∪) * Set Difference (-) * Rename (ρ) | CO2 | U | 6 |
|  | b. | Develop the following Student and Course relations:  Student(SID, SName, Age, DeptID)  Course(CID, CName, DeptID, Credits)   1. Write a relational algebra expression to retrieve the names of students from the ‘CSE’ department. 2. Write a relational algebra query to find the Course ID(CID) with more than 3 credits. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Write the queries for the given questions.  **Database Schema**  **Customers** (CustomerID, FirstName, LastName, Email, Phone)  **Orders** (OrderID, CustomerID, OrderDate, TotalAmount)  **Products** (ProductID, Name, Category, Price, StockQuantity)  **OrderDetails** (OrderDetailID, OrderID, ProductID, Quantity, Subtotal)  **CustomerOrdersView** (OrderID, CustomerName, ProductName, Quantity, Subtotal)   1. Retrieve the list of customers who have placed orders and those who have not using a set operation. 2. Find the total revenue generated from all orders. 3. List all orders along with customer names and the total amount for each order. 4. Create a view that displays order details, including customer names, product names, quantity, and subtotal. | CO2 | A | 8 |
|  | b. | Discuss the differences between before and after triggers in SQL. Explain the effect of triggers on data modification and transaction handling. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Construct an ER diagram for the Hospital Management System. A hospital maintains records of patients, doctors, appointments, and departments. Each patient has a unique PatientID and may schedule multiple appointments for consultations, but each appointment is associated with only one patient. Doctors, identified by a unique DoctorID, specialize in different fields and provide consultations to multiple patients daily, while a patient may consult more than one doctor over time. The hospital is structured into various departments, each identified by a unique DepartmentID and responsible for overseeing multiple doctors, while each doctor belongs to only one department. Appointments serve as a bridge between doctors and patients, ensuring that each appointment is linked to a single doctor and a single patient, but over time, both doctors and patients may have multiple appointments. The system ensures proper management of patient records, doctor assignments, and healthcare services while maintaining data integrity and accessibility. | CO3 | A | 6 |
|  | b. | Explain different ER diagram notations with their symbols and usage. Support your answer with examples | CO3 | U | 6 |
|  |  |  |  |  |  |
| 21. |  | Summarize the concepts of 1NF, 2NF, 3NF, and BCNF normalization forms. Provide clear examples for each of these forms and discuss the importance of normalizing a database in terms of data integrity and efficiency. Additionally, elucidate any potential challenges or trade-offs involved in achieving higher normal forms. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain different file organization techniques used in database systems using suitable applications. Compare their advantages and disadvantages. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Restate the key characteristics and advantages of B+ trees in database indexing. | CO4 | U | 8 |
|  | b. | Illustrate the insertion of the following elements: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50in the B+ tree of order 4. | CO4 | A | 4 |
|  | | | | | |
| 24. |  | Generalize the working of column-based NoSQL databases and their advantages over relational databases. | CO6 | U | 12 |

**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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2017** | **Duration** | **3hrs** |
| **Course Title** | **DESIGN AND ANALYSIS OF ALGORITHMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the asymptotic notation for the polynomial expression. | | CO1 | R | 1 |
| 2. | Differentiate time and space complexity. | | CO1 | U | 1 |
| 3. | Identify the code word for the number ‘6’ from the Huffman tree given. | | CO2 | A | 1 |
| 4. | Identify the time complexity of the fractional knapsack problem using greedy solution. | | CO2 | R | 1 |
| 5. | List any two applications of dynamic programming. | | CO3 | R | 1 |
| 6. | Write the recursive formula to apply the 0/1 knapsack dynamic programming approach. | | CO3 | R | 1 |
| 7. | State the formula to identify the minimum distance between two cities in travelling salesman problem using dynamic programming. | | CO3 | R | 1 |
| 8. | Define the cycle in a graph. | | CO4 | R | 1 |
| 9. | List the three types of approximation algorithms. | | CO5 | R | 1 |
| 10. | Differentiate class P and class NP problems | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain Big-Omega notation with a suitable example. | | CO1 | U | 3 |
| 12. | Identify the total number of comparisons needed in brute force string matching technique, where the text T is a c a a b c and the pattern P is a a b. | | CO2 | U | 3 |
| 13. | Write the Warshall’s algorithm to find the transitive closure of the graph. | | CO3 | A | 3 |
| 14. | Consider the following graph, apply the FIFO branch and bound algorithm to find the minimum path. | | CO4 | A | 3 |
| 15. | Identify any two spanning trees from the following vertices. | | CO5 | A | 3 |
| 16. | Write short notes on CIRCUIT-SAT problem. | | 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 steps based on mathematical model of recursive method for the following algorithm (substitution method):  **ALGORITHM F(n)**  Computes n! recursively  Input: A nonnegative integer n  Output: The value of n!  **if** n = 0 return 1  **else** return F(n-1) \* n | CO1 | An | 6 |
|  | b. | Apply Master’s theorem to represent the solution of the following recurrence relations using the asymptotic representations:   1. T(n) = 2T(n-2) + O(n) 2. T(n) = 3T(n-2) + n2 | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Given the character set S = <A, B, C, D>, occurrence in the text file is P = <5, 1, 6, 3>. Apply the Huffman coding method to compute prefix-free code for each character. Also, compute the compression ratio. | CO2 | A | 6 |
|  | b. | Write an algorithm to find the solution for fractional knapsack problem. Apply the solution for the following instances to select the items to get the maximum profit.  Knapsack capacity = 10   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Items** | **1** | **2** | **3** | **4** | **5** | | **Weights (in kg)** | 3 | 3 | 2 | 5 | 1 | | **Profits** | 10 | 15 | 10 | 12 | 8 | | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Using the dynamic programming technique, calculate the most efficient way to multiply the matrices A1, A2, A3 and A4 together. Array dimensions of the matrices are:   * A1: 5 x 10 * A2: 10 x 15 * A3: 15 x 20 * A4: 20 x 25 | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Consider a scenario with 4 workers and 4 jobs. Apply the job assignment algorithm to determine the optimal job allocation that minimizes the total cost.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Workers** | **Job-1** | **Job-2** | **Job-3** | **Job-4** | | **A** | 11 | 4 | 9 | 10 | | **B** | 8 | 6 | 5 | 9 | | **C** | 7 | 10 | 3 | 10 | | **D** | 9 | 8 | 11 | 6 | | CO4 | A | 8 |
|  | b. | Solve the sum of subset problems using the backtracking strategy for the following data:  n = 4, (w1, w2, w3, w4) = (2, 3, 5, 8) and sum = 10. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Write Prim's algorithm to compute the Minimum Spanning Tree (MST). Apply the algorithm to the given graph to construct the MST. | CO5 | A | 8 |
|  | b. | Calculate the time complexity of the given algorithm:  Algorithm add(A,B,n)  {  for(i=0;i>n;i++)  {  for(j=0;i>n;j++)  {  C[i,j]=A[i,j]+B[i,j];  }  }  } | CO1 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Apply Warshall’s algorithm and find all pairs shortest paths for the given graph: | CO3 | A | 4 |
|  | b. | Operate the first two iterations of Dijkstra’s algorithm for the following graph from the source vertex: | CO5 | A | 8 |
|  |  |  |  |  |  |
| 23. |  | Predict the minimal tour path in the travelling salesman problem with branch and bound technique.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ∞ | 20 | 30 | 10 | 11 | | 15 | ∞ | 16 | 4 | 2 | | 3 | 5 | ∞ | 2 | 4 | | 19 | 6 | 18 | ∞ | 3 | | 16 | 4 | 7 | 16 | ∞ | | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the First Fit Decreasing (FFD) and best fit algorithms for the bin packing problem. Illustrate the solution to find the number of bins for packing the set of items with sizes {5, 6, 4, 10, 2, 3} in bins of capacity 10. | CO6 | R | 8 |
|  | b. | Define the vertex cover problem. Explain its computational complexity. | CO6 | R | 4 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | evaluate algorithms, expressing their efficiency using advanced notation |
| **CO2** | develop effective algorithms by employing strategic approaches like Brute Force and Greedy methods |
| **CO3** | develop optimized solutions for optimization and sequencing problems using Dynamic Programming techniques. |
| **CO4** | employ Branch-and-Bound and Backtracking methods to optimize solutions and resource allocation. |
| **CO5** | apply Graph Algorithms for shortest paths, minimum spanning trees, and network flow problems |
| **CO6** | evaluate quick-solving and time-consuming problems, and apply suitable strategies accordingly. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2019** | **Duration** | **3hrs** |
| **Course Title** | **DISTRIBUTED COMPUTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the pitfalls of distributed systems. | | CO1 | U | 1 |
| 2. | State the use of Daemon. | | CO1 | R | 1 |
| 3. | Identify the purpose of a message broker in message-oriented middleware. | | CO2 | U | 1 |
| 4. | State the purpose of a death certificate in gossip protocols. | | CO2 | R | 1 |
| 5. | Differentiate data-centric and client-centric consistency models. | | CO3 | U | 1 |
| 6. | Define strict consistency in the context of data-centric consistency models. | | CO3 | R | 1 |
| 7. | Identify the method used to manage multiple identical processes as a single logical unit. | | CO4 | U | 1 |
| 8. | Name the key technique used to handle failures in distributed systems. | | CO4 | R | 1 |
| 9. | Identify the use of authentication. | | CO5 | U | 1 |
| 10. | State the name given for hash functions. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the client server architecture with a diagram. | | CO1 | U | 3 |
| 12. | Distinguish between flooding and rumor spreading in terms of message propagation efficiency. | | CO2 | An | 3 |
| 13. | Summarize the role of a primary replica in primary backup replication. | | CO3 | U | 3 |
| 14. | List the difference between availability and reliability in the context of fault tolerance in distributed systems. | | CO4 | R | 3 |
| 15. | Illustrate the security mechanism that would be the most effective in preventing unauthorized access to a system. | | CO5 | A | 3 |
| 16. | State the characteristics of multimedia applications. | | 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. |  | Describe the different architectural styles in detail. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the steps involved in the operation of Remote Procedure Calls (RPC) and explain the challenges that arise due to different address spaces, parameter passing, and system failures. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | A banking system has multiple branches where customers can deposit and withdraw money. The system follows sequential consistency (Data-Centric Consistency), meaning all transactions appear in the same order across all servers, but different clients may see different interleaving of operations.  Consider two clients, Alice and Bob: Alice deposits $500 into her account from Branch A. Bob withdraws $300 from the same account at Branch B. A third transaction at Branch C checks the balance. Depending on the order of execution, Bob's withdrawal might succeed or fail based on whether Alice's deposit has been applied.  (a) Analyze the application of sequential consistency to this scenario.  (b) Illustrate two possible sequences of operations that maintain sequential consistency.  (c) Explain how a system could ensure sequential consistency across all branches. | CO3 | An | 12  (3x4) |
|  |  |  |  |  |  |
| 20. |  | Explain the Two-Phase Commit (2PC) protocol used in distributed commit. Describe its phases, the roles of the coordinator and participants, and the way failures are handled in the protocol. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the concept of trust in distributed systems. Describe how trust management is established and maintained among distributed components, and state its role in ensuring system security and reliability. | CO5 | R | 6 |
|  | b. | Analyze the Token Ring algorithm that ensures mutual exclusion in a distributed system and discuss potential drawbacks or failure scenarios in its implementation. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Alice and Bob are using the Diffie-Hellman key exchange to establish a shared secret key over an insecure channel. They agree on the following public values:   * Prime number p = 31 * Generator g = 6 * Alice selects a private key a = 7 * Bob selects a private key b = 13   (a) Compute Alice’s public key. (b) Compute Bob’s public key.  (c) Compute the shared secret key that Alice and Bob will derive. (d) Explain why Diffie-Hellman key exchange remains secure even if an attacker intercepts the public keys. | CO4 | A | 8  (4x2) |
|  | b. | A university's IT department wants to secure access to its internal servers and resources for students and faculty. They decide to implement a **Key Distribution Center (KDC)** for authentication and secure key management. Explain how the **Key Distribution Center (KDC)** facilitates secure communication in a distributed system. Support your explanation with a diagram showing the key exchange process. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 23. | a. | Describe the various resource sharing algorithms in detail. | CO6 | R | 6 |
|  | b. | Discuss the key differences between BitTorrent-based multimedia distribution and traditional client-server streaming | CO6 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the distributed multimedia systems by considering its characteristics, QoS management and parameters. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the architecture of distributed systems. |
| **CO2** | Infer the process, communication and coordination in distributed systems. |
| **CO3** | Examine naming, consistency and replication protocols in distributed systems. |
| **CO4** | Explain fault tolerance mechanisms in distributed systems. |
| **CO5** | Analyze the security features in distributed systems. |
| **CO6** | Appraise distributed multimedia systems and the design of distributed systems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY 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. | Define quantitative data and provide an example. | | CO1 | U | 1 |
| 2. | Name the Python library used for data manipulation and analysis, particularly for handling tabular data structures. | | CO1 | R | 1 |
| 3. | Differentiate between structured and unstructured data. | | CO1 | U | 1 |
| 4. | Interpret the following command: data.iloc[2:6, 0] | | CO2 | U | 1 |
| 5. | Calculate the measures of central tendency to analyze the demand for  the product (in units) in past 15 days.  3, 12, 7, 17, 3, 14, 9, 6, 11, 10, 1, 4, 19, 7, 15. | | CO3 | A | 1 |
| 6. | Compute the 'five number summary' and IQR for the below data.  2, 1, 7, 6, 5, 9, 18, 15, 12, 19, 27. | | CO3 | A | 1 |
| 7. | List the cluster similarity measures used in hierarchical clustering. | | CO4 | R | 1 |
| 8. | Infer the optimal K value from the following graph. | | 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. | Differentiate between categorical and quantitative data. | | CO1 | U | 3 |
| 12. | Compare and contrast scatterplots and box plots in terms of their purpose, usage, and the type of insights they provide in data analysis. | | CO2 | U | 3 |
| 13. | A sample of 400 male students is found to have a mean height of 67.47 inches. Can it be reasonably regarded as a sample from a large population with a mean height of 67.39 inches and a standard deviation of 1.30 inches. Test at 5% level of significance. | | CO3 | An | 3 |
| 14. | Sketch the dendogram using the following distance matrix. | | CO4 | A | 3 |
| 15. | Determine the similarity between A and B from the following utility matrix. | | CO5 | A | 3 |
| 16 | Differentiate between transparency and accountability in data science. | | 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. | As a data scientist at an educational platform, your task is to recommend courses to learners based on their preferences. You have structured data (user profiles, course completions) and unstructured data (student feedback, discussion forum posts). Explain the steps you would take through the Data Science lifecycle to create an effective course recommendation model. | CO1 | An | 6 |
|  | b. | Explain the role of data science in enhancing solutions and addressing challenges in the sectors of Food and Health, with specific examples for each sector. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Write python snippets for the following conditions:   1. Read the dataset to a dataframe.  Retrieve values of the dataframe as a Python array.  1. Display all the statistical information of qualitative atttributes 2. Select the first 4 rows of (‘Customer ID’, ‘Genre’, ‘Age’) 3. Fill the null values with the previous values of the same column 4. Drop the Score column permanently 5. Sort the dataset based on ‘Score’ 6. Draw the boxplot for ‘Age’ | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | A researcher collected the following data on the number of hours studied and the corresponding test scores of 7 students:    Calculate the Pearson correlation coefficient (r) between age and monthly grocery spending. Show all calculations, including the mean and standard deviation of both variables and explain the significance of the correlation coefficient obtained. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | A university claims that the average GPA of its students is 3.5. A researcher suspects that the actual average GPA is different and collects a random sample of 100 students, finding a sample mean GPA of 3.4 with a known population standard deviation of 0.3.  At a 95% confidence level (α = 0.05),   1. Formulate the null and alternative hypotheses. 2. Apply a Z-test to determine if there is a significant difference between the claimed and observed GPA. 3. Analyze the results and interpret whether the university's claim is statistically valid. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Apply k-means algorithm and Euclidean distance to cluster the following 8 examples into 3 clusters: A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9). The initial clusters are A1=(2,10), A4=(5,8), A7=(1,2), update the centers of new clusters after one iteration. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Compute the information gain of a1 and a2 for the given dataset: | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | A travel booking platform wants to improve its hotel recommendation system. Currently, it only uses user ratings for recommendations, but customers often complain about irrelevant suggestions. To enhance personalization, the company decides to integrate content-based filtering with collaborative filtering.  Develop a hotel recommendation system that effectively combines these two techniques. Analyze the advantages and challenges of integrating them. Proposestrategies to handle issues like the cold start problem and scalability. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | A health-tech company collects patient data to develop an AI-powered diagnosis system. The company claims to anonymize the data but does not clearly inform users about how their information is used. Later, a researcher finds that certain de-identified records can still be linked back to individuals. Additionally, some patients were unaware that their data was being shared with third-party researchers.  Analyze the ethical issues in this scenario, focusing on privacy, confidentiality, and informed consent. Evaluate the risks of inadequate anonymization and consent mechanisms. Proposestrategies to ensure ethical data collection and stronger privacy safeguards. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOME** |
| **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 – MAY / JUNE 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. | Interpret the update in S after processing a new positive training example ⟨sunny, cool, high, same⟩ for the given specific boundary S=⟨sunny, warm, high, same⟩. | | CO1 | U | 1 |
| 2. | Compute the Interquartile Range (IQR) for the dataset where the first quartile's value is 20, the third quartile's value is 70, and the median value is 45. | | CO2 | A | 1 |
| 3. | Differentiate SLP and MLP. | | CO3 | R | 1 |
| 4. | A company uses a simple linear regression model to predict monthly sales (y) based on the amount spent on advertising (x). Given that the intercept is 2 and the regression coefficient is 3. Compute the predicted sales when the company spends $5,000 on advertising. | | CO3 | R | 1 |
| 5. | Identify the primary purpose of the self-organizing map. | | CO4 | U | 1 |
| 6. | Name the type of clustering labeled in A and B. | | CO4 | A | 1 |
| 7. | Determine the criteria to fix the root node in the regression tree. | | CO5 | U | 1 |
| 8. | List applications of tree-based models. | | CO5 | U | 1 |
| 9. | Distinguish between Grid Search and Randomized Search in hyperparameter tuning. | | CO5 | U | 1 |
| 10. | State the purpose of regularization in machine learning | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define PAC Learning. | | CO1 | R | 3 |
| 12. | Apply data smoothing with bin size of 3 to remove the noisy data for the dataset D= {21, 20, 9, 13, 2, 25, 30, 6, 7} using the following methods.   1. Bin boundary 2. Bin median 3. Bin mean | | CO2 | A | 3 |
| 13. | Classify the types of regression and give examples. | | CO3 | U | 3 |
| 14. | Compute the class label for the new point (4,6) using KNN with K=1, based on the given classified data points.  (2,3) → Class A  (8,5) → Class B  (7,9) → Class C | | CO4 | A | 3 |
| 15. | Construct a dendrogram with the step-by-step procedure in hierarchical agglomerative clustering using single linkage criteria. | | CO4 | A | 3 |
| 16. | Calculate Accuracy, Recall, and Precision using the given data:  True Positive (TP)= 45, True Negative (TN) = 25, False Positive (FP)= 18, False Negative (FN)= 12. | | 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. |  | Construct a consistent hypothesis using the Candidate Elimination algorithm for the given dataset.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Citation** | **Size** | **Library** | **Price** | **Edition** | **Buy** | | Many | Big | No | High | Many | Yes | | Many | Medium | No | High | Few | Yes | | Some | Small | No | Medium | One | No | | Many | Small | No | Medium | Many | Yes | | CO1 | A | 8 |
|  |  | Explain the taxonomy of machine learning models with suitable examples. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Describe the following machine learning techniques.   1. Principal Components Analysis 2. Data Transformation | CO2 | U | 8 |
|  | b. | A cricket board wants to examine whether a player's country influences their role preference in the team. To investigate this, data was collected from 200 professional players from India and Australia. Perform a Chi-Square test on the given observed data at a 0.001 significance level for determining if there is a statistical correlation between a player's country and their role preference.   |  |  |  |  | | --- | --- | --- | --- | | **DF** | **Critical-Value** | | | | **0.05** | **0.01** | **0.001** | | 1 | 3.84 | 6.64 | 10.83 | | 2 | 5.99 | 9.21 | 13.82 | | 3 | 7.82 | 11.35 | 16.27 | | 4 | 9.49 | 13.28 | 18.47 |  |  |  |  |  | | --- | --- | --- | --- | | **Mode of Learning** | **India** | **Australia** | **Total** | | **Batting** | 60 | 40 | 100 | | **Bowling** | 40 | 60 | 100 | | **Total** | 100 | 100 | 200 | | CO2 | An | 4 |
|  |  |  |  |  |  |
| 19. | a. | Apply the single-layer perceptron learning algorithm for the given data by assuming the weights as [2.4, 1.8], threshold >= 1, learning rate = 0.4 and determine the updated weight after one iteration.   |  |  |  | | --- | --- | --- | | **X1** | **X2** | **Y** | | 0 | 0 | 0 | | 0 | 1 | 0 | | 1 | 0 | 0 | | 1 | 1 | 1 | | CO3 | A | 8 |
|  | b. | Explain the working principle of the Support Vector Machine. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. |  | Discuss the working principle of Naïve Bayes classification. Apply the Naive Bayes classifier on the given dataset to determine the class of the given test instance:  <Outlook = Sunny, Temperature = Cool, Humidity = Normal, Wind = Strong> | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Apply the Apriori algorithm to the following dataset with a support threshold of 33% and a confidence threshold of 70%. Tabulate the strong rules and sort them based on their confidence.   |  |  | | --- | --- | | Transaction ID | Items | | T1 | I1, I2, I5 | | T2 | I2, I4 | | T3 | I2, I3 | | T4 | I1, I2, I4 | | T5 | I1, I3 | | T6 | I2, I3 | | CO4 | A | 8 |
|  | b. | Discuss Decision Tree Algorithm. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | 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. | CO5 | A | 8 |
|  | b. | Describe the steps involved in the Fuzzy C-Means clustering algorithm. | CO5 | R | 4 |
|  |  |  |  |  |  |
| 23. |  | Discuss the role of Ensemble Learning in improving recommendation accuracy by blending multiple perspectives, focusing on Bagging (Random Forest) and Boosting (AdaBoost) with suitable examples. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | A data science team is building 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. Analyze the suitability of K-fold, Stratified K-fold, Leave-One-Out, and 0.632 Bootstrap cross-validation methods with examples. | CO6 | An | 8 |
|  | b. | A company aims to develop an AI system for categorizing customer reviews into multiple classes, such as Positive, Negative, and Neutral. Explain various approaches for multiclass classification. | 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 – MAY / JUNE 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. | Differentiate RAM and ROM. | | CO1 | U | 1 |
| 2. | Define Operating system. | | CO1 | R | 1 |
| 3. | Sketch the different states of a process. | | CO2 | A | 1 |
| 4. | List the types of parallelism in multicore programming. | | CO2 | R | 1 |
| 5. | Describe the structure of the bounded buffer problem. | | CO3 | U | 1 |
| 6. | Define semaphore. | | CO3 | R | 1 |
| 7. | Differentiate logical and physical address. | | CO4 | U | 1 |
| 8. | Define thrashing. | | CO4 | R | 1 |
| 9. | Sketch the structure of file-control block. | | CO5 | A | 1 |
| 10. | Give examples of different types of files. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the storage system hierarchy. | | CO1 | R | 3 |
| 12. | Describe the threading model for many-to-many and many-to-one approach with diagrammatic representation. | | CO2 | U | 3 |
| 13. | Deduce Peterson’s solution for mutual exclusion, where two processes (Pi and Pj) that are in race condition. | | CO3 | An | 3 |
| 14. | Consider a system having 64 frames with 4 processes, the virtual memory size is as follows v(1)=16, v(2)=128, v(3)=64, v(4)=48. Allocate free page frames by using equal allocation and Proportional allocation. | | CO4 | E | 3 |
| 15. | Analyze the different attributes of a file. | | CO5 | An | 3 |
| 16. | Sketch the structure of Hard disk drive and illustrate the components. | | 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. | Compare the various operating system structures. | CO1 | U | 6 |
|  | b. | Illustrate the following functions of the operating system.   * Process management * Main memory management * Secondary storage management * File management * I/O system management * Protection and security | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. |  | Consider the following set of processes, with the length of the CPU burst time given in milliseconds.   |  |  |  | | --- | --- | --- | | Process | Burst Time | Priority | | P1 | 10 | 3 | | P2 | 29 | 4 | | P3 | 3 | 2 | | P4 | 7 | 5 | | P5 | 12 | 1 |   i) Sketch the Gantt chart illustrating the execution of these processes using FCFS, Non-preemptive SJF, Priority, Round Robin (time quantum=10 milliseconds)  ii) Calculate the Average Waiting Time and Average Turnaround Time of each process using the above technique. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Consider a scenario where five philosophers are seated around a circular table, each with a single chopstick placed between them. One evening, all five philosophers become hungry at the same time. Each philosopher picks up the chopstick to their left, intending to pick up the right chopstick next. However, since every philosopher has already taken their left chopstick, no one can pick up their right chopstick, leading to a deadlock where no one can eat. Solve this deadlock situation in the problem using semaphore-based synchronization technique. | CO3 | A | 6 |
|  | b. | A system has five processes (P1, P2, P3, P4, P5) and four resource types (A, B, C, D) with the following total available instances:  A = 10, B = 5, C = 7, D = 8. The current allocation and maximum need of resources for each process are as follows:   | Process | Allocation (A, B, C, D) | Max (A, B, C, D) | | --- | --- | --- | | P1 | (1, 1, 2, 1) | (3, 2, 2, 2) | | P2 | (2, 0, 0, 1) | (2, 2, 2, 2) | | P3 | (3, 0, 2, 2) | (9, 0, 2, 2) | | P4 | (2, 1, 1, 0) | (4, 3, 3, 1) | | P5 | (0, 0, 2, 1) | (3, 3, 2, 2) |   The remaining available resources are:   * A = 2, B = 3, C = 0, D = 3   Determine whether the system is in a safe state using the Safety Algorithm. If so, find the safe sequence. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Consider the reference string 0,1,2,3,0,1,2,3,0,1,2,3,4,5,6,7. Calculate the page faults using FIFO, LRU and Optimal page replacement algorithm with 3 frames. Check whether this string suffers from Belady’s anomaly in FIFO using 4 frames. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the following file access methods with a neat sketch.   1. Sequential Access Method 2. Direct Access Method 3. Indexed Access Method | CO5 | A | 6 |
|  | b. | A company manages a large database where files are frequently modified, deleted, and resized. Over time, fragmentation has led to slower file access, impacting system performance. The IT team needs a file allocation technique that balances efficient disk space utilization, supports both sequential and random access, and minimizes fragmentation while allowing dynamic file growth. Given these requirements, justify the file allocation technique would be the most suitable for the system. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 22. | a. | Apply various operating system services to ensure the efficient operation of the system. | CO1 | A | 6 |
|  | b. | A large-scale e-commerce website like Amazon or Flipkart handles millions of users requests simultaneously. To ensure fast response times and efficient processing, it uses a multiprocessor system. Examine the merits of a multiprocessing system that a large-scale e-commerce website can utilize. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the Inter-Process Communication (IPC) mechanisms using Shared Memory and Message Passing models, and discuss their differences, benefits, and practical applications. | CO2 | An | 6 |
|  | b. | A system has the following free memory partitions (in KB):  Partition sizes: 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in this order).  Three processes need to be allocated memory:   * Process P1 requires 212 KB * Process P2 requires 417 KB * Process P3 requires 112 KB   Using First Fit, Best Fit, and Worst Fit memory allocation strategies, determine the memory allocation for each process and identify the remaining free partitions after allocation. | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Consider a disk with 1000 tracks and the queue has random requests from different processes in the order: 123,874,692,475,105,367. Initially the arm is at 500. Calculate the Average Seek length using FIFO, SSTF, SCAN and C-SCAN algorithm. | CO6 | An | 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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2045** | **Duration** | **3hrs** |
| **Course Title** | **SYSTEM SOFTWARE AND COMPILER DESIGN** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the registers of the SIC Machine. | | CO1 | R | 1 |
| 2. | Distinguish between System Software and Application Software. | | CO1 | U | 1 |
| 3. | Predict the output of the lexical analysis phase. | | CO2 | U | 1 |
| 4. | Define the role of sentinel characters in the context of input buffering. | | CO2 | R | 1 |
| 5. | State the conditions for a grammar to be LL(1) grammar. | | CO3 | R | 1 |
| 6. | Compute the function goto(I, a), given the item I: A → .aB and the grammar:  A → aB, B → b | | CO3 | A | 1 |
| 7. | Identify the type of attribute B.val in the rule given:  A → B C A.val = C.val  B.val = f(C.val, A.val) | | CO4 | U | 1 |
| 8. | Name the type of attribute that is computed using the attributes of a node’s parent or siblings in a syntax-directed definition. | | CO4 | R | 1 |
| 9. | Define type expression. | | CO5 | R | 1 |
| 10. | Differentiate between machine-dependent and machine-independent optimization. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the function of a bootstrap loader. | | CO1 | U | 3 |
| 12. | Write a Lex program that counts the number of vowels and consonants in a given input text. | | CO2 | A | 3 |
| 13. | Represent the operator precedence relations (<•, =•, >•) among the terminal symbols using the operator precedence table for the grammar given:  E → E + E  E → E \* E  E → ( E )  E → id | | CO3 | U | 3 |
| 14. | Sketch the annotated parse tree for “*3 \* 5 + 4n*” using the following grammar:   |  |  | | --- | --- | | L → En | L.val=E.val | | E → E1+T | E.val=E1.val+T.val | | E → T | E.val=T.val | | T → T1\*F | T.val=T1.val\*F.val | | T → F | T.val=F.val | | F → (E) | F.val=E.val | | F → digit | F.val=digit.lexval | | | CO4 | A | 3 |
| 15. | Illustrate a simple type-checking system for declaration statements. | | CO5 | U | 3 |
| 16. | Rewrite the following code by eliminating dead code (if any) with suitable justification:  *int main() {*  *int x = 10;*  *int y = 20;*  *int z;*  *z = z + y;*  *printf("z Value = %d", &z);*  *return 0;*  *}* | | 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. |  | Given the following macro definitions and macro calls.  a) Construct the assembly code by expanding the macro calls.  b) Illustrate and explain the data structures used by the macro processor during macro expansion. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Interpret the role of each compiler phase in processing the expression: *X = Y \* (Z + W) / V*. Illustrate the intermediate representations generated at each phase and assess the impact of optimization techniques applied before code generation. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Construct the non-recursive predictive parsing table for the following grammar; and also, determine the acceptance of the input *a,(a, a)*.  *S -> (L) | a*  *L -> L, S | S* | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain S-attributed and L-attributed definitions with suitable examples. | CO4 | A | 6 |
|  | b. | Describe the activation record structure in function calls and its components. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. |  | Convert *p = p \* (p + q) - (p + q) / (-s)* into three address codes, quadruples, triples, indirect triples, syntax tree, and DAG. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Construct a CLR parsing table for the following grammar and show the derivation of the string “*aadad*”.  *S → CC*  *C → aC*  *C → d* | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the control flow of looping and conditional statements with the necessary semantic rules. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Convert the given code into a three-address code. Represent it as a flow graph by identifying the suitable leaders and the basic blocks.  for i from 1 to 10 do  for j from 1 to 10 do  a[i,j]=0.0  for i from 1 to 10 do  a[i,i]=1.0 | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Articulate the fundamental data structures and algorithms for assembler, macro processor, and loader. |
| **CO2** | Describe the different phases of a compiler and design lexical analyzers using tools like regular expressions and finite automata to recognize tokens in a programming language. |
| **CO3** | Illustrate the parsing techniques such as LL(1), SLR(1), CLR(1), LALR(1). |
| **CO4** | Infer the concept of Syntax Directed Definition and implement runtime environment components such as activation records, symbol tables, and memory management routines. |
| **CO5** | Develop intermediate code from a given source program using the principles of intermediate representations. |
| **CO6** | Apply machine-dependent and machine-independent optimizations to generate optimized machine code. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2050** | **Duration** | **3hrs** |
| **Course Title** | **EMBEDDED SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the key differences between embedded systems and general-purpose computer systems. | | CO1 | U | 1 |
| 2. | State dependency graph. | | CO1 | R | 1 |
| 3. | Identify different types of processor architectures used in embedded systems. | | CO2 | R | 1 |
| 4. | Mention the role of scratchpad memory in embedded hardware. | | CO2 | R | 1 |
| 5. | State why device drivers are important in embedded systems. | | CO3 | U | 1 |
| 6. | How do you calculate mean time between failures (MTBF)? | | CO3 | R | 1 |
| 7. | List different types of scheduling used in real-time systems. | | CO4 | U | 1 |
| 8. | Define execution time prediction in embedded systems. | | CO4 | R | 1 |
| 9. | Define task-level Concurrency Management. | | CO5 | U | 1 |
| 10. | Define validation in the context of embedded systems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze and discuss the applications of embedded systems in modern technology. | | CO1 | An | 3 |
| 12. | Write a short note on memories in Embedded system. | | CO2 | U | 3 |
| 13. | Compare and contrast Verilog and System Verilog in terms of design flexibility. | | CO3 | An | 3 |
| 14. | Explain the difference between aperiodic and periodic scheduling. | | CO4 | U | 3 |
| 15. | Analyze the reasons for designing special optimizations and compilers for embedded systems. | | CO5 | An | 3 |
| 16. | Discuss the need for rapid prototyping and emulation in detail. | | 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 various communication paradigms used for computations in embedded systems. | CO1 | U | 6 |
|  | b. | Show how state charts can be used to model a real-world embedded system. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Analyze how the Von-Neumann model influences processor design. | CO2 | An | 6 |
|  | b. | Demonstrate the models of computation available in UML with its components. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe the importance of dependability requirements in Embedded System Hardware. | CO3 | U | 6 |
|  | b. | Develop a hardware/software co-design strategy for a telemedicine application. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Investigate how middleware affects the performance of embedded applications. | CO4 | An | 6 |
|  | b. | Explain the scheduling of independent jobs in uniprocessors using Earliest Deadline First (EDF) Algorithm. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Demonstrate how high-level optimizations can enhance an embedded application. | CO5 | A | 6 |
|  | b. | Describe the role of compilers in optimizing embedded software. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the need for reconfigurable logic in embedded systems. | CO2 | U | 6 |
|  | b. | Analyze the importance Digital-to-Analog Converters in Embedded Hardware. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the Scheduling of Independent Jobs on Identical Multiprocessors using Partitioned Scheduling. | CO4 | U | 6 |
|  | b. | Evaluate the performance of resource access protocols to improve the efficiency of embedded OS. | CO4 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate the significance of self-test programs in enhancing automotive system reliability. | CO6 | E | 6 |
|  | b. | Compare and analyse fault simulation and fault injection techniques in embedded systems. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recall specific requirements and comprehend the architecture of embedded systems. |
| **CO2** | Develop embedded systems using formal models and methods as well as computer-based synthesis methods |
| **CO3** | Apply the formal models and methods in embedded system design in practical applications using the programming language C and to design and develop programs for specific embedded applications |
| **CO4** | Interpret the embedded architectures and components, hardware-software interfaces, memory architecture, and communication between components |
| **CO5** | Illustrate embedded operating systems, real-time scheduling theory, and hardware architecture synthesis. |
| **CO6** | Identify validation and testing methodologies for embedded systems. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23CS2057** | **Duration** | **3hrs** |
| **Course Title** | **FUNDAMENTALS OF PROGRAMMING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the primary function of the Arithmetic Logic Unit (ALU) in a computer. | | CO1 | U | 1 |
| 2. | Identify any two types of computer classification. | | CO1 | R | 1 |
| 3. | List any two applications of Python programming. | | CO2 | R | 1 |
| 4. | State the role of comments in Python. | | CO2 | R | 1 |
| 5. | Predict the use of the break statement in loops. | | CO3 | U | 1 |
| 6. | Identify the difference between continue and pass statements. | | CO3 | R | 1 |
| 7. | Interpret the role of indexing in strings. | | CO4 | U | 1 |
| 8. | Recall any two built-in methods for tuple. | | CO4 | R | 1 |
| 9. | Summarize the importance of dictionary keys. | | CO5 | U | 1 |
| 10. | Identify the use of packages in Python. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the functions of different units of a computer. | | CO1 | U | 3 |
| 12. | Differentiate a dictionary and a list. | | CO2 | U | 3 |
| 13. | Identify the purpose of the return statement in a function. | | CO3 | U | 3 |
| 14. | Explain string-slicing operations with examples. | | CO4 | U | 3 |
| 15. | Compare different data types in Python with examples. | | CO5 | An | 3 |
| 16. | Explain the use of recursion in Python. | | 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 evolution and characteristics of different generations of computers. Describe the five generations of computers, their key technologies, and examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Write a Python program that takes a user’s name and age as input, processes them, and displays the output as eligible or ineligible for voting. | CO2 | A | 6 |
|  | b. | Create code examples to demonstrate the various data types in python. Write separate code snippets for each of the following datatypes: integer, float, string, list, tuple, dictionary, and set. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain different looping statements in Python. Write a Python program using for loop to generate and print the first 10 terms of the Fibonacci sequence. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain string-slicing operations with examples. Write a Python program that accepts a string from the user and extracts the first five characters, the last five characters, every alternate character, and the string in reverse order. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate how lists can be used to store and process student marks. Write a Python program that takes the marks of five students, stores them in a list, sorts them in ascending order, and calculates the highest, lowest, and average marks. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Write a Python program that takes two lists: one with names and the other with phone numbers. Convert them into a dictionary where names are keys and phone numbers are values. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Write a Python program that counts the frequency of each given list of words and stores it in a dictionary. | CO5 | A | 6 |
|  | b. | Develop an application in python to demonstrate the conversion between a list of tuples and a dictionary. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop a Python program that uses functions and modules to generate an electricity bill. Accept the customer’s name, and number of units consumed, and calculate the bill based on the following:   * Up to 100 units: ₹2 per unit * 101 to 300 units: ₹3 per unit * Above 300 units: ₹5 per unit * Display the final bill amount | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Gain knowledge on fundamental concepts of computer programming. |
| **CO2** | Relate the concepts of data types and expressions in python. |
| **CO3** | Demonstrate the usage of conditional and control statements in python. |
| **CO4** | Illustrate strings, tuples and set with applications. |
| **CO5** | Solve problems using list and dictionaries. |
| **CO6** | Apply functions and modules for real world applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC1007** | **Duration** | **3hrs** |
| **Course Title** | **INTRODUCTION TO ARTIFICIAL INTELLIGENCE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify one key application of expert systems. | | CO1 | R | 1 |
| 2. | State the role of an intelligent agent in AI. | | CO1 | R | 1 |
| 3. | Define state space in problem-solving by search. | | CO2 | R | 1 |
| 4. | Identify the main data structure used in Breadth-First Search. | | CO2 | R | 1 |
| 5. | List any two differences between supervised and unsupervised learning. | | CO3 | R | 1 |
| 6. | State one application of neural network learning. | | CO3 | R | 1 |
| 7. | Identify the role of search algorithms in AI planning. | | CO4 | U | 1 |
| 8. | Name a common application of AI planning in robotics. | | CO4 | U | 1 |
| 9. | Identify a common language model used in NLP. | | CO5 | U | 1 |
| 10. | Identify an application of autonomous delivery robots. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the characteristics of an intelligent agent. | | CO1 | U | 3 |
| 12. | List three applications of search algorithms in artificial intelligence. | | CO2 | U | 3 |
| 13. | Explain reinforcement learning with an example. | | CO3 | U | 3 |
| 14. | Describe a real-world application of AI planning. | | CO4 | U | 3 |
| 15. | Explain information retrieval and information extraction with examples. | | CO5 | U | 3 |
| 16. | Identify the advantages of virtual assistants in daily life. | | 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. | Differentiate between Simple Reflex Agents and Model Based Agents with neat diagrams. | CO1 | An | 6 |
|  | b. | Illustrate the manner in which agents are situated in environments and the way they perceive and act within it. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the problem characteristics with examples. | CO2 | U | 6 |
|  | b. | Differentiate between informed and uninformed search strategies with examples. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain about genetic learning and its phases with neat diagram. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the role of hierarchical planning in complex problem-solving. | CO4 | U | 6 |
|  | b. | Describe goal stack planning and compare it with other planning techniques. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the process of syntactic and semantic analysis in detail. | CO5 | A | 6 |
|  | b. | Describe the components of a language model and their significance in NLP. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Explain the applications of NLP in spell checking and text classification. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Apply reinforcement learning techniques to optimize the decision-making process in driverless cars. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the way a diagnostic agent can assist doctors in disease detection. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Define AI as intelligent agent that receive precepts from the environment. |
| **CO2** | Illustrate different search algorithms to reach the goal in state-space problems. |
| **CO3** | Apply learning strategies to intelligent agents to acquire knowledge from the environment. |
| **CO4** | Generalize the planning methods with certainty factors for problem solving in AI. |
| **CO5** | Choose the communicating and perceiving agents in the AI field. |
| **CO6** | Facilitate the real-time applications of intelligent agents in various fields. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC1008** | **Duration** | **3hrs** |
| **Course Title** | **PYTHON PROGRAMMING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two rules for naming variables in Python | | CO1 | R | 1 |
| 2. | Write a Python program that prints the name and age 10 times. | | CO1 | A | 1 |
| 3. | Illustrate the removal of duplicates from the given list by converting it into a set:  List: numbers = [10, 20, 20, 30, 40, 40, 50, 60]. | | CO2 | U | 1 |
| 4. | Illustrate the creation of tuple to store the given fruits: Apple, Banana, Cherry | | CO2 | U | 1 |
| 5. | Name the method to save an object in a file using pickle. | | CO3 | R | 1 |
| 6. | Predict the output of the following program:  class Car:  def \_\_init\_\_(self, color):  self.color = color  my\_car = Car("red")  print("The color of my car is:", my\_car.color) | | CO3 | U | 1 |
| 7. | Write a Python code to open an image using PIL. | | CO4 | A | 1 |
| 8. | State the roles of penup() and pendown() methods in Turtle graphics. | | CO4 | R | 1 |
| 9. | Predict the output of the following program:  import numpy as np  arr2 = np.ones((2, 2), dtype=np.int32)  print(arr2) | | CO5 | U | 1 |
| 10. | State the purpose of the legend() function in Matplotlib. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the significance of break, continue, and pass statements in loop execution with suitable examples. | | CO1 | U | 3 |
| 12. | Compare the mutability of tuples and lists in Python. | | CO2 | U | 3 |
| 13. | Write a Python program that handles a ZeroDivisionError when dividing two numbers. | | CO3 | A | 3 |
| 14. | Predict the shape of output from the following turtle program.  import turtle  my\_pen = turtle.Turtle()  for i in range(6):  my\_pen.forward(100)  my\_pen.left(60)  turtle.done() | | CO4 | U | 3 |
| 15. | Predict the output of the following program:  import numpy as np  arr2D = np.array([[1, 2, 3, 4],  [5, 6, 7, 8],  [9, 10, 11, 12]])  print(arr2D[1:, 2:])  print(arr2D[:2, :3])  print(arr2D[:, 1]) | | CO5 | U | 3 |
| 16. | Write a Python code to generate Scatter plot for the dataset given below.   |  |  |  | | --- | --- | --- | | **Category** | **Sales** | **Profit** | | A | 100 | 20 | | B | 150 | 35 | | C | 80 | 25 | | | 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. | A company is developing an automated customer feedback system. The system needs to process numeric ratings (1-5) and textual comments ("Good," "Bad," "Average"). Write a Python program to validate and categorize customer feedback using selection statements. | CO1 | A | 6 |
|  | b. | Illustrate the use of arithmetic operators and comparison operators in Python with a suitable example. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain any five string methods in Python with examples. | CO2 | A | 6 |
|  | b. | Construct a Python script to perform the following operations on the 'colors' tuple:  colors = ("Red", "Blue", "Green", "Yellow", "Purple").   1. Iterate through the tuple and print each color. 2. Access and display the last item using negative indesxing. 3. Add the item "Orange" to the tuple. 4. Remove the item "Green" from the tuple. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain multilevel inheritance with a suitable example program. | CO3 | A | 6 |
|  | b. | Write a Python program to overload the **+** operator to add two objects of a class representing a Point with X and y coordinates | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the structure of the Indian national flag as shown below and write a Python Turtle code that accurately represents the flag, including three horizontal bands (saffron, white, and green) and the Ashoka Chakra with 24 spokes in the center. Justify your choice of colors, proportions, and the method used to draw the Chakra. | CO4 | An | 6 |
|  | b. | Explain the following operation using Python code with PIL package.   1. Resize the image(500,500).. 2. Crop an image to (65,200,120,220). 3. Flip Image to top to bottom. | CO4 | A | 6 |
| 21. |  | Write a Python program that:   1. Creates a Pandas DataFrame from a dictionary 2. Adds an index column dynamically 3. Filters rows based on a condition 4. Sorts the data in ascending order | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Write a Python program to generate student reports with the following specifications: Create a class called *Student* with attributes *Regno*, *Name*, and *CGPA*,include the necessary constructor and mutator methods. Create two *Student* objects and display their reports. | CO3 | An | 8 |
|  | b. | Write a Python program to copy the content of one file into another file. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Write a GUI based Python program to design a simple calculator as shown below. | CO4 | A | 8 |
|  | b. | Write a Python program to calculate the sum of 15 numbers entered by the user. | CO1 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyse the scenario given below and write a Python program using Pandas and Matplotlib to visualize the trends:  A retail company wants to analyze monthly sales and profit trends for three different product categories. The dataset includes the following columns: 'Month', 'Category A Sales', 'Category B Sales', 'Category C Sales', and 'Profit'.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Month** | |  | | --- | |  |  |  | | --- | | **Sales** | | | | **Profit** | | **Category A** | **Category B** | **Category C** | | January | 120 | 100 | 90 | 50 | | February | 135 | 115 | 105 | 60 | | March | 150 | 130 | 95 | 70 |   Using the given dataset, write a Python program to:  **a)** Plot a **line chart** showing sales trends for each product category across the months. **b)** Plot a **bar chart** comparing the **monthly total sales** (sum of all categories) and **profit.** | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Illustrate the basic programming constructs of Python suitably. |
| **CO2** | Analyze the concepts of string processing, Encryption, file I/O, lists and dictionary. |
| **CO3** | Apply modules for reusability and the object-oriented principles for modeling and developing  software systems. |
| **CO4** | Develop applications with graphical user interface. |
| **CO5** | Demonstrate data handling using Numpy arrays and Pandas. |
| **CO6** | Demonstrate visualization techniques using Pandas and matplot libraries. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC1011** | **Duration** | **3hrs** |
| **Course Title** | **MICROPROCESSOR AND MICROCONTROLLER** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the addressing mode used in the instruction: MOV AX, [1234]. | | CO1 | U | 1 |
| 2. | Compute the physical address when DS=3000H and SI=1500H. | | CO1 | A | 1 |
| 3. | State the clock frequency range for standard 8051 operation. | | CO2 | R | 1 |
| 4. | Differentiate between the MOV and MOVX instructions in 8051. | | CO2 | U | 1 |
| 5. | Write an instruction to load the value 0xAA into the Accumulator. | | CO3 | A | 1 |
| 6. | State the alternate function of Port 1 in 8051. | | CO3 | R | 1 |
| 7. | Write the function of the RS (Register Select) pin in an LCD. | | CO4 | A | 1 |
| 8. | Name the register used as the stack pointer (SP) in ARM. | | CO4 | R | 1 |
| 9. | Identify an application of LCDs in real time. | | CO5 | U | 1 |
| 10. | List one key difference between Von Neumann and Harvard architecture. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Sketch the control word register of 8255 IC. | | CO1 | An | 3 |
| 12. | Show the status of CY, AC, P flags after the addition of 93H and 84H. | | CO2 | U | 3 |
| 13. | Write an assembly language program to count the number of 55 in an array [55 03 55 40] and store the count value in memory location 5000H. | | CO3 | An | 3 |
| 14. | List any four command codes of LCD. | | CO4 | U | 3 |
| 15. | Summarize any three salient features of ARM processor. | | CO5 | An | 3 |
| 16. | Define Key debounce. | | 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 addressing modes of 8051 microcontroller with examples. | CO2 | A | 10 |
|  | b. | Write an assembly language program to copy the value 55H into RAM locations 40H and 41H using direct addressing mode. | CO2 | A | 2 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the architecture of the 8086 microprocessor and summarize the functions of the Bus Interface Unit (BIU) and Execution Unit (EU). | CO1 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain with neat diagrams the various timer modes of 8051 with special function registers. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Sketch the minimum mode configuration of the 8086 microprocessor and explain briefly the function of the pins. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain briefly with a neat sketch the block diagram of 8255 PPI IC. | CO1 | A | 10 |
|  | b. | Predict the 8255 control word for Port A (input), Port B (output), and Port C upper (output) in Mode 0 in I/O mode. | CO4 | A | 2 |
|  |  |  |  |  |  |
| 22. | a. | Interpret briefly the various operating modes of ARM processor. | CO5 | U | 6 |
|  | b. | Explain the important features of RISC instruction set. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Design an 8051 based microcontroller system to control stepper motor in the forward and reverse direction. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain with a neat block diagram the data-flow model of ARM processor. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the various microprocessors including Intel Pentium Processors. |
| **CO2** | Examine the architecture and the programming of Intel 8086 Microprocessor. |
| **CO3** | Develop assembly language program using 8051 microcontroller. |
| **CO4** | Demonstrate interfacing of various peripherals such as general purpose input/ output, timers, serial communication, LCD, keypad and ADC with 8051 microcontroller. |
| **CO5** | Develop simple applications using ARM processor. |
| **CO6** | Demonstrate the concepts of advanced microprocessors and microcontrollers. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC1013** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER ORGANIZATION AND ARCHITECTURE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the mechanism that allows an I/O module or other hardware to signal the processor to suspend its current execution and handle an event. | | CO1 | U | 1 |
| 2. | Indicate the phase of instruction cycle that retrieves the next instruction from memory. | | CO1 | U | 1 |
| 3. | List the replacement algorithm used in fully associative cache mapping. | | CO2 | R | 1 |
| 4. | Indicate an example of internal memory. | | CO2 | U | 1 |
| 5. | Indicate the role of control logic in I/O module. | | CO3 | U | 1 |
| 6. | Give an example of machine-readable external device. | | CO3 | U | 1 |
| 7. | Represent the number -5 in 4-bit sign magnitude format. | | CO4 | U | 1 |
| 8. | Indicate the element of machine instruction that specifies how operands are interpreted or retrieved. | | CO4 | U | 1 |
| 9. | Identify a widely used algorithm for register allocation by compiler optimization techniques. | | CO5 | U | 1 |
| 10. | List two microoperations. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | A workstation has a 64-bit address bus, and each address references an 8-bit byte.   1. Predict the number of possible unique addresses. 2. Write the total memory capacity in bytes? 3. Compute the result in exabytes (EB) | | CO1 | A | 3 |
| 12. | Compare cache hit with cache miss. | | CO2 | An | 3 |
| 13. | Explain the functions of an I/O module. | | CO3 | An | 3 |
| 14. | Infer how nesting procedures enhances program execution. | | CO4 | An | 3 |
| 15. | Infer the need for pipelining. | | CO5 | An | 3 |
| 16. | Illustrate the role of MESI protocol in achieving cache coherence. | | 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. | Analyze the sequence and function of various instruction states in the instruction cycle. | CO1 | An | 8 |
|  | b. | Explain the sequence of instruction states involved in executing the immediate load instruction LOAD R1, #10. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Consider a three-level cache system with the following specifications:  L1: Access time: 1 ns, Hit rate = 95%  L2: Access time: 2 ns, Hit rate = 85%  L3: Access time: 10 ns, Hit rate = 75%  Main memory access time = 80 ns.  Calculate the Average Memory Access Time. | CO2 | A | 8 |
|  | b. | Explain the sequence of operations involved in cache read operation. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 19. |  | Explain the functions of direct mapping method in cache memory with a neat sketch. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Illustrate the mechanism of interrupt-driven data exchange between the CPU and I/O device. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Analyze the role of Direct Memory Access in improving the system performance during I/O operation with block diagram. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the various addressing modes with examples and analyze their impact in instruction execution time. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Analyze the functional elements and organizational structure of a RISC architecture in efficient instruction execution. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the internal structure and functioning of microprogrammed control unit on sequencing logic to execute instructions efficiently. | CO6 | E | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Configure basic hardware components and their interconnection in a computing system using fundamental concepts of computer architecture. |
| **CO2** | Evaluate the performance of memory technologies like Cache, DRAM and Flash memory using principles of locality. |
| **CO3** | Examine efficient data transfer strategies using I/O techniques like programmed I/O interrupt-drive I/O and DMA. |
| **CO4** | Choose the number representation, addressing modes and instruction formats for precise integer and floating-point arithmetic operations. |
| **CO5** | Inspect the register and processor organization of RISC architecture. |
| **CO6** | Test the performance of symmetric multiprocessor organization and cache coherence protocols. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2005** | **Duration** | **3hrs** |
| **Course Title** | **CYBER PHYSICAL SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Internet of Things. | | CO1 | R | 1 |
| 2. | Describe the key advancement in industrial revolution 3.0. | | CO1 | R | 1 |
| 3. | Name two real life applications of cyber physical systems. | | CO2 | R | 1 |
| 4. | List two CPS system requirements. | | CO2 | R | 1 |
| 5. | Define continuous dynamics in system behaviour. | | CO3 | R | 1 |
| 6. | Describe the modelling technique that represent behaviour of digital components. | | CO3 | U | 1 |
| 7. | State the three Synchronous Reactive models. | | CO4 | R | 1 |
| 8. | Describe the model which is a computational model where the output of a system or a component is fed back into the system as an input, creating a closed-loop system. | | CO4 | R | 1 |
| 9. | Name the final layer in IOT architecture. | | CO5 | R | 1 |
| 10. | Describe the primary goal of an active attack. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List three real life examples of CPS. | | CO1 | R | 3 |
| 12. | Describe microcontroller. | | CO2 | U | 3 |
| 13. | Name the three key modeling issues. | | CO3 | R | 3 |
| 14. | Describe ill-formed model with example. | | CO4 | U | 3 |
| 15. | Define scheduling in embedded system design. | | CO5 | R | 3 |
| 16. | Explain three-way handshake. | | 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 two real world applications of CPS:   1. Smart grid and 2. Pacemaker | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Differentiate the hardware platforms microcontrollers and microprocessor for cyber-physical systems. | CO2 | U | 8 |
|  | b. | Describe the wireless technologies used in CPS. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. |  | Construct state transition diagram with outputs for the following.   |  |  |  | | --- | --- | --- | | **State** | **Input 0** | **Input 1** | | S₀ | S₁ | S₀ | | S₁ | S₃ | S₀ | | S₂ | S₁ | S₂ | | S₃ | S₂ | S₁ | | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain the following three ssynchronous reactive models with example:   1. Feedback model, 2. Well-formed model and 3. Ill-formed model. | CO4 | R | 12  (3x4) |
|  |  |  |  |  |  |
| 21. |  | Explain the classification, functionalities, key components, and technologies of each layer in the Cyber-Physical System (CPS) architecture, and analyze how these layers contribute to the seamless interaction between physical and cyber elements. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Compare the Industrial Internet of Things (IIoT) and Cyber-Physical Systems (CPS), highlighting their key differences, and describe various applications of IIoT by providing suitable examples. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Analyze the effect of priority inversion on task scheduling in real-time systems and the potential consequences if it is not managed effectively. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the impact of limited energy resources and the use of low-power transceivers in CPS devices on their vulnerability to jamming and denial of service attacks, and identify energy-efficient countermeasures that can be implemented to mitigate these threats. | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe how Cyber Physical Systems operate in reality and their significance in Industry 4.0 and the Industrial Internet of Things (IIoT). |
| **CO2** | Identify how to design Cyber Physical Systems, learn their requirements, explore real-world uses, and understand the hardware and wireless technologies involved. |
| **CO3** | Apply the concepts of continuous dynamics, discrete dynamics, and hybrid systems to understand the models and behavioral dynamics of Cyber Physical Systems. |
| **CO4** | Analyze various models of computation such as synchronous reactive models, dataflow models, and timed models to understand their role in Cyber Physical Systems. |
| **CO5** | Design embedded Systems, Internet of Things Architecture, and Cyber Physical System Architecture, focusing on their respective components and structures. |
| **CO6** | Evaluate the security and privacy of Cyber Physical Systems, focusing on network safety, internet communication, and privacy in cloud-connected setups. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2008** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER NETWORKS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | The number of cable links required to establish communication between 12 devices connected in a mesh topology is \_\_\_\_\_\_\_\_ | | CO1 | U | 1 |
| 2. | The process of reducing the number of crosspoints during heavy traffic is called \_\_ | | CO1 | R | 1 |
| 3. | Which error detection method is used by higher-layer protocols to ensure the reliable transmission? | | CO2 | R | 1 |
| 4. | Two persons have to make some official communication between them through e-mail using their laptops that uses different source encoding methods. Which OSI layer is responsible for creating compatibility of information exchange between these two persons? | | CO2 | R | 1 |
| 5. | Technique of transmitting a message to all the receivers concurrently through a communication channel is called \_\_\_\_\_\_\_\_\_\_ | | CO3 | U | 1 |
| 6. | Identify the protocol that establishes the relation between the Domain Name and IP. | | CO3 | R | 1 |
| 7. | In an organization, servers are interconnected by point to point connection. If there are 105 such connections, find the total number of servers. | | CO4 | U | 1 |
| 8. | A telephone line has SNR of 1023 dB and bandwidth of 3khz. Find out the capacity of the channel. | | CO4 | R | 1 |
| 9. | A method defines a characteristic of the channel, not the method of transmission is called \_\_\_\_\_\_\_\_\_\_\_\_ | | CO5 | U | 1 |
| 10. | A sender sends a message with extra bits through a commutation link to receiver and the extra bits are added to ensure the correct message received by a receiver. This mechanism is performed in the \_\_\_\_\_\_\_\_\_\_\_\_ layer. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the following:- a) LAN b) ARPANET | | CO1 | An | 3 |
| 12. | List the different types of transmission Medias in computer networks. | | CO2 | U | 3 |
| 13. | Differentiate pure ALOHA and slotted ALOHA. Consider the delay of both at low load. Which one is less? Explain your answer. | | CO3 | An | 3 |
| 14. | List the various types of error correcting techniques. | | CO4 | U | 3 |
| 15. | Define OSI Model. Describe the functions, protocols and services of each layer. | | CO5 | An | 3 |
| 16. | Identify which term refers to the way in which a network is laid out physically. Illustrate each type with their advantages and disadvantages | | 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. |  | Mr. Sam and Mr. Ram are communicating over a network. Each message exchanged between them is processed and wrapped before being transmitted. Suggest two models that are used to wrap the data? Show the similarities and dissimilarities between the two models. | CO1 | R | 12 |
|  |  |  |  |  |  |
| 18. | a. | Design a subnetting scheme for a given network with IPv4 addressing, ensuring optimal address allocation. | CO2 | A | 6 |
|  | b. | Demonstrate how Link State Routing Algorithm updates routing tables when a new link is added. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Design a subnetting scheme for a given network with IPv6 addressing, ensuring optimal address allocation. | CO3 | C | 7 |
|  | b. | Analyze how error correction techniques improve the reliability of data transmission in wireless networks. | CO3 | An | 5 |
|  |  |  |  |  |  |
| 20. | a. | Propose a new transport layer protocol that balances the speed of UDP and the reliability of TCP for multimedia applications. | CO4 | R | 7 |
|  | b. | Assess the effectiveness of different mobility management techniques in cellular networks. | CO4 | C | 5 |
|  |  |  |  |  |  |
| 21. |  | An Internet Service Provider (ISP) has the following chunk of IP addresses available with it: 245.248.128.0/20. The ISP wants to give half of this chunk of addresses to Organization A, and a quarter to Organization B, while retaining the remaining with itself. Mention the valid allocation of addresses to A and B? | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Mr. A wants to communicate with Mr. B over a public communication network. When he places a call, the switching equipment within the system look for a dedicated path from A’s network device to the B’s network device. Brief about the switching technique used in this scenario and give the advantages and disadvantages of the same. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Given that the data word 1010011110 is sent from a system with the generator 10111. Identify the error detection method that is applicable and show the generation of the codeword at the sender side. Analyse the codeword received. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | For the given sequence, using sliding window flow control, draw the sliding windows of size 7 between the sender A and receiver B,  a. Frames 0, 1 and 2 are sent; frames 0 through 2 are acknowledged.  b. Frame 3 is sent; frame 3 is acknowledged.  c. Frames 4 and 5 are sent; frames 4 and 5 are acknowledged.  d. Frames 6, 7, 0 and 1 are sent; frames 6 through 1 are acknowledged.  e. Frames 2, 3, 4 and 5 are sent; frames 2 through 5 are acknowledged. | CO6 | C | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the protocol layers, Internet protocol and their service models. |
| **CO2** | Identify and understand the fundamental principles of network applications, protocols, transport layer services, congestion control mechanisms. |
| **CO3** | Apply knowledge of forwarding, routing algorithms, IP addressing (IPv4 and IPv6), and network management protocols to analyze and optimize network performance and design. |
| **CO4** | Analyze the fundamentals of the link layer. |
| **CO5** | Design comprehensive security strategies for computer networks. |
| **CO6** | Evaluate the principles and technologies of wireless and mobile networks |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2010** | **Duration** | **3hrs** |
| **Course Title** | **DATABASE MANAGEMENT SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the database language category to which the following command belongs:  **GRANT privileges ON object TO user;** | | CO1 | U | 1 |
| 2. | List any two roles of database administrator. | | CO1 | R | 1 |
| 3. | Identify the output of the following query:  **SELECT MIN(salary) FROM Employees WHERE department = 'IT';**   |  |  |  |  | | --- | --- | --- | --- | | **Emp\_id** | **Name** | **Department** | **Salary** | | 1 | John | HR | 50000 | | 2 | Alice | IT | 60000 | | 3 | Bob | Finance | 55000 | | 4 | Charlie | IT | 62000 | | | CO2 | A | 1 |
| 4. | Identify the missing keyword in the following query to remove duplicate values:  **SELECT \_\_\_\_\_ department FROM Employees;** | | CO2 | A | 1 |
| 5. | Indicate the minimal required normal form for a good database design. | | CO3 | U | 1 |
| 6. | State the purpose of normalization in databases. | | CO3 | R | 1 |
| 7. | List one advantage of using a B+ Tree over a B-Tree. | | CO4 | U | 1 |
| 8. | Name any two types of ordered indices. | | CO4 | R | 1 |
| 9. | Define SQL injection. | | CO5 | R | 1 |
| 10. | Name a graph-based NoSQL database. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between a schema and an instance in a relational database. | | CO1 | U | 3 |
| 12. | Convert the following relational algebra expression into an SQL query:  ***πname,salary(σ(department=′IT′)(Employees))*** | | CO2 | U | 3 |
| 13. | Identify the key attribute given the following relation schema R = {E, F, G, H, I, J, K, L, M, N} and the set of functional dependencies {{E, F} 🡪 {G}, {F} 🡪 {I, J}, {E, H} 🡪{K, L}, K 🡪 {M}, L 🡪 {N} on R. | | CO3 | U | 3 |
| 14. | Differentiate between static hashing and dynamic hashing. | | CO4 | U | 3 |
| 15. | Write short notes on the four transaction properties. | | CO5 | U | 3 |
| 16. | List any four key characteristics of Column-Oriented NoSQL databases. | | 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 architecture of a database system with a neat diagram. | CO1 | U | 8 |
|  | b. | Describe the different types of database users and their roles. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Given the "Orders" and "Customers" tables:  Orders (OrderID, CustomerID, OrderDate, Amount)  Customers (CustomerID, CustomerName, City)  Write SQL queries to:   1. Retrieve all orders placed by customers from "New York." 2. Find the total sales amount for each customer. 3. Display customer names who have never placed an order. | CO2 | A | 6 |
|  | b. | Explain the importance of constraints in the relational model with examples. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Define normalization and explain the different normal forms (1NF, 2NF, 3NF, BCNF) with examples. | CO3 | U | 10 |
|  | b. | Justify why BCNF is preferred over 3NF in database normalization. | CO3 | E | 2 |
|  |  |  |  |  |  |
| 20. | a. | Construct an ER diagram representing the hospital database, including entities, attributes, relationships, and cardinality.  Consider the following:  A hospital maintains records of its patients, doctors, staff, and treatments. The system needs to store the following details:  Each patient has a unique PatientID, Name, Date of Birth, Contact Number, and Address. A patient can visit the hospital multiple times and may be assigned to a specific doctor. Each doctor has a unique DoctorID, Name, Specialization, and Contact Number. A doctor can treat multiple patients, but a patient is assigned to only one primary doctor. A patient can book multiple appointments, and each appointment has a unique AppointmentID, Date, Time, and Status (Scheduled, Completed, or Canceled). Each patient may undergo multiple treatments, and each treatment has a TreatmentID, TreatmentName, Date, and Cost. A treatment is prescribed by a doctor. The hospital has various staff members, each identified by a unique StaffID, Name, Role (e.g., Nurse, Receptionist, Technician), and Contact Number. | CO3 | A | 7 |
|  | b. | Transfer the ER model into a relational schema with appropriate foreign keys. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 21. | a. | Construct the B+ Tree step by stepas each key is inserted considering the following set of keys to be inserted into an empty B+ Tree of order 3 (each node can have at most 2 keys and 3 children):  **Keys to insert (in order): 10, 20, 5, 6, 12, 30, 7, 17** | CO4 | A | 8 |
|  | b. | Sketch the updated B+ Tree if the key 6 is deleted. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Analyze and compare various database security mechanisms, including DAC, MAC, and RBAC models with relevant examples. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Compare and contrast SQL and NoSQL databases. Explain different types of NoSQL databases with suitable examples | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the implementation of a Mandatory Access Control (MAC) mechanism and demonstrate how it helps prevent security breaches with suitable illustrations. | CO5 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Recognize the role of database administrator and database management systems in software  applications and other advanced concepts. |
| **CO2** | Apply query language to retrieve data efficiently from the database. |
| **CO3** | Identify the database for the given requirement specification using the ER method and  normalization. |
| **CO4** | Illustrate the database objects such as file structures and index schemes. |
| **CO5** | Demonstrate the techniques for transaction processing and implementing security in the  database. |
| **CO6** | Design and implement scalable and efficient data storage solutions using various types of  NoSQL databases, including column-oriented, key/value, and graph databases. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2012** | **Duration** | **3hrs** |
| **Course Title** | **DESIGN AND ANALYSIS OF ALGORITHM** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Give the diagrammatic representation of the Notion of an algorithm. | | CO1 | U | 1 |
| 2. | List the basic asymptotic efficiency classes. | | CO1 | R | 1 |
| 3. | State brute force approach. | | CO2 | R | 1 |
| 4. | Define exhaustive search. | | CO2 | R | 1 |
| 5. | Compare feasible solution and optimal solution. | | CO3 | U | 1 |
| 6. | State the principle of optimality. | | CO3 | R | 1 |
| 7. | Define spanning tree problem. | | CO4 | R | 1 |
| 8. | Define backtracking. | | CO4 | R | 1 |
| 9. | State flow augmenting path. | | CO5 | R | 1 |
| 10. | Differentiate between polynomial time vs exponential time. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the order of growth for the following function:  using the omega (Ω) notation. | | CO1 | An | 3 |
| 12. | Explain the objective of the knapsack problem. | | CO2 | U | 3 |
| 13. | Write the Floyd’s algorithm. | | CO3 | A | 3 |
| 14. | Trace the topological ordering for the following graph. | | CO4 | U | 3 |
| 15. | Explain the requirements for the standard form of a linear programming problem. | | CO5 | U | 3 |
| 16. | Explain approximation algorithms for NP-hard problems. | | 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 mathematical analysis of non-recursive algorithms with an example. | CO1 | A | 7 |
|  | b. | Compute the recurrence relations. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 18. | a. | Write an algorithm for binary search and analyze its time complexity. | CO2 | A | 6 |
|  | b. | Apply the brute force algorithm to determine the combination of the items that gives the maximum profit without exceeding the knapsack capacity. The knapsack capacity W= 8 | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Compute the binomial coefficient for C(3,2) and C(5,2) by applying the formula. | CO3 | A | 7 |
|  | b. | Construct the complete dynamic programming table to find the length of their longest common subsequence for the given strings.  X= “ ABCBDAB”  Y= “BDCABA” | CO3 | A | 5 |
|  |  |  |  |  |  |
| 20. |  | Write the algorithm to compute the lengths of shortest paths between all pairs of nodes for the given adjacency matrix. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Apply the shortest augmenting path algorithms to find a maximum flow and a minimum cut in the following network. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the algorithm by applying the following keys and probabilities to obtain the optimal binary tree. | CO3 | An | 8 |
|  | b. | Differentiate between dynamic programming and greedy technique. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 23. |  | Analyze the steps involved in solving the following instance of the Travelling Salesman Problem using the Branch and Bound algorithm. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the class P, NP, NP-hard and NP-complete problems with an example. | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | analyze given algorithm and express its complexity in asymptotic notation |
| **CO2** | design algorithms using brute force and greedy techniques. |
| **CO3** | develop dynamic programming solutions for optimization problems. |
| **CO4** | propose solutions using backtracking and branch-and-bound technique. |
| **CO5** | solve problems using fundamental graph algorithms |
| **CO6** | apply suitable algorithmic technique to solve a problem and identify the problems belonging to the class of P, NP-Complete or NP-Hard |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2013** | **Duration** | **3hrs** |
| **Course Title** | **COMMUNICATION FOR CYBER PHYSICAL SYSTEMS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Edge Devices in IoT. | | CO1 | U | 1 |
| 2. | Define M2M. | | CO1 | R | 1 |
| 3. | State the reason why connectivity important in IoT. | | CO2 | R | 1 |
| 4. | Give examples of input and output transducers. | | CO3 | R | 1 |
| 5. | State the role of sensors and Actuators in IoT. | | CO3 | U | 1 |
| 6. | Point out the challenges in adopting NFC technology widely across industries. | | CO4 | R | 1 |
| 7. | Name the Wi-Fi Standards used in IoT. | | CO4 | U | 1 |
| 8. | Identify the need for 6LoWPAN in IoT networks. | | CO5 | R | 1 |
| 9. | List the advantages of IPv6. | | CO5 | U | 1 |
| 10. | How does AMQP ensure reliable message delivery? | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Identify the enabling technologies for IoT. | | CO1 | An | 3 |
| 12. | Summarize the functions of physical devices and controllers. | | CO2 | U | 3 |
| 13. | Illustrate the interfacing of sensors, Transducer and actuator with embedded systems. | | CO3 | Ap | 3 |
| 14. | Compare passive and active RFID systems. Which one is suitable for asset tracking and why? | | CO4 | U | 3 |
| 15. | Distinguish between IPv4 and IPv6. | | CO5 | An | 3 |
| 16. | Interpret how REST APIs handle authentication, security and ensure scalability in large distributed systems. | | 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 communication models used in IoT. | CO1 | U | 6 |
|  | b. | Summarize the characteristics and applications of IoT. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Examine various protocols and Communication APIs for IoT. | CO2 | An | 6 |
|  | b. | Investigate the role of Data Accumulation, Data Abstraction and Collaboration in IoT. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the WSN and its technologies. | CO3 | An | 6 |
|  | b. | Classify the sensors, transducer and Actuator | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. |  | Explain and perform comparison of the following  i)Blue Tooth  ii)LoRA  iii)WiMAX  iv)LTE | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the transmission types in IPv6 Protocols. | CO5 | An | 6 |
|  | b. | Explain the working of IPv6 Tunneling. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a | Discuss the role of IPSec in IPv6 for securing network communications. | CO5 | An | 6 |
|  | b | Explain how Quality of Service (QoS) is implemented in IPv6. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Draw and explain the architecture of MQTT with neat sketch. | CO6 | A | 6 |
|  | b. | Illustrate and describe the architecture of XMPP with key components and their roles. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the architecture, applications of CoAP and compare MQTT, DDS& AMQP. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze the foundational concepts of loT including terms, characteristics, enabling technologies, sensors, edge devices, and communication models. |
| **CO2** | Demonstrate the components of IoT architecture: physical devices, connectivity, communication protocols, edge computing, data management, and application collaboration processes. |
| **CO3** | Apply transducers, sensors, and actuators knowledge by defining, classifying, and interfacing them with embedded systems and wireless sensor networks. |
| **CO4** | Analyse Layer 1/2 connectivity technologies including RFID, NFC, Bluetooth, ZigBee, LoRa, Wi-Fi, WiMAX, LTE, and their case studies |
| **CO5** | Design Layer 3 connectivity solutions by understanding IPv4 vs IPv6 addressing, IPv6 protocol, tunneling, IPsec, QoS, and 6LoWPAN |
| **CO6** | Apply communication protocols to solve real time usecases |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2015** | **Duration** | **3hrs** |
| **Course Title** | **MACHINE LEARNING TECHNIQUES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the probabilistic machine learning algorithm commonly used for classification problems. | | CO1 | U | 1 |
| 2. | Identify the type of machine learning approach used in the following problem statement:  "Predicting a patient's blood sugar level based on their age, weight, blood pressure, and medical history." | | CO1 | U | 1 |
| 3. | Identify the interquartile range for the given data set.  5,7,3,7,4,9,7,10,2,3,8 | | CO2 | U | 1 |
| 4. | Identify the purpose of data normalization in data preprocessing. | | CO2 | R | 1 |
| 5. | State the purpose of support vectors in SVM. | | CO3 | U | 1 |
| 6. | Differentiate between linear regression and logistic regression. | | CO3 | R | 1 |
| 7. | Identify the nearest neighbor by calculating the Euclidean distance between the points A(7, 3) and B(12, 8). | | CO4 | U | 1 |
| 8. | List all the linkage criteria in the hierarchical clustering. | | CO4 | R | 1 |
| 9. | Identify the purpose of the gini index in the CART algorithm. | | CO5 | U | 1 |
| 10. | Differentiate between bagging and boosting in ensemble approach. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Consider the following dataset containing information about different weather conditions and whether people go for a picnic. Construct the most specific hypothesis that fits all the positive examples using the Find-S algorithm.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Sky** | **Temp** | **Humidity** | **Wind** | **Picnic?** | | Sunny | Hot | High | Weak | Yes | | Rainy | Cool | Normal | Strong | No | | Sunny | Hot | Normal | Weak | Yes | | Cloudy | Hot | High | Strong | No | | Sunny | Hot | High | Strong | Yes | | | CO1 | A | 3 |
| 12. | Given the dataset: 10, 14, 12, 26, 10, 17, 2, 3, 20, 30, 22, 10, apply Min-Max Normalization to transform the value 105 to the range [0.0, 1.0], and use Decimal Scaling Normalization to transform the same value. | | CO2 | A | 3 |
| 13. | Consider a single-layer perceptron with 5 input neurons having weight link values of (0.2, 0.4, 0.1, 0.5, 0.3) and an input vector of (1, 3, 2, 1, 2). Using the following threshold activation function, calculate the output of the perceptron.  Output: 1 if Net Input > 0.7  0 Otherwise | | CO3 | A | 3 |
| 14. | Explain the difference between Self-Organizing Map (SOM) and basic competitive learning in terms of weight adjustment and neighborhood influence. | | CO4 | U | 3 |
| 15. | Illustrate ordered rule lists and unordered rule lists in rule-based learning with example | | CO5 | A | 3 |
| 16. | Explain the impact of low bias and high variance in a model. | | 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. | Apply the Candidate Elimination Algorithm to determine the most specific and most general hypotheses for a dataset that classifies different types of fruits based on attributes such as Shape, Color, Size, and Surface Texture. Identify the final version space after processing all instances.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Shape** | **Color** | **Size** | **Surface** | **Edible?** | | Round | Red | Large | Smooth | Yes (+) | | Round | Green | Medium | Smooth | Yes (+) | | Oval | Yellow | Small | Rough | No (-) | | Round | Yellow | Large | Smooth | Yes (+) | | CO1 | A | 8 |
|  | b. | Explain the types of machine learning with suitable examples. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Real-world datasets frequently contain missing values, noise, and inconsistencies, which can impact the accuracy of data analysis and model performance. Explain the key data preprocessing techniques, including data cleaning (handling missing values, noisy data, and inconsistencies) and data integration (combining data from multiple sources, resolving schema conflicts, and handling redundant data), with suitable examples. | CO2 | A | 8 |
|  | b. | Apply the Wavelet Transform to convert the following dataset into wavelet coefficients: S = [6, 2, 4, 4, 8, 6, 2, 0] | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. |  | Apply perceptron learning algorithm for the given AND gate and update the weights for one iteration. Initial weights are W1=0.3, W2=0, threshold=0.2 and the learning rate is 0.1.   |  |  |  | | --- | --- | --- | | **X1** | **X2** | **Y** | | 0 | 0 | 0 | | 0 | 1 | 0 | | 1 | 0 | 0 | | 1 | 1 | 1 | | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Apply K-Means clustering to categorize the following seven students based on their study hours per week and test scores into two clusters.   |  |  |  | | --- | --- | --- | | **Student** | **Study Hours per Week** | **Test Score (out of 10)** | | S1 | 2 | 3 | | S2 | 5 | 7 | | S3 | 3 | 4 | | S4 | 6 | 9 | | S5 | 4 | 6 | | S6 | 7 | 10 | | S7 | 2 | 4 |   Assume the initial cluster centers as: S1(2,3) and S4(6,9). Perform K-Means clustering and determine the final cluster assignments after two iterations. | CO4 | A | 8 |
|  | b. | Explain the working principle of the Fuzzy C-Means (FCM) algorithm | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. |  | Consider the following dataset and construct the tree based on the CART algorithm to decide whether to approve the loan or not.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ID | Income Level | Credit Score | Loan Amount | Approved | | 1 | Low | Poor | Low | No | | 2 | High | Good | High | Yes | | 3 | Medium | Fair | Medium | Yes | | 4 | High | Excellent | High | Yes | | 5 | Low | Poor | Medium | No | | 6 | Medium | Good | Low | Yes | | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the given distance matrix and construct a dendrogram using single linkage agglomerative clustering. Depict the levels of clusters.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | X | Y | Z | W | V | U | | X | 0 |  |  |  |  |  | | Y | 0.3 | 0 |  |  |  |  | | Z | 0.5 | 0.4 | 0 |  |  |  | | W | 0.5 | 0.4 | 0.3 | 0 |  |  | | V | 0.6 | 0.5 | 0.4 | 0.3 | 0 |  | | U | 0.4 | 0.3 | 0.2 | 0.3 | 0.4 | 0 | | CO4 | An | 6 |
|  | b. | Explain any three data transformation techniques in data preprocessing with relevant examples. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 23. |  | Apply the Apriori algorithm on the given grocery store transaction dataset with a minimum support count of 2 and a confidence threshold of 70%. The dataset contains transactions where customers purchase items like Milk, Bread, Butter, and Eggs. Identify the candidate and frequent itemsets for each database scan, enumerate all the final frequent itemsets, and generate association rules.   |  |  | | --- | --- | | Transaction ID | Items Purchased | | T1 | Milk, Bread, Butter | | T2 | Milk, Bread, Eggs | | T3 | Bread, Butter, Eggs | | T4 | Milk, Eggs | | T5 | Milk, Bread, Butter, Eggs | | T6 | Bread, Butter | | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate different types of ensemble learning techniques applied to enhance model performance with relevant examples. | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Illustrate the concepts, mathematical background, applicability, and limitations of existing Machine Learning techniques. |
| **CO2** | Implement the simple feature engineering steps. |
| **CO3** | Apply linear discriminant and Multilayer Perceptronalgorithm for a given task. |
| **CO4** | Demonstrate the working principle of distance-based algorithms to handle unlabeled data. |
| **CO5** | Distinguish tree and rule-based machine learning algorithms and appropriately apply to the suitable application. |
| **CO6** | Implement ensemble learning methods to improve predictive modeling and decision-making tasks. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2017** | **Duration** | **3hrs** |
| **Course Title** | **DATA ENGINEERING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the primary objective of data engineering. | | CO1 | U | 1 |
| 2. | Identify one key difference between data engineers and data scientists. | | CO1 | R | 1 |
| 3. | Identify two major undercurrents in the data engineering lifecycle and their purpose. | | CO2 | R | 1 |
| 4. | List any two methods used for serving data after transformation. | | CO2 | R | 1 |
| 5. | Define domain with suitable examples. | | CO3 | U | 1 |
| 6. | Name the primary domains of a data architecture. | | CO3 | R | 1 |
| 7. | Select the most suitable data architecture for storing large volumes of raw, unstructured data. | | CO4 | U | 1 |
| 8. | Identify the data architecture model that combines both on-premises and cloud environments. | | CO4 | R | 1 |
| 9. | Identify the data creation source system. | | CO5 | U | 1 |
| 10. | Define Batch processing. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare and contrast the roles of data engineers and data scientists based on their responsibilities and outputs. | | CO1 | An | 3 |
| 12. | Explain the role of transformation in the lifecycle and analyze its impact on the serving phase of data pipelines. | | CO2 | U | 3 |
| 13. | Explain the role of architectural leadership in decision-making. | | CO3 | U | 3 |
| 14. | Differentiate between multicloud and hybrid cloud. | | CO4 | U | 3 |
| 15. | Explain any three practical storage solutions. | | CO5 | U | 3 |
| 16. | Differentiate between Bounded Vs Unbounded data consideration. | | 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 interdependence between data engineering and data science, and evaluate how their collaboration influences the scalability of data-driven solutions. | CO1 | An | 6 |
|  | b. | Explain the flexibility of the continuum and how roles adapt to diverse requirements. Analyze its relevance to evolving organizational needs, and evaluate its effectiveness in solving industry-specific challenges. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the importance of source systems in data generation and lifecycle management. | CO2 | U | 6 |
|  | b. | Classify the different methods used for data storage and ingestion. Discuss their advantages, disadvantages, and suitability for handling structured, semi-structured, and unstructured data in large-scale systems. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain principles of data engineering architecture in detail. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Distinguish between server vs serverless based solutions. | CO4 | U | 5 |
|  | b. | Analyze the impact of cost, speed, and interoperability on choosing a data architecture solution. | CO3 | An | 7 |
|  |  |  |  |  |  |
| 21. | a. | Write a short notes on data warehouse, data lake and datamart. | CO3 | A | 6 |
|  | b. | Describe environment choices in data engineering | CO4 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the trends in data storage with example. | CO5 | U | 6 |
|  | b. | Compare Block storage, File storage, and Object Storage. | CO5 | E | 6 |
|  |  |  |  |  |  |
| 23. |  | Explain Common file format and Data Sharing Technique. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the data engineering lifecycle, analyze its current structure, and evaluate its role in supporting machine learning and AI advancements. | CO1 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe the evolution and key roles of data engineering within the technology sector. |
| **CO2** | Explain the critical phases and best practices within the data engineering lifecycle. |
| **CO3** | Apply principles of good data architecture to effectively design scalable and resilient systems. |
| **CO4** | Identify the factors that influence technology decisions, considering cost, speed, and environmental suitability. |
| **CO5** | Analyse various data generation sources and storage systems, emphasizing modern storage trends. |
| **CO6** | Explain effective techniques for data ingestion and management, suitable for handling diverse data types. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2018** | **Duration** | **3hrs** |
| **Course Title** | **QUANTUM MACHINE LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the Hadamard transformation and its mathematical representation. | | CO1 | R | 1 |
| 2. | Define amplitude encoding. | | CO3 | R | 1 |
| 3. | List any two examples of a quantum algorithm used for classification. | | CO1 | R | 1 |
| 4. | Identify a key property of RKHS that makes it useful for quantum machine learning. | | CO4 | U | 1 |
| 5. | Identify the condition under which a square matrix has an inverse. | | CO2 | R | 1 |
| 6. | Name a common application where matrix-valued feature vectors are utilized. | | CO4 | R | 1 |
| 7. | State one challenge associated with arbitrary state preparation in quantum computing. | | CO3 | R | 1 |
| 8. | State the primary purpose of a Bayesian Network in probabilistic modeling. | | CO5 | R | 1 |
| 9. | Identify one key difference between classical and Quantum Hopfield Models. | | CO6 | U | 1 |
| 10. | Name one type of annealer used for encoding classifiers. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Justify the way Hadamard interference is essential for quantum speedup in algorithms like Grover’s search. | | CO1 | E | 3 |
| 12. | Apply the concept of quantum parallelism to enable multiple function inputs simultaneously, using superposition. | | CO2 | A | 3 |
| 13. | Differentiate between the representation of binary inputs in classical computing and representation as basis states in quantum computing. | | CO3 | U | 3 |
| 14. | Describe the concept of quantum kernels and their role in quantum machine learning. | | CO4 | U | 3 |
| 15. | Explain the way matrix inversion is important in training machine learning models, particularly in regression and optimization problems. | | CO5 | U | 3 |
| 16. | Explain the basic principles of Quantum Hopfield Models. | | 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 working principle of the Squared-Distance Classifier as a quantum algorithm for classification and its role in improving classification accuracy. | CO1 | U | 6 |
|  | b. | Apply the concept of risk minimization in supervised learning and its impact on model performance and generalization. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Explain the process of amplitude encoding and discuss its significance and challenges in quantum machine learning. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Justify the importance of the postulates of quantum mechanics in quantum computing and explain the way they form the foundation for quantum algorithms. | CO2 | E | 8 |
|  | b. | State the primary objective of the Deutsch algorithm and its significance in quantum computing. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the connection between quantum models and kernel methods, and highlight their role in quantum machine learning. | CO4 | U | 7 |
|  | b. | Describe the role of a feature map in data encoding and the way it transforms input data for machine learning applications. | CO4 | U | 5 |
|  |  |  |  |  |  |
| 21. | a. | Explain the process of finding closest neighbors in machine learning and its significance in classification and clustering tasks. | CO5 | U | 8 |
|  | b. | Illustrate the concept of amplitude amplification for perceptron training and its impact on quantum machine learning. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Describe the relationship between quantum phase estimation and matrix multiplication and inversion. | CO2 | U | 5 |
|  | b. | Explain the working principle of Grover's search algorithm and its advantage over classical search algorithms. | CO2 | U | 7 |
|  |  |  |  |  |  |
| 23. | a. | Explain the process of encoding a dataset via the Hamiltonian in quantum computing and its significance in quantum machine learning. | CO3 | U | 7 |
|  | b. | Explain the different process of training in unsupervised learning | CO1 | U | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Classify the different types of Quantum Ising Models and discuss their applications in quantum computing and optimization. | CO6 | U | 6 |
|  | b. | Correlate the effect of the transverse field with the learning capability and optimization performance of Boltzmann Machines in quantum computing. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the fundamental principles of quantum computing and its relationship to machine learning. |
| **CO2** | Apply quantum algorithms for classification,such as the squared-distance classifier and Grover search. |
| **CO3** | Illustrate the various techniques, including basis states, amplitude encoding, time evolutions, and feature maps. |
| **CO4** | Demonstrate quantum models as kernel methods for solving machine learning problems. |
| **CO5** | Experiment the fault-tolerant quantum machine learning techniques, including linear algebra accelerators, search and amplitude amplification, and probabilistic models. |
| **CO6** | Develop various applications of quantum models based on the Ising models. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2019** | **Duration** | **3hrs** |
| **Course Title** | **FEDERATED LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define Federated Learning. | | CO1 | R | 1 |
| 2. | State the reason why term “Federated Learning” came into AI applications. | | CO1 | U | 1 |
| 3. | Discuss the major improvements of **FedAvg** approach and the reasons of designing them. | | CO2 | U | 1 |
| 4. | Name the Google protocol to communicate in C/S Environment of FL. | | CO2 | R | 1 |
| 5. | Identify the various performance metrics of Fed HM. | | CO3 | U | 1 |
| 6. | List the various encoding methods in Federated Learning applications. | | CO3 | R | 1 |
| 7. | Identify the key features of Federated Transfer Learning. | | CO4 | U | 1 |
| 8. | Give example of Additively Homomorphic Encryption for privacy handling. | | CO4 | R | 1 |
| 9. | Define Adversarial Robustness in FL training. | | CO5 | U | 1 |
| 10. | Provide categorization of FRD in Federated Learning applications. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Enumerate the features of Privacy Preserving machine learning (PPML) which facilitates confidentiality and profit lending to Business. | | CO1 | U | 3 |
| 12. | Give examples of the typical steps of Horizontal FL with an illustration. | | CO2 | U | 3 |
| 13. | Illustrate the algorithm for one-hot encoding and express in detail. | | CO3 | An | 3 |
| 14. | Discuss the working of Federated Transfer Learning with an example diagram. | | CO4 | U | 3 |
| 15. | Classify the major issues addressed by Fair Federated Learning. | | CO5 | An | 3 |
| 16. | Describe the system level challenges in typical FL applications. | | 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. | Assess the Federated Learning paradigm and its major applications in our life. | CO1 | E | 8 |
|  | b. | Explain in detail **Data breaching, Financial loss,** and **Reputational harm** as threats for privacy preserving. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the approaches for Federated Evaluation and write the steps for evaluating the Model. | CO2 | An | 6 |
|  | b. | Explainthe **FedAvg** approach by presenting a detailed pseudocode and brief the shortcomings of **FedAvg.** | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the major heterogeneity challenges in encoding tasks with examples and diagrams. Also write the means of handling these challenges. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. | a. | Analyze the reasons of Security Analysis executed in FTL. Tell the strategies for handling attacks with illustrations. | CO4 | An | 6 |
|  | b. | Explain the design of FTL with respect to Generative Adversarial Networks. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. |  | Apply the principles of Adversarial attacks on a FL system by specifying the types of typical attacks as well as its Evaluation Metrics with diagrams. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the representation of Feature Maps as Encoded information. | CO3 | An | 8 |
|  | b. | Give examples of encoding binary inputs into basis states with a diagram. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Articulate the steps of Reverse Auction as a decisive factor in designing Incentive Mechanism. | CO4 | A | 8 |
|  | b. | Relate the process of Homomorphic Encryption within the FTL framework. | CO4 | U | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Enumerate and elaborate the steps of Federated Hyper-Parameter Optimization algorithm (FHPO) designed to benefit FL applications and to reduce costs of communication. | CO6 | E | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the knowledge of the basic concepts, architecture, and applications of Federated Learning. |
| **CO2** | Illustrate the concepts of Horizontal and Vertical Federated Learning. |
| **CO3** | Demonstrate the encoding techniques in classical data transmission. |
| **CO4** | Describe the incentive mechanism design in Federated Learning. |
| **CO5** | Explore privacy-preserving Federated Learning algorithms and guarantees. |
| **CO6** | Apply research and application trends in Federated Learning. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2023** | **Duration** | **3hrs** |
| **Course Title** | **ZERO TRUST ARCHITECTURE** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the year in which the Zero Trust model was introduced by Forrester Research. | | CO1 | R | 1 |
| 2. | Identify the CVSS metric that considers exploit availability and remediation options. | | CO1 | R | 1 |
| 3. | State one primary goal of Data Loss Prevention. | | CO2 | R | 1 |
| 4. | Expand the term CASB in cloud security. | | CO2 | R | 1 |
| 5. | Identify the purpose of implementing a DMZ in a network. | | CO3 | U | 1 |
| 6. | Name the compliance standard established by major payment card issuers to secure cardholder data. | | CO3 | R | 1 |
| 7. | Name the OSI layer responsible for end-to-end communication and error handling. | | CO4 | R | 1 |
| 8. | Identify the term used for the process of dividing a network into isolated segments to improve security. | | CO4 | R | 1 |
| 9. | Name the type of traffic analysis used to understand endpoint behavior in Zero Trust networks. | | CO5 | R | 1 |
| 10. | Name the U.S. Executive Order focused on improving national cybersecurity. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Identify the key challenges faced during Zero Trust cybersecurity workshop. | | CO1 | U | 3 |
| 12. | Identify the ways in which maintaining asset identity helps improve an organization’s security posture. | | CO2 | U | 3 |
| 13. | List any three types of services commonly hosted in a DMZ. | | CO3 | R | 3 |
| 14. | Differentiate between Macro-Segmentation and Micro-Segmentation in a network environment. | | CO4 | U | 3 |
| 15. | List three practical considerations when implementing contextual identity within a Zero Trust environment. | | CO5 | R | 3 |
| 16. | Differentiate between greenfield and brownfield Zero Trust deployment. | | 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 healthcare organization plans to protect sensitive patient data while enabling remote access. Describe the use of Cisco’s Zero Trust capabilities to support secure access and data protection in this scenario. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | An enterprise expanding to a hybrid work model needs consistent security policies across cloud and on-premise environments. Describe the use of Cisco’s Policy and Governance solutions in enforcing unified security controls in this scenario. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate the significance of common business services in ensuring organizational security. | CO3 | E | 6 |
|  | b. | Evaluate the importance of Payment Card Industry Business Services in maintaining compliance and securing financial transactions. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 20. |  | An enterprise is redesigning its network to enhance security and performance. The team is considering strategies like endpoint visibility and understanding access requirements. Evaluate the contribution of these strategies to achieving a secure and well-structured network. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | A manufacturing company is starting its Zero Trust journey and uses monitor mode to identify legacy devices connected via USB-to-Ethernet adapters. The team discovers that multiple device types appear as a single identity on the network. Analyze the importance of contextual identity, traffic analysis, and asset profiling in preventing misclassification and ensuring business continuity. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Analyze the challenges and strategies associated with understanding external access requirements of endpoints in a Zero Trust architecture. | CO4 | An | 6 |
|  | b. | An organization is restructuring its network to improve security and reduce lateral movement of threats. Evaluate the role of Zero Trust Enclave Design in achieving effective network segmentation and strengthening overall organizational security. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the contribution of a well-defined onboarding process for new devices to long-term security and compliance in a Zero Trust organization. | CO5 | A | 6 |
|  | b. | Explain the role of continuous improvement in Zero Trust operations and the contribution of analytics in this process. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the role of the Cloud Security Alliance (CSA) in promoting Zero Trust architecture. | CO6 | An | 6 |
|  | b. | Explain the application of asset identity in strengthening security and improving operational visibility within a Zero Trust framework. | CO6 | U | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Acquire proficiency in implementing and analysing zero trust architecture. |
| CO2 | Illustrate the working of zero trust capabilities. |
| CO3 | Analyze and implement the zero trust reference architecture. |
| CO4 | Demonstrate segmentation in zero trust architecture. |
| CO5 | Apply zero trust architecture to secure enterprise against unauthorized access. |
| CO6 | Design zero trust architecture for real time applications. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2028** | **Duration** | **3hrs** |
| **Course Title** | **DATA EXPLORATION AND VISUALIZATION** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Differentiate EDA from classical statistical analysis. | | CO1 | U | 1 |
| 2. | State how pivot tables aid in EDA. | | CO1 | R | 1 |
| 3. | Mention how histograms represent data. | | CO2 | R | 1 |
| 4. | Define the term "Colormap" in Matplotlib. | | CO2 | R | 1 |
| 5. | Describe the Numerical Summaries of Level and Spread. | | CO3 | U | 1 |
| 6. | Define Interquartile Range (IQR). | | CO3 | R | 1 |
| 7. | Differentiate between Percentage Tables and Contingency Tables. | | CO4 | U | 1 |
| 8. | Define Resistant Lines in Regression. | | CO4 | R | 1 |
| 9. | Write the Significance of Longitudinal Data in Analysis. | | CO5 | U | 1 |
| 10. | State the role of Causal Explanations in Predictive Modeling. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the purpose of Data Aggregation. | | CO1 | An | 3 |
| 12. | Describe the process of creating a Simple Line Plot in Matplotlib. | | CO2 | U | 3 |
| 13. | Illustrate the process of Scaling and Standardizing Variables. | | CO3 | An | 3 |
| 14. | List the characteristics and applications of resistant lines in regression. | | CO4 | U | 3 |
| 15. | Illustrate the application of batch handling in experimental design. | | CO5 | An | 3 |
| 16. | State the role of grouping in visualizing Time Series Data. | | 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. | Explore the significance of grouping datasets and how it aids in focused analysis. | CO1 | A | 6 |
|  | b. | Explain the Process of choosing the best chart. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the purpose of using subplots and their significance in complex visualizations. | CO2 | R | 6 |
|  | b. | Explain the Process of Geographic Data Visualization with Basemap. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the Smoothing Techniques for time series data with suitable example. | CO6 | U | 6 |
|  | b. | List and explain the 10 essential numerical summaries in statistics. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Discuss in detail about data cleaning. | CO3 | A | 6 |
|  | b. | Write a note on Discretization and binning. | CO4 | R | 6 |
|  |  |  |  |  |  |
| 21. | a. | Elaborate the Purpose of Resistant Lines in Outlier-Prone Data. | CO5 | E | 6 |
|  | b. | Explain how transformations improve Linearity in Regression. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the challenges and strategies in handling several batches in data analysis. | CO4 | An | 6 |
|  | b. | Illustrate the role of scatterplots in visualizing relationships. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe the characteristics of Time Series Data. | CO5 | R | 6 |
|  | b. | Explain the cleaning procedures for Time Series Data. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate a case study on univariate and multivariate analysis with example. | CO2 | C | 6 |
|  | b. | Describe various distributions module of seaborn for visualization. | CO2 | U | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Describe exploratory data analysis fundamentals |
| **CO2** | Explain the appropriate visualization methods |
| **CO3** | Apply data cleaning techniques |
| **CO4** | Illustrate the benefits of data transformation in enhancing data quality and analysis accuracy. |
| **CO5** | Examine the statistical concepts of data analysis and interpretation |
| **CO6** | Apply the advanced data analysis techniques and application of statistical methods in real-world scenarios. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – APRIL/MAY 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2031** | **Duration** | **3hrs** |
| **Course Name** | **GENERATIVE AI** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the metrics used for training and evaluating language models. | | CO1 | R | 1 |
| 2. | List two application of generative AI. | | CO1 | R | 1 |
| 3. | Identify any two benefits of agents. | | CO2 | U | 1 |
| 4. | Define Prompt Chaining. | | CO2 | R | 1 |
| 5. | Identify the purpose of retriever in LangChain. | | CO3 | U | 1 |
| 6. | Name one vector database supported by LangChain. | | CO3 | R | 1 |
| 7. | Identify the tool used to execute Python for answering computational queries. | | CO4 | U | 1 |
| 8. | Relate Visualization and EDA. | | CO4 | U | 1 |
| 9. | Distinguish Tracking and Tracing in the field of software operation and management. | | CO5 | U | 1 |
| 10. | Identify two observability tools. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the steps involved in stable diffusion to generate images from text. | | CO1 | R | 3 |
| 12. | Identify any three limitations of LLM. | | CO2 | U | 3 |
| 13. | Apply **PubMed retriever for a medical chatbot application.** | | CO3 | A | 3 |
| 14. | Describe Reinforcement Learning with Human Feedback. | | CO4 | R | 3 |
| 15. | Write a prompt using zero-shot prompting technique to classify the sentiment of the text. | | CO5 | A | 3 |
| 16. | List the important metrics for monitoring LLMs in production. | | 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. | Explain the working principle of GPT model. | CO1 | U | 8 |
|  | b. | Identify the limitations of Large Language Models(LLM). | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the memory component of LangChain with neat diagram. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the importance of vector storage and vector indexing in chatbot building. | CO3 | An | 8 |
|  | b. | State the importance of embeddings. | CO3 | R | 4 |
|  |  |  |  |  |  |
| 20. |  | Analyze the concept of fine-tuning on an open source model. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the functionalities of AI agents for data exploration in Iris dataset using LLMs. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | **Analyze the metrics needed to evaluate LLM apps.** | CO6 | An | 8 |
|  | b. | Explain the services and framework available for deploying LLM applications. | CO6 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the concept of Prompt Engineering in detail. | CO4 | U | 6 |
|  | b. | Write a Python code to combine several memory mechanisms. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the role of LangSmith and Promptwatch in monitoring LLM production. | CO6 | An | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Explain the different varieties of generative AI models and working of GPT. |
| CO2 | Illustrate the key components and working of LangChain. |
| CO3 | Develop the skills necessary to apply generative AI techniques creatively for building chatbots. |
| CO4 | Describe the on-going research on customizing LLM. |
| CO5 | Demonstrate the impact of generative AI on data science. |
| CO6 | Deploy and evaluate the LLM aaps. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2032** | **Duration** | **3hrs** |
| **Course Title** | **FULL STACK DEVELOPMENT** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the tag used in HTML to create a hyperlink. | | CO1 | U | 1 |
| 2. | Name the HTML element to display a photo with dimensions of 200x200 pixels. | | CO1 | R | 1 |
| 3. | Identify the JavaScript event that occurs when an HTML button is pressed. | | CO2 | U | 1 |
| 4. | Predict the JavaScript method used to display a popup dialog box. | | CO2 | U | 1 |
| 5. | Identify the two ways of binding data to HTML view in AngularJS. | | CO3 | U | 1 |
| 6. | List any two AngularJS validations state variables. | | CO3 | R | 1 |
| 7. | State the import statements needed for React and ReactDOM. | | CO4 | R | 1 |
| 8. | State the default method in a React class component. | | CO4 | R | 1 |
| 9. | Predict the module name used to create a server in NodeJS. | | CO5 | U | 1 |
| 10. | Identify the method used to fetch all records from MongoDB collection. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | State the CSS selector that selects an HTML element using the # symbol. | | CO1 | R | 3 |
| 12. | Write a jQuery program to demonstrate the fading effects. | | CO2 | A | 3 |
| 13. | Differentiate between ng-model and ng-bind in Angular JS | | CO3 | U | 3 |
| 14. | Write the React hook used to manage local state in a function component. | | CO4 | A | 3 |
| 15. | State the predefined NodeJS module used for creating server application | | CO5 | R | 3 |
| 16. | Write the MongoDB methods used for updating documents inside a MongoDB collection. | | 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. |  | Develop an online registration form using HTML as specified below and include the necessary attributes to ensure all fields are mandatory. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Write an HTML program with JavaScript to calculate and display the BMI value and status based on the given weight and height.  **BMI = weight(kg)/[height(m)]2**  Check the status using the following conditions.  • Underweight: BMI < 18  • Normal: BMI between 18 – 25  • Overweight: BMI between 25 – 30  • Obese: BM > 30 | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Develop an HTML page using AngularJS to calculate the Monthly EMI, Total Repayment, and Total Interest based on the given input when the 'Calculate EMI' button is clicked.  Formula Reference: E = p \* r \* (1 + r ) n / ( ( 1 + r )n - 1 ) where E is EMI, p is principal loan amount, r is monthly rate of interest, n is number of months. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Develop a React application that renders a simple login form with fields for Email, Password and a Submit button. The form should handle changes and submit events to log the data to the console. Use functional components and hooks. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Develop a Node JS server application program to design the following HTML form to collect user input and save the details in a mongodb database name “company” under the collection called “users” when the form is submitted via POST method.  [Sample Output Given Below]  URL: <http://localhost:2000/>    When Register button is clicked, the URL: <http://localhost:2000/server>  **Data Saved in MongoDB Database Successfully** | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Write jQuery code to design the following page for Age Calculator App using HTML and CSS. Include appropriate JQuery code to find the age in years, months and days and display the same as per the design. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Write HTML and CSS code using Bootstrap to display the webpage shown in the below image. Include a navigation bar with "Home," "Products," "Services," and "Contact Us" links, a culinary-themed background image, and two forms: "Sign In" and "Sign Up." Ensure the forms match the image's layout, demonstrating web layout, styling, and responsive design. | CO1 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate the following MongoDB operations to perform banking tasks:   1. Create a database called 'bank'. 2. Create a collection 'account' with fields such as name, email, phone, account number, and balance. 3. Insert new account details for four customers. 4. Display the balance amount of a particular account. 5. Deposit an amount into the specified existing account using the account number. 6. Withdraw an amount from the specified existing account using the account number. 7. Display all account details. | CO6 | A | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Design responsive web pages using front-end UI tools like HTML5, CSS3 and Bootstrap4. |
| **CO2** | Create dynamic web pages using JavaScript and jQuery. |
| **CO3** | Construct simple web applications using AngularJS framework. |
| **CO4** | Develop simple web applications using ReactJS framework. |
| **CO5** | Analyze different web applications using node.js framework. |
| **CO6** | Invent the real time web applications with backend tools. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2040** | **Duration** | **3hrs** |
| **Course Title** | **DEEP LEARNING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any three Deep Learning (DL) frameworks for developing deep neural network applications. | | CO1 | R | 1 |
| 2. | Identify an appropriate Artificial Neural Networks (ANN) algorithm for classifying a nonlinear dataset. | | CO1 | R | 1 |
| 3. | State the purpose of learning rate parameter in ANN. | | CO2 | R | 1 |
| 4. | Define the goal of generalization. | | CO2 | R | 1 |
| 5. | Calculate the size of the output feature map by applying convolution operation with 32 filters of size 10 x 10 with a stride of 2 and zero padding on an input image of size 60 x 60 x 3. | | CO3 | A | 1 |
| 6. | Apply the given filter on the input matrix and calculate the value at the position of the question mark using convolution operation. | | CO3 | A | 1 |
| 7. | State the limitation of Recurrent Neural Network (RNN) architecture. | | CO4 | R | 1 |
| 8. | Identify the type of RNN architecture for predicting the (n+1)th word in a sequence, given an n-character word. | | CO4 | U | 1 |
| 9. | Construct 2-skip-3-grams for the following text : ‘*A simple sentence consists of a single independent clause, containing a subject and a verb*’. | | CO5 | A | 1 |
| 10. | Name the transformer based models for language translation. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Enumerate at least three activation functions along with their mathematical notations. | | CO1 | R | 3 |
| 12. | Compare the advantages and disadvantages of a RNN in contrast to a feed-forward ANN. | | CO2 | U | 3 |
| 13. | Describe the two key interesting properties of Convolutional Neural Network (CNN). | | CO3 | U | 3 |
| 14. | Explain the ‘backpropagation through time’ algorithm to determine the gradients in RNN. | | CO4 | U | 3 |
| 15. | Calculate the Jaccard Similarity score for the following documents:  Document 1 ={Deep learning is the new concept}  Document 2 ={Deep learning is a subset of neural networks} | | CO5 | A | 3 |
| 16. | Differentiate between the transformer model and conventional seq2seq model. | | 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. | Describe the concept of learning and compare the learning laws of SLP and MLP algorithms. | CO1 | U | 5 |
|  | b. | Compute the updated weight vector after one iteration by applying the SLP algorithm on the following 3-input dataset.   |  |  |  |  | | --- | --- | --- | --- | | **Input** | | | **Desired Output** | | **X1** | **X2** | **X3** | | 0.2 | 0.1 | 0.3 | 0 | | 0.3 | 0.2 | 0.4 | 1 | | 0.5 | 0.6 | 0.2 | 1 | | 0.1 | 0.4 | 0.7 | 0 |   The initial weight vector is W = {0.2 0.3 0.5}, learning rate parameter = 0.1  Threshold activation function:  Output = 1 if Net ≥ 0.4  = 0 if Net < 0.4 | CO2 | A | 7 |
|  |  |  |  |  |  |
| 18. | a. | Explain the difference between batch gradient descent, stochastic gradient descent, and mini-batch gradient descent. List the advantages and disadvantages of each. | CO2 | U | 5 |
|  | b. | Apply the backpropagation algorithm on the following MLP architecture and determine the new weight values between [H1, O1], [H2, O1] after one iteration.  Given input vector = [22, 40], desired output = [1] and learning rate parameter = 0.1  [I1, H1] = 0.35, [I2, H1] = 0.31, [I1, H2] = 0.24, [I2, H2] = 0.42, [H1, O1] = 5.1, [H2, O1] = 0.5,  Use unipolar sigmoidal activation function. | CO2 | A | 7 |
|  |  |  |  |  |  |
| 19. | a. | Compare the concepts of different types of adaptive optimization algorithms, using mathematical notations. | CO2 | U | 6 |
|  | b. | Explain the purpose of regularization and provide a detailed analysis of the following techniques, including relevant illustrations.\   * L1/L2 regularization * Dropout * Batch Normalization | CO1 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Describe the function of each layer in a CNN architecture and provide equations for calculating the dimensions of the output image and number of learnable parameters. | CO3 | U | 6 |
|  | b. | Calculate the output image size and the number of learnable parameters at different layers of the following CNN architecture by applying an input image of size 227 x 227 x 3   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Layer** | **No of Filters/ kernels** | **Filter Size** | **Stride** | **Padding** | **Output image size** | **Learnable parameters** | | Input | - | - | - | - |  |  | | Conv 1 | 12 | 4 x 4 | 4 | - |  |  | | Max Pool 1 | - | 2 x 2 | 2 | - |  |  | | Conv 2 | 15 | 5 x 5 | 1 | 2 |  |  | | Max Pool 2 | - | 2 x 2 | 2 | - |  |  | | FC Layer | Nodes =1000 | | | |  |  | | CO3 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the structure of Long Short Term Memory (LSTM) and describe its function by incorporating mathematical expressions. | CO4 | A | 8 |
|  | b. | Compare the advantages of RNNs over CNNs. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 22. | a. | Develop a simple RNN to detect named entities in the following text. Outline the architecture and the algorithm used for text analysis.  “[Mike]Person is working in [Wipro]Organization from [2016]Time.” | CO4 | A | 6 |
|  | b. | Compare and contrast three neural language models, highlighting their respective architectures. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the main idea behind Word2Vec and describe its two primary models: Continuous Bag of Words (CBOW) and Skip-gram with suitable illustration. | CO5 | An | 8 |
|  | b. | Distinguish between one-hot encoding and word embeddings. | CO5 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the following concepts for sequence to sequence learning with suitable illustration.   * Encoder-decoder architecture * Attention mechanism and transformer model | CO6 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze various neural network architectures, including fully connected networks, convolutional neural networks, and recurrent neural networks. |
| **CO2** | Implement perceptron learning algorithms using linear algebra and understand gradient-based learning techniques. |
| **CO3** | Apply convolutional neural networks and transfer learning techniques to solve complex image classification problems using pre-trained models. |
| **CO4** | Demonstrate recurrent neural network models, including LSTMs, to predict time sequences and perform text auto-completion. |
| **CO5** | Evaluate the performance of natural language models and generate accurate word embeddings using Word2Vec and GloVe. |
| **CO6** | Design and develop sequence-to-sequence learning models, incorporating attention mechanisms and transformers for neural machine translation tasks. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2043** | **Duration** | **3hrs** |
| **Course Title** | **CLOUD COMPUTING FOR DATA ANALYTICS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List two components required for initiating continuous delivery for a Hugo static site. | | CO1 | R | 1 |
| 2. | Define PaaS and its support for continuous delivery workflows. | | CO1 | R | 1 |
| 3. | Identify one key feature that differentiates Amazon Web Services (AWS) from other cloud platforms. | | CO2 | R | 1 |
| 4. | List two main components required to set up continuous integration using CircleCI in a cloud environment. | | CO2 | R | 1 |
| 5. | Define hypervisor. Give an example. | | CO3 | R | 1 |
| 6. | List any two advantages of using Docker containers. | | CO3 | R | 1 |
| 7. | Summarize the significance of Key Value databases. | | CO4 | U | 1 |
| 8. | List any two applications of Google BigQuery. | | CO4 | R | 1 |
| 9. | Define ETL in the context of data processing | | CO5 | U | 1 |
| 10. | Identify two features of Jupyter Notebook that support collaborative data analysis workflows. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Identify the key principles of Infrastructure as Code and explain how they contribute to consistent and repeatable deployments. | | CO1 | R | 3 |
| 12. | Analyze the advantages of using Docker and CircleCI together for setting up a cloud environment with continuous integration. | | CO2 | An | 3 |
| 13. | Analyze the role of containerization in optimizing resource utilization and deployment efficiency in cloud environments. | | CO3 | An | 3 |
| 14. | Classify the different types of cloud storage and list their use cases. | | CO4 | An | 3 |
| 15. | Differentiate between Serverless ETL and traditional ETL based on scalability, cost, and deployment speed. | | CO5 | An | 3 |
| 16. | Analyze how AWS SageMaker simplifies the machine learning lifecycle and supports both training and deployment of models. | | 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. | Explain the steps involved in setting up continuous delivery for a Hugo static site from zero. Highlight the tools and techniques required to implement this process effectively. | CO1 | U | 6 |
|  | b. | Analyze the interplay between Infrastructure as Code and continuous delivery in modern software development. How do they work together to ensure reliable and scalable deployments? | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. |  | Analyze how Docker contributes to the efficiency of continuous integration and deployment in cloud environments and how it ensures consistency across different platforms | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the step-by-step process of deploying a containerized application using Kubernetes. | CO3 | U | 6 |
|  | b. | Illustrate the different types of virtualization and their role in enhancing the efficiency of cloud infrastructure with diagram. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Explain the contribution of batch and streaming data processing techniques in improving the efficiency of data handling techniques. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | Describe the three phases of ETL (Extract, Transform, Load) and how serverless technologies handle each phase. | CO5 | U | 6 |
|  | b. | Describe the major components of FaaS architecture, including function execution, event sources, and scaling mechanisms. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Explain how AWS SageMaker's elastic architecture supports scalable machine learning workflows. | CO6 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the key features and uses of Google Cloud BigQuery. | CO4 | A | 6 |
|  | b. | Explain the differences between key-value and graph databases in structure, use cases, and performance. | CO4 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the significance of cloud platforms like AWS, Azure, and GCP in providing scalable solutions for continuous integration. | CO2 | U | 12 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the foundational concepts of cloud computing, including paas, infrastructure as code, and continuous delivery principles, and demonstrate setting up a hugo static site |
| **CO2** | Implement cloud onboarding processes for aws, gcp, and azure, and utilize tools like docker and circleci to achieve continuous integration. |
| **CO3** | Analyze virtualization and containerization technologies such as docker and kubernetes, including their application in hybrid and multi-cloud environments. |
| **CO4** | Design and implement effective cloud storage solutions, addressing challenges in distributive computing, data governance, and various types of databases. |
| **CO5** | Develop serverless applications using technologies like aws lambda and google cloud functions, focusing on etl processes and solving real-world data integration problems. |
| **CO6** | Evaluate various managed machine learning platforms such as aws sagemaker and google automl, and apply these tools to practical data analytics projects. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2049** | **Duration** | **3hrs** |
| **Course Title** | **NATURAL LANGUAGE PROCESSING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the significance of the regular expression ^a | | CO1 | R | 1 |
| 2. | Predict the bigram probability *P(would/I)* from the given corpus: | | CO1 | A | 1 |
| 3. | Express the major word classes in the English language. | | CO2 | U | 1 |
| 4. | Identify the number of morphemes in the given word ‘*unladylike’* | | CO2 | R | 1 |
| 5. | Show the three grammatical constituents for the given sentence:  *‘The cat with fluffy fur sat on the brown colour mat’.* | | CO3 | A | 1 |
| 6. | Identify the key difference between Context-Free Grammars and Dependency Grammars. | | CO3 | U | 1 |
| 7. | Estimate the probability of the given parse tree: | | CO4 | U | 1 |
| 8. | Name the similarity measure commonly used in vector semantics. | | CO4 | R | 1 |
| 9. | Indicate a suitable technique for extracting relations between named entities. | | CO5 | U | 1 |
| 10. | Identify the key factors influencing the accuracy of question-answering systems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Apply Levinstein approach to calculate the edit distance to transform the word ‘SATURDAY’ to ‘SUNDAY’ by constructing a two-dimensional array. | | CO1 | A | 3 |
| 12. | Describe the role of Hidden Markov Models in sequence labeling. | | CO2 | U | 3 |
| 13. | Differentiate constituency and dependency parsing by discussing their advantages and limitations. | | CO3 | An | 3 |
| 14. | Explain the wordnet organization of lexical relations among words. | | CO4 | U | 3 |
| 15. | Compare information extraction and relation extraction with examples. | | CO5 | An | 3 |
| 16. | Write three applications of text classification. | | 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. | Explain the three tasks of text normalization process and analyze their challenges in language processing. | CO1 | U | 8 |
|  |  |  |  |  |  |
|  | b. | Describe the relationship between perplexity and entropy in language modeling, providing real-world examples. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 18. |  | Apply Viterbi algorithm to find the most probable sequence of POS tags for the given statement: *‘Big bank will loan’*  Transition Matrix: Emission Matrix:   | Word/  POS | N | V | Adj | | --- | --- | --- | --- | | Big | 0.1 | 0.1 | 0.8 | | bank | 0.5 | 0.1 | 0.1 | | will | 0.1 | 0.5 | 0.1 | | loan | 0.4 | 0.3 | 0.1 |      | From/ To | N | V | Adj | | --- | --- | --- | --- | | <S> | 0.5 | 0.3 | 0.2 | | N | 0.3 | 0.6 | 0.1 | | V | 0.7 | 0.2 | 0.1 | | A | 0.8 | 0.1 | 0.1 | | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Apply CKY parsing to parse the statement “*The man read this book*” using the following rules: | CO3 | A | 8 |
|  | b. | Examine the different types of ambiguity in parsing and propose methods to handle them effectively. | CO3 | An | 4 |
|  |  |  |  |  |  |
| 20. |  | Evaluate the role of vector semantics in improving NLP applications such as search engines and chatbots. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Discuss the distant supervision model for relation extraction and analyze its advantages and challenges. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Compare the working of Top-Down and Bottom-Up Parsing by applying both approaches to parse the sentence: "*The cat chased the mouse*" using the following grammar:  S → NP VP  NP → Det N  VP → V NP  Det → "The"  N → "cat" | "mouse"  V → "chased" | CO3 | An | 12 |
| 23. |  | Analyze the elements of lexical semantics in shaping the organization of the lexicon and to find the relations between senses. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Apply Naïve Bayes classifier to categorise the given test document into "Positive" or "Negative" class. Show your approach with a step-by-step explanation. | CO6 | A | 6 |
|  | b. | Analyze the role of AI techniques in improving the chatbots and dialogue systems. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Illustrate the linguistic components of language models in text processing |
| **CO2** | Analyze the sequence labeling for parts of speech and Named entities |
| **CO3** | Demonstrate the parse tree construction with Syntactic and Statistical Parsing |
| **CO4** | Examine vector semantics and embeddings in language processing |
| **CO5** | Implement computational semantics and semantic parsing techniques |
| **CO6** | Develop real time applications of natural language processing |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **23DC2054** | **Duration** | **3hrs** |
| **Course Title** | **CRYPTOGRAPHY AND NETWORK SECURITY** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the key used for decryption in asymmetric encryption. | | CO1 | R | 1 |
| 2. | Identify one limitation of Caesar Cipher algorithm. | | CO1 | U | 1 |
| 3. | Define Collision resistant hashing. | | CO2 | R | 1 |
| 4. | Name any two methods in cryptography to ensure message integrity. | | CO2 | R | 1 |
| 5. | Define Primitive root. | | CO3 | R | 1 |
| 6. | Identify the primary advantage of hash-based signatures over traditional digital signatures. | | CO3 | U | 1 |
| 7. | Identify any two web security threats. | | CO4 | U | 1 |
| 8. | Define the primary function of a firewall in a computer network. | | CO4 | R | 1 |
| 9. | Describe the core principle of Zero Trust Architecture. | | CO5 | U | 1 |
| 10. | Identify any two advantages of Blockchain for security. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Apply Playfair cipher key square starting with the keyword **"MONARCHY"** to encrypt the digraph **"HE LP"**. | | CO1 | A | 3 |
| 12. | Illustrate the key features of PMAC. | | CO2 | U | 3 |
| 13. | A user wants to encrypt a message M = 20 using the ElGamal encryption algorithm with the following parameters:   * Prime number (p) = 29 * Generator (g) = 7 * Private key (x) = 9 * Random integer (k) = 4   Find the ciphertext (C₁, C₂) using the ElGamal encryption formula. | | CO3 | A | 3 |
| 14. | Describe IPSec and its importance in network security. | | CO4 | U | 3 |
| 15. | Define Post Quantum Cryptography. | | CO5 | R | 3 |
| 16. | Differentiate between public and private blockchains. | | 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 with sketches the key steps involved in the encryption process of AES algorithm. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the working of Merkle Damgard construction method in building a secure hash function. | CO2 | U | 6 |
|  | b. | Explain the process of CCM (Counter with CBC-MAC) in providing confidentiality and authentication of messages. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Describe the X.509 certificate format in detail, highlighting its key fields. Also, explain the process and importance of certificate revocation. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain with sketches the architecture and the working of TLS protocol. | CO4 | U | 12 |
|  |  |  |  |  |  |
| 21. |  | A multinational company is shifting to a hybrid work model, allowing employees to access corporate resources from remote locations. To enhance security, the company plans to implement Cisco’s Zero Trust Architecture (ZTA) to protect against cyber threats.  Based on the above scenario, describe the Security Capability Requirements of Cisco Zero Trust Architecture in securing users, devices, networks, applications, and data. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain with sketch the Diffie-Hellman key exchange algorithm. | CO3 | U | 6 |
|  | b. | Alice and Bob use the Diffie Hellman key exchange technique with a common prime q=353 and a primitive root **α = 3.**  Find  i) Public key of Alice, YA ( private key XA= 97)  ii) Public key of Bob, YB (private key XB=233)  iii) Shared secret key between Alice and Bob. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | A financial institution needs to exchange sensitive client data securely over email. Explain the importance of the following four key message-related services provided by S/MIME in ensuring secure email communication.  i) authentication  ii) confidentiality  iii) compression  iv) email compatibility | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the following key features of Blockchain Technology.  a) Peer-to-Peer networks,  b) cascaded encryption,  c) distributed databases,  d) transparency, and  e) irreversibility of records. | CO6 | U | 6 |
|  | b. | In a smart city, various IoT devices are deployed for automation and efficiency. However, cyber threats target different aspects of the IoT ecosystem. Consider the following scenarios:   * A hacker gains access to a smart home’s security cameras and locks. * Attackers alter factory sensors, leading to incorrect temperature readings in a manufacturing plant. * Unauthorized access to a hospital’s IoT-connected patient monitoring devices exposes sensitive health data.   Analyze these scenarios and explain the three primary targets of attack in IoT systems. Discuss how each attack could impact security, privacy, and system functionality. | CO6 | An | 6 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Analyze the security issues and identify the suitable cryptographic algorithms. |
| **CO2** | Apply security algorithms to achieve confidentiality, integrity and availability. |
| **CO3** | Illustrate the importance of network security in the context of various attacks. |
| **CO4** | Develop secure electronic applications using digital signatures. |
| **CO5** | Construct combinations of cryptographic algorithms for securing network applications. |
| **CO6** | Analyze the advancements in network security implementations. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Interpret how AI improves diagnostics in healthcare. | | CO1 | U | 1 |
| 2. | List the AI technologies used in healthcare. | | CO1 | R | 1 |
| 3. | State how AI & IoT work together for early disease detection. | | CO2 | R | 1 |
| 4. | List three main types of image processing techniques used in dermatology. | | CO2 | R | 1 |
| 5. | Explain about IBM Watson Health platform. | | CO3 | U | 1 |
| 6. | Name the virtual tools available for Skin Cancer Detection using Dermatoscopic Image Analysis. | | CO3 | R | 1 |
| 7. | Identify the key components of AI-Enabled telemedicine systems. | | CO4 | U | 1 |
| 8. | Infer the use of AI in chronic disease management. | | CO4 | R | 1 |
| 9. | Name any two deep learning models available for medical image analysis. | | CO5 | R | 1 |
| 10. | State any two applications of Tele-Robotics in surgery and diagnostics. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe AI-Enabled telemedicine platform with an example. | | CO1 | U | 3 |
| 12. | Differentiate agglomerative clustering and divisive clustering. | | CO2 | An | 3 |
| 13. | Distinguish AI-assisted diagnosis with traditional radiology. | | CO3 | An | 3 |
| 14. | Illustrate AI-Enabled Telemedicine Platform. | | CO4 | U | 3 |
| 15. | Compare traditional image processing with deep learning models. | | CO5 | An | 3 |
| 16. | Explain interdisciplinary research and collaboration in AI and telemedicine. | | 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. | Examine AI applications in healthcare, such as radiology, disease diagnosis, and electronic health records (EHR),that impact clinical decision-making and patient outcomes, and identify the potential challenges in their adoption. | CO1 | A | 6 |
|  | b. | Illustrate the challenges and opportunities in integrating AI with telemedicine platforms. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Describe the below regulatory frameworks governing telemedicine and AI applications  a) Telemedicine Practice Guidelines (2020)  b) Digital Information Security in Healthcare Act (DISHA)  c) Information Technology Act (2000) and IT (Reasonable Security Practices and  Procedures and Sensitive Personal Data or Information) Rules  d) Personal Data Protection Bill (PDPB) | CO2 | U | 3  3  3  3 |
|  |  |  |  |  |  |
| 19. | a. | Explain the various common imaging modalities for Medical Imaging Interpretation. | CO3 | 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. | CO3 | An | 2  2  2 |
|  |  |  |  |  |  |
| 20. | a. | Explain the various international regulatory frameworks governing telemedicine and AI applications. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 21. | a. | A 45-year-old diabetic patient logs into a telehealth app for a routine check-up. The app has:   * An AI chatbot for initial screening. * A virtual assistant to schedule consultations. * An AI note-taker for doctors during the call.   Analyze the integration of AI-driven chatbots and virtual assistants in tele consultations. | CO4 | An | 6 |
|  | b. | A digital health initiative aims to develop an early detection system for cardiovascular diseases (CVDs) like hypertension, arrhythmias, and heart failure in at-risk populations (e.g., diabetics, elderly patients, or individuals with a family history of CVD). Illustrate a conceptual framework for detecting early signs of cardiovascular diseases using wearable devices, AI-driven analytics, and remote monitoring. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | 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 how each algorithm would process the patient's data to generate a risk prediction. | CO3 | A | 6 |
|  | b. | A regional healthcare network is implementing a smart hospital initiative to improve patient outcomes through advanced sensor technologies. The system will monitor inpatients across general wards, ICUs, and post-surgical recovery units. Analyze the key sensor technologies and IoT devices that should be deployed in each hospital unit, evaluating their specific applications. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Explain the architecture and data flow of a telemedicine platform, highlighting key components, security considerations, and integration with electronic health records (EHR). Provide a real-world example of how patient data moves from a remote consultation to diagnosis and follow-up. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Develop a use case where AR glasses assist in remote wound care management, enabling specialists to guide on-site nurses in real time. Illustrate the AI components that enhances this system. | CO6 | A | 6 |
|  | b. | A hiker in a remote mountain area suffers a severe leg fracture and internal bleeding after a fall. A wilderness medic arrives with a portable tele-robotic kit and AR glasses, connected to a trauma surgeon in a city hospital. Analyze the techniques for performing AI-powered Tele-Robotic surgery with AR guidance. | CO6 | An | 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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3005** | **Duration** | **3hrs** |
| **Course Title** | **ETHICAL HACKING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Describe the Cyber Kill Chain and its stages. Identify its role in strengthening cybersecurity defence strategies and how defenders can counteract attacks at each stage. | CO1 | R | 10 |
|  | b. | Compare and contrast **full vendor disclosure, full public disclosure, and coordinated disclosure.** | CO1 | An | 6 |
|  |  |  |  |  |  |
| 2. | a. | A security analyst detects unusual network traffic patterns in an organization. Explain how the analyst identifies and mitigates potential threats as part of the threat-hunting process. | CO2 | U | 10 |
|  | b. | Determine the benefits of a collaborative approach between Red and Blue teams in a Purple team framework. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. |  | Analyze advanced reverse engineering techniques for malware deobfuscation and binary analysis, highlighting the role of IDA Pro, Ghidra, and dynamic analysis frameworks. | CO3 | An | 16 |
|  |  |  |  |  |  |
| 4. |  | Analyze vulnerabilities in IoT devices across various communication protocols and wireless technologies, also propose effective mitigation strategies. | CO4 | An | 16 |
|  |  |  |  |  |  |
| 5. |  | Examine secure hypervisors' architecture, security challenges, and mitigation strategies, emphasizing their role in virtualization and cloud security. | CO5 | A | 16 |
|  |  |  |  |  |  |
| 6. |  | Illustrate the role of functions in modifying the flow of a program, including function calls, argument passing, return values, and memory flow with suitable code snippets. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | A financial institution experiences a data breach where attackers gain initial access through a phishing email containing a malicious attachment. The attackers then escalate privileges, move laterally across the network, and exfiltrate sensitive customer data. Using the MITRE ATT&CK Framework, illustrate how this attack can be mapped to specific tactics and techniques. Identify the stages of the attack and the corresponding mitigation strategies. | CO2 | A | 10 |
|  | b. | Analyze the impact of social engineering attacks in cybersecurity. | CO2 | An | 6 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Illustrate an attacker exploitation of Azure AD misconfigurations to escalate privileges and manage identities within an Azure environment. Suggest defensive measures to mitigate these risks. | CO6 | A | 10 |
|  | b. | **Illustrate** the security trade-offs of containerization and explain how vulnerabilities in container components can be exploited. | CO6 | An | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Describe the skill of ethical hacking and the tools |
| CO2 | Infer the skills being employed by professionals as they attack and defend networks. |
| CO3 | Discover the exploit on Windows and Linux systems. |
| CO4 | Practice hacking of the Internet of Things (IoT) and hardware devices |
| CO5 | Appraise hacking the hypervisors |
| CO6 | Employ hacking and security implications in emerging technologies of cloud. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3006** | **Duration** | **3hrs** |
| **Course Title** | **MALWARE ANALYSIS AND REVERSE ENGINEERING** | **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 malware based on their behaviors and objectives. | CO1 | U | 10 |
|  | b. | Express the architecture of ARM assembly in malware analysis. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 2. |  | Imagine a scenario where Vawtrak has infected a system, and the stolen data is encrypted before transmission. Illustrate a suitable technique to track the evolution of Vawtrak and decrypt the illegal acquisition of personal or confidential information. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 3. |  | Analyze few suspicious services running in the background of an infected system. Explain the procedure. | CO3 | An | 16 |
|  |  |  |  |  |  |
| 4. |  | Construct a strategy to detect and evade behavioral analysis for the given scenario: when a long-time, trusted employee, typically accessing company data during standard business hours from their usual work location, suddenly starts logging in from a foreign country at odd hours, accessing highly sensitive financial files that they normally wouldn't need, which would trigger an alert from a behavioral analytics system, indicating potential malicious activity or a compromised account, prompting further investigation by the security team. | CO4 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Explain the different types of sandboxes in Cybersecurity. | CO5 | U | 10 |
|  | b. | Discuss about dependent DLLs. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 6. |  | Explain different armoring techniques used to evade malware analysis. | CO4 | U | 16 |
|  |  |  |  |  |  |
| 7. | a. | Compare OllyDbg with IDA Pro. | CO3 | An | 8 |
|  | b. | Explain the role of Ghidra in malware analysis. | CO3 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | A user reports that their **Android phone is sending SMS messages** without their knowledge. **Examine and analyze the APK for malicious SMS-sending behavior.** | CO6 | An | 20 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Analyze different types of malware and will be able to set up safe environments for analysis. |
| CO2 | Identify the static and dynamic analysis procedures with relevant debugging methods. |
| CO3 | Describe the malware behavior and recognize the anti-reverse engineering techniques which prevent the identification of malware. |
| CO4 | Use the malware analysis tools to identify the malware attacks. |
| CO5 | Synthesize the malware samples by using Sandboxes. |
| CO6 | Examine Android and iOS malwares. |

A black background with red text

Description automatically generated

**END SEMESTER EXAMINATION – MAY / JUNE 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 (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the different types of IoT Networking components. | CO1 | U | 10 |
|  | b. | Compare different classes of Address management classes. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 2. | a. | Identify the type of actuators used in the following application:   1. Prosthetic arm 2. Valve control in water pipes. 3. Robotic arm 4. Wings of Planes 5. Mechanical switches 6. Fruit harvesting | CO2 | A | 10 |
|  | b. | Represent the working principle of actuators. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 3. | a. | A user wants to control home appliances remotely using voice commands via a mobile app. Choose MQTT to manage communication between the mobile app and IoT devices. | CO3 | A | 10 |
|  | b. | **Interpret** how the publish-subscribe model in MQTT improves energy efficiency in IoT networks. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 4. | a. | **Appraise** how LoRaWAN’s architecture influences its suitability for smart city applications. | CO3 | An | 8 |
|  | b. | **Compare** the messaging mechanisms of MQTT and CoAP in handling data communication. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | **Explain** the concept of an attack vector in IoT security and provide examples. | CO4 | U | 8 |
|  | b. | **Interpret** how a Man-in-the-Middle (MITM) attack can compromise IoT device communication. | CO4 | U | 8 |
|  |  |  |  |  |  |
| 6. | a. | **Design** an Arduino-based smart home system where sensors detect temperature and automatically control a fan. Include a pin diagram to show the sensor connections. | CO5 | C | 10 |
|  | b. | Compare the functions of analog and digital pins in Arduino. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 7. | a. | **Explain** the key components of a fog computing architecture. | CO5 | U | 10 |
|  | b. | **Compare** fog computing and edge computing in terms of data processing. | CO5 | An | 6 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | **Develop an** IoT-enabled surveillance system for smart transportation systems. | CO6 | C | 15 |
|  | b. | Summarize the challenges of implementing IoT in health sector. | CO6 | U | 5 |

**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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3019** | **Duration** | **3hrs** |
| **Course Title** | **DATA ANALYTICS AND VISUALIZATION** | **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 steps involved in data analytics, and enumerate the advantages and disadvantages of its various types, with relevant examples. | CO1 | U | 10 |
|  | b. | Illustrate the different data types in data science and their significance with examples. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 2. | a. | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Order\_ID | Customer Name | Age | Email | Purchase\_Amount ($) | Date | Product | Feedback | | 101 | John Doe | 25 | johndoe@email.com | 250.5 | 2024/02/30 | Laptop | Good | | 102 | Mary Smith | NaN | mary\_smith@.com | -50 | 02-15-2024 | Mobile Phone | Excellent | | 103 | NULL | 40 | peter@gmail.com | 320.75 | 2024-13-10 | Tablet | NULL | | 104 | Alice Brown | 29 | alicebrown@email | 540 | 20-10-2024 | NULL | Poor | | 105 | Bob Johnson | 22 | bob.johnson@email.com | 0 | 12-05-2024 | Headphones | Fair | | 106 | NULL | 30 | sam@website.com | 1000 | 2024-06-31 | Smartwatch | Good | | 107 | Chris Evans | -5 | chris\_evans@email.com | 85.2 | 2023-14-25 | Gaming Mouse | NULL | | 108 | Nancy Drew | 27 | nancy.drew.email.com | 420.3 | 18-09-2024 | Keyboard | Excellent | | 109 | Steve Adams | 35 | steve@email.com | NaN | 07-08-2024 | Laptop | Poor | | 110 | Olivia Ford | 28 | olivia\_ford@email.com | 310 | 15-07-2024 | Mobile Phone | NULL |   The dataset below contains various data quality issues such as missing values, incorrect formatting, invalid data entries, and inconsistencies.   * **Identify** the various data quality issues present in the dataset. * Apply the appropriate data-cleaning techniques to correct these issues. * Describe how cleaning the data will improve its quality for analysis and decision-making. | CO1 | A | 10 |
|  | b. | Explain discriminant analysis and detail one of its types. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. | a. | A study assigns **100 participants** to either a **yoga group** or a **running group,** measuring their stress and sleep quality afterward. Analyze the following facts using Manova.   * Determine whether there is a significant difference between the groups. * Analyze whether **exercise type** influences both **stress levels** and **sleep quality**. | CO2 | An | 10 |
|  | b. | Describe Bayes theorem and its Beta distribution with a suitable visualization. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 4. | a. | Explain the four main steps of Factor Analysis: computing the correlation matrix, extracting initial factors, performing factor rotation, and making final decisions on the number of underlying factors to retain. Discuss the significance of factor rotation in clarifying the factor structure and improving the interpretability of results. Apply factor analysis in a real-world context, such as identifying underlying customer satisfaction dimensions in a retail service survey. | CO2 | A | 10 |
|  | b. | | **Customer ID** | **Age** | **Annual Income ($)** | **Purchased (1 = Yes, 0 = No)** | | --- | --- | --- | --- | | 1 | 22 | 25000 | 0 | | 2 | 35 | 50000 | 1 | | 3 | 29 | 42000 | 0 | | 4 | 40 | 60000 | 1 | | 5 | 50 | 80000 | 1 | | 6 | 23 | 28000 | 0 |   An online website wants to predict whether a customer will purchase a product (Yes = 1, No = 0) based on their age and annual income. Construct a **Logistic Regression** model and determine the probability of purchase for a new customer’s age is 67. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 5. | a. | A company is analyzing customer behavior based on two factors: **X1 (Annual Spending in $1000s)** and **X2 (Customer Engagement Score)**. The company wants to classify customers into two groups:   |  |  |  | | --- | --- | --- | | **Annual Spending (X1)** | **Engagement Score (X2)** | **Customer Group (Y)** | | 2 | 3 | 0 | | 3 | 3 | 0 | | 3 | 4 | 0 | | 5 | 6 | 1 | | 6 | 7 | 1 | | 7 | 8 | 1 | | 8 | 8 | 1 | | 2 | 1 | 0 | | 4 | 2 | 0 | | 6 | 5 | 1 |  * **Group 0**: Low-value customers * **Group 1**: High-value customers   The collected data is as follows:  Using a **Support Vector Machine (SVM)**, determine the best **hyperplane (decision boundary)** that separates the two customer groups.   * Identify the **support vectors**. * Calculate the **hyperplane equation** in the form of   **w₁X₁ + w₂X₂ + b = 0**.   * Sketch the hyperplane and mark the margin lines. | CO3 | A | 10 |
|  | b. | For the given data:  8,10,13,26,26,28,30,33,34,34,35,36,43,50,59   * Determine the five-number summary for the given dataset. * Construct a boxplot and histogram to visually represent the distribution of the given dataset. * Calculate the interquartile range (IQR) method for the given dataset. * Identify outliers in the given dataset using the interquartile range (IQR) method. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 6. |  | Illustrate the following Tableau features in detail, providing examples of their usage:  1. Data Blending  2. Join  3. Union  4. Calculated Fields  5. Dashboard Actions  6. Filters (Dimension, Measure, Context, and Extract Filters)  7. Forecasting and Trend Analysis  8. Geospatial Mapping | CO4 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | Compute sentiment analysis on customer reviews for a product purchase using the NLTK toolkit. | CO5 | A | 10 |
|  | b. | Evaluate the impact of Avro, pig, Spark SQL, Spark MLlib, Spark Streaming, and Spark GraphX in large-scale data processing and machine learning workflows. | CO5 | A | 6 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | **Compare** the key differences between Real-Time data analytics and streaming analytics and analyze their applications in any two use cases. | CO6 | A | 10 |
|  | b. | Analyze the principles, approaches, and techniques of Explainable AI (XAI) in enhancing transparency and interpretability of the model. | CO6 | An | 10 |

**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 | Evaluate 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 – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **24CS3034** | **Duration** | **3hrs** |
| **Course Title** | **OPTIMIZATION TECHNIQUES** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the different type of optimization techniques and illustrate each type with a relevant example. | CO1 | A | 12 |
|  | b. | Discuss the applications of optimization in the fields of engineering and economics. | CO1 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | A dietician wishes to mix two types of food F1 and F2 in such a way that the vitamin contents of the mixture contains atleast 6units of vitamin A and 9 units of vitamin B. Food F1 costs Rs.50 per kg and F2 costs Rs.70 per kg. Food F1 contains 4 units per kg of vitamin A and 6 units per kg of vitamin B while food F2 contains 5 units per kg of vitamin A and 3 units per kg of vitamin B. Formulate the above problem as a linear programming problem to minimize the cost of mixture. | CO2 | A | 12 |
|  | b. | Compute the following using simplex method.  max z = x+2y  Sub to x + 4y ≤ 8 x + y ≤ 12  x, y ≥ 0 | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Explain the Steepest Descent Method for unconstrained optimization. Derive the update rule and apply it to minimize the function f(x,y) = x2+y2 starting from an initial point (x0,y0) = (1,2) for two iterations. | CO3 | A | 12 |
|  | b. | Explain the Conjugate Gradient Method with suitable example. | CO3 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | A courier company needs to determine the shortest route for a delivery agent who must visit five cities exactly once and return to the starting point. The distance between each pair of cities is given in the table below:  **Distance Matrix (in km)**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Cities** | **C1** | **C2** | **C3** | **C4** | | **C1** | - | 20 | 30 | 10 | | **C2** | 20 | - | 16 | 4 | | **C3** | 30 | 16 | - | 5 | | **C4** | 10 | 4 | 5 | - |   **Analyze** the given scenario and **formulate it as a Travelling Salesman Problem (TSP)** using **Integer Linear Programming** including the **objective function, decision variables,** and **constraints** (including subtour elimination) and **identify a suitable optimization method** to solve the problem. | CO4 | A | 12 |
|  | b. | Compute the minimization of the function f(x,y) = x2+y2 using the Steepest Descent Method. Start from the point (1,1) and perform two iterations with step size α = 0.1. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. | a. | Illustrate the working principle of Simulated Annealing (SA) and the application of the annealing concept to solve optimization problems. | CO5 | A | 12 |
|  | b. | Compute the updated velocity and position of the particle which starts at position x=2 with velocity v=1. The particle’s personal best is xp=2 and the global best is xg=0. Use the PSO update rule with w=0, c1=c2=1 and random values r1=0.7, r2=0. | CO5 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Solve the following Linear Programming Problem using the Graphical Method. Maximize Z=3x+5y  Subject to:  x+2y ​≤10  3x+y ≤15  x, y ≥0​ | CO2 | A | 8 |
|  | b. | A manufacturing company aims to minimize production costs while satisfying product demand and adhering to resource limitations. The initial basic feasible solution violates one of the resource constraints, although the objective function appears optimal.  Analyse the concept of duality in linear programming in the context of this scenario, emphasizing the structure of primal and dual problems, the interpretation of dual variables, and the suitability of the dual simplex method in addressing the infeasibility of the initial solution. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 7. | a. | Explain the Penalty Function Method for constrained optimization to convert a constrained problem into an unconstrained one. Give Example. | CO4 | A | 12 |
|  | b. | Apply Newton’s Method to minimize the function f(x) = x2−4x+4. Start from x0= 0 and perform two iterations. | C04 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Analyze the process of formulating and solving a linear programming problem using MATLAB and justify the suitability of this tool with respect to user-friendliness, flexibility, and scalability. | CO6 | An | 8 |
|  | b. | Analyse the given scenario and identify a suitable optimization technique that can be implemented using Python. Formulate the necessary constraints to arrive at the optimal solution and explain the approach.  **Scenario:** A logistics company aims to minimize the transportation cost of delivering goods from three warehouses to four retail outlets. Each warehouse has a limited supply, and each retail outlet has a fixed demand. The cost per unit for transportation between each warehouse and retail outlet is known. The company wants to use an optimization technique to determine the optimal quantity of goods to be transported from each warehouse to each outlet. | CO6 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Analyze the use of Python’s Pyomo and Excel Solver in solving a finance-based optimization problem, and state their respective advantages and limitations in terms of modeling capabilities, scalability, and integration with data workflows. | CO6 | An | 10 |
|  | b. | Explain the use of gradient-based optimization methods like SGD and Adam in training a neural network for image classification. Compare their performance with traditional solvers such as SciPy’s minimize, focusing on convergence speed, scalability, and suitability for this application. | CO6 | An | 10 |

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

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Use the techniques of optimization in solving real-world problems. |
| CO2 | Evaluate LP problems to assess solution robustness. |
| CO3 | Develop gradient-based methods for unconstrained and constrained optimization problems. |
| CO4 | Develop integer linear programming models solve combinatorial optimization problems. |
| CO5 | Demonstrate evolutionary algorithms and compare their strengths and limitations for different optimization problems. |
| CO6 | Evaluate real-world optimization in practical scenarios to address complex, multidimensional problems. |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 8 | 12 |  |  |  | 20 |
| CO2 | - |  | 28 | 12 |  |  | 40 |
| CO3 | - |  | 20 |  |  |  | 20 |
| CO4 | - |  | 40 |  |  |  | 40 |
| CO5 | - |  | 20 |  |  |  | 20 |
| CO6 | - |  |  | 40 |  |  | 40 |
| Total | | | | | | | **180** |