

Roll No.

Total Pages : 04

BT-3/D-25

43228

APPLIED STATISTICAL ANALYSIS
FOR AI
BS-CS-AIML-201A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all by selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) What are the basic steps involved in the research process ? Illustrate with a suitable example. 8
- (b) What is the difference between a Census Method and a Sampling Method ? Discuss the advantages and disadvantages of each. 7
2. (a) Differentiate between the following terms with suitable examples : 8
 - (i) Experimental Data and Survey Data
 - (ii) Independent and Dependent Variables.

- (b) The following are the marks obtained by 10 students in a test :

45, 50, 55, 60, 40, 35, 50, 60, 70, 65

Calculate : 7

- (a) Mean
(b) Median
(c) Mode.

Unit II

3. (a) Explain different Measures of Central Tendency and Measures of Dispersion with examples. Why are both necessary in data analysis ? 8
- (b) Determine the value c so that the following function can serve as a probability distribution of the discrete random variable x : 7
- $f(x) = c(x^2 + 4)$, for $x = 0, 1, 2, 3$;
4. (a) Define estimator and estimate. Give an example of a point estimate for a population mean. 8
- (b) Construct a probability distribution for the number of heads in 2 tosses of a coin. 7

Unit III

5. (a) The following are the processing times (in seconds) for 9 AI algorithms : 8
12.5, 14.8, 13.2, 15.5, 14.1, 13.8, 12.9, 14.6, 13.5.
(i) Calculate sample variance.
(ii) Calculate sample standard deviation
- (b) Define Null and Alternative Hypothesis. Explain steps involved in Hypothesis Testing with suitable examples. 7
6. What is Analysis of Variance (ANOVA) ? Explain its types, applications, and discuss how it is used to compare more than two population means, with an appropriate example ? 15

Unit IV

7. A study was made on the amount of converted sugar in a certain process at various temperatures. The data were coded and recorded as follows : 15

Temperature (x)	Converted Sugar (y)
1.0	8.1
1.1	7.8
1.2	8.5

1.3	9.8
1.4	9.5
1.5	8.9
1.6	8.6
1.7	10.2
1.8	9.3
1.9	9.2
2.0	10.5

- (a) Estimate the linear regression line.
- (b) Estimate the mean amount of converted sugar produced when the coded temperature is 1.75.
- (c) Plot the residuals versus temperature

8. Write short notes on the following : **15**

- (a) Neural Networks
- (b) Polynomial Regression Models.



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**DATA STRUCTURE
ES-CS-AIML-203A**

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Write algorithm for binary search and analyze its time complexity. **10**
- (b) Differentiate between best, average, and worst-case analysis of an algorithm. **5**
2. Write algorithms for Selection sort and Insertion sort. Compare their complexities. **15**

Unit II

3. (a) Define stack. Write algorithms for PUSH and POP operations using arrays. **8**

- (b) Explain the implementation of a circular queue using an array. 7
4. (a) Write algorithms for Merge Sort and Quick Sort. 8
- (b) Discuss different types of queues and explain the implementation of priority queue. 7

Unit III

5. (a) Write an algorithm to insert a node at the end of a singly linked list. 8
- (b) Explain in detail the implementation of singly linked list. 7
6. Write algorithms for performing insertion, deletion and traversal in a circular linked list. 15

Unit IV

7. (a) Explain BFS algorithm and differentiate BFS and DFS. 8

- (b) Define binary tree and explain different types of binary trees. 7
8. (a) Write algorithms for preorder, inorder and postorder traversal of a binary tree. 8
- (b) Explain Dijkstra's algorithm for finding the shortest path in a weighted graph. 7



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OBJECT ORIENTED PROGRAMMING
PC-CS-AIML-205A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) What do you understand by Data Abstraction ?
What are the advantages of using an Object Oriented approach to develop the software ? 8
- (b) What is the difference between compile time and run time polymorphism ? Explain using suitable examples. 7
2. (a) What is a class ? What is the relationship between object and class ? Write a program that shows how to access member functions and how to create and access object in C++. ? 10

- (b) What is the concept of namespace in C++ ? Explain its importance. 5

Unit II

3. (a) What do you understand by Visibility Modifiers ? Discuss the access control to the public, private and protected members of derived class in case of public derivation, private derivation and protected derivation. 8
- (b) What is the use of friend functions ? Write a code in C++ to access friend class. 7
4. (a) Describe the working of constructors and destructors in Inheritance. 7
- (b) Explain the concept of Dynamic memory allocation and deallocation using new and delete keywords. 8

Unit III

5. (a) What is operator overloading ? Write a program in C++ to overload the + operator as a friend function. 10
- (b) Under what circumstances overloading using friend function becomes necessary. 5

6. (a) Why do we use Virtual functions ? Explain. 7
(b) When do we make a virtual function 'pure'. What are the implications of making a function a pure virtual function ? 8

Unit IV

7. (a) What is an exception ? Explain exception handling mechanism of C++ with suitable example. 8
(b) Write a function template for finding the maximum value in an array. 7
8. Write short notes on the following : 15
(a) Explain sequential and random file operations.
(b) Rethrowing an exception
(c) Exception and Inheritance.



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INTRODUCTION TO AI

PC-CS-AIML-207A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Discuss case study on Dialogflow. 7
- (b) Discuss the history of AI. 8
2. (a) What are different languages used in AI ? Discuss it with example. 8
- (b) Explain the role of multi agents in AI. 7

Unit II

3. (a) Difference between Optimization search and Adversarial Search. Explain. 8
- (b) Discuss case study on health care system. 7

4. (a) Write and explain alpha beta search algorithm. 7
(b) Discuss the various Heuristic and informed search strategies. 8

Unit III

5. (a) Differentiate Bayesian and temporal reasoning with example. 7
(b) Distinguish propositional logic and predicate logic. Write backward chaining algorithm. 8
6. (a) Discuss the role of AI in Medical diagnosis with example. 7
(b) Differentiate web mining and data mining with example. 8

Unit IV

7. (a) Describe the significance of AI in creativity. 7
(b) Discuss the role of AI in agriculture. 8
8. (a) Discuss the role of AI in space exploration. 8
(b) Explain the role of AI in banking. 7

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PROGRAMMING LANGUAGE

ES-CS-AIML-209A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Write few characteristics of a good programming language. 5
- (b) Explain in detail Compiler and Interpreter. 10
2. Explain the concept of general problem and formal method of describing syntax. 15

Unit II

3. (a) How is Declaration and Type checking of data structure done. 10
- (b) Explain the term Generic Subprograms. 5
4. Explain the following : 15
 - (a) Abstraction
 - (b) Encapsulation
 - (c) Overloaded subprograms

Unit III

5. (a) Explain the concept of Monitors and Message passing. 7.5
(b) Explain Implicit and Explicit Sequence Control. 7.5
6. Explain the following : 15
(a) Exception Handlers
(b) Co-routines
(c) Local referencing environment

Unit IV

7. (a) Differentiate between procedural and non-procedural languages. 7.5
(b) Explain the concept of Static Storage Management. 7.5
8. Explain the concept of Stack Based Storage Management in detail. 15



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**BUSINESS INTELLIGENCE AND
ENTREPRENEURSHIP
HM-902A**

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. Write a detailed note on classification of entrepreneurs in India. **15**
2. Discuss the various EDP programmes conducted by the government to promote the culture of entrepreneurship. **15**

Unit II

3. Discuss the purpose of Industry Analysis. Identify the competitive forces that determine industry profitability. Demonstrate with a with the help of competitor analysis model. **15**

4. Discuss the steps involved in project planning technique PERT CPM. Also list the difference between PERT and CPM. 15

Unit III

5. Discuss the objectives and scope of SSI. What are the steps involved in their registration and getting NOC from pollution board ? 15
6. List the salient features of MSME Act, 2006. Also discuss the MSME schemes implemented by the government in India. 15

Unit IV

7. Explain the functions and objectives of NSIC, NISBUD, SIDBI. 15
8. Write a detailed note on Venture Capital financing. Also discuss various venture capital financing schemes offered by financial institutions in India. 15



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AUTOMATA

Paper : PC-CS-AIML-301A

Time : Three Hours] [Maximum Marks : 75

Note : Each Question carry equal marks and attempt any *five* questions out of Eight Questions by selecting atleast one question from each Unit.

UNIT-I

1. Construct and explain a finite automaton (FA) that accepts all strings over the alphabet $\{0,1\}$ that end with the substring "01". Provide both DFA and NFA representations. 15
2. Differentiate between Regular Languages, Context-Free Languages, and Context-Sensitive Languages. Provide examples of each. 15

UNIT-II

3. Describe the Chomsky Hierarchy of languages and grammars. Discuss the relationship between each level with suitable examples. 15

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4. State and prove the Pumping Lemma for Regular Languages. Use it to show that the language $L = \{0^n 1^n \mid n \geq 0\}$ is not regular. 15

UNIT-III

5. Design a Moore machine to generate 1's complement of a given binary number. 15
6. What is deterministic push down automata and Construct a pushdown automaton (PDA) that accepts the language $L = \{a^n b^n \mid n \geq 0\}$ by empty stack. Provide both transition table and diagram. 15

UNIT-IV

7. What is use of turing machine. Design a turing machine for addition of binary numbers. 15
8. Define decidability and undecidability. Explain with examples two undecidable problems related to Turing Machines. 15

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DESIGN AND ANALYSIS OF ALGORITHMS

Paper : PC-CS-AIML-303A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

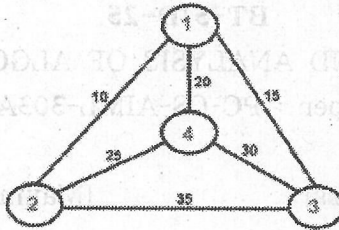
1. (a) Explain the need for algorithm efficiency. Compute the Best-case, Worst-case, and Average-case time complexity of sequentially searching the array of numbers {20, 10, 15, 5, 25}. (7)
- (b) Write the formal algorithm for the Insertion sort and compute its Best-case, Worst-case, and Average-case time complexity. Use Insertion sort algorithm to sort the array of numbers {75, 35, 45, 10, 20, 50}. (8)
2. (a) Differentiate between Bigoh and omega notation with example. (7)
- (b) Explain the properties of an algorithm with an example. (8)

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UNIT-II

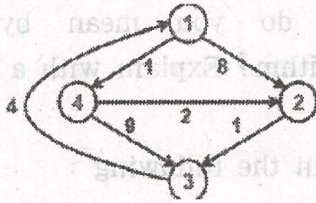
3. (a) Apply Dynamic Programming to solve the given travelling salesperson problem. (7)



- (b) Give the algorithm for matrix multiplication and find the time complexity of the algorithm using step-count method. (8)
4. (a) Give the algorithm for transpose of a matrix $m \times n$ and determine the time complexity of the algorithm by frequency - count method. (7)
- (b) Write short notes on the following :
- (i) Binomial Heap.
 - (ii) Splay Tree.
 - (iii) Fibonacci Heap.
 - (iv) Huffman Code. (2*4=8)

UNIT-III

5. (a) Find the shortest path between all pairs of vertices for the given graph using the Floyd-Warshall algorithm and describe its complexity analysis (7)

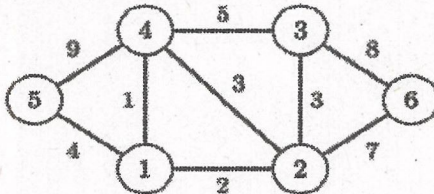


(b) How are P and NP problems related? State and explain cook's theorem. (8)

6. (a) Explain the following :

- (i) Class P.
- (ii) Class NP.
- (iii) NP Complete Problem.
- (iv) NP Hard Problem. (2+2+2+2=8)

(b) Apply Prim's algorithm to obtain a minimum cost spanning tree for the given graph. (7)



UNIT-IV

7. (a) How to search an answer node in branch and bound using Least Cost Search? Explain. (7)

(b) What do you mean by Flow Network? Justify with an example. (8)

8. (a) What do you mean by Ford-Fulkerson Algorithm? Explain with a suitable example. (7)

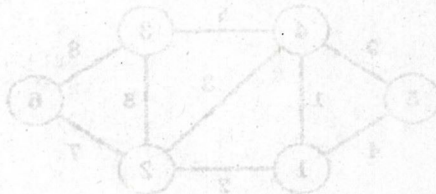
(b) Explain the following :

(i) Comparison Network.

(ii) Zero One Principle.

(iii) Merging Network.

(iv) Bitonic Sorting Network. (2+2+2+2=8)



UNIT-IV

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COMPUTER NETWORK

Paper-ES-CS-AIML-305A

Time : Three Hours]

[Maximum Marks : 75

Note : There are 8 questions in this question paper. Students are required to attempt any five questions.

1. Answer each part in brief. Each question carries 3 marks :
 - (a) Differentiate between star and mesh topology.
 - (b) Differentiate between circuit switching and packet switching.
 - (c) What is the use of Repeaters?
 - (d) Discuss MAC sublayer design issues.
 - (e) Explain the role of DNS.

2. What do you mean by Data Communication? Explain different guided and unguided transmission media in detail. (15)

3. Discuss different layer of ISO-OSI Reference Model. (15)

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4. (a) Differentiate between CSMA and CSMA/CD. (5)
(b) Explain different network devices. (10)
 5. (a) Discuss different error detection and correction methods. (8)
(b) Differentiate between pure ALOHA and Slotted ALOHA. (7)
 6. Differentiate between distance vector routing and link state routing. How they work? (15)
 7. Write short notes on following :
 - (a) Internet Addresses and subnetting. (8)
 - (b) Differentiate between IPv4 and IPv6. (7)
 8. (a) What is HTTP? Discuss Non-Persistent and Persistent connections of HTTP. (8)
(b) What is the difference between symmetric key and asymmetric key cryptography? Explain with the help of an example. (7)
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ARTIFICIAL NEURAL NETWORKS

Paper-PC-CS-AIML-307A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Explain the biological prototype of a neuron and compare it with an artificial neuron model. (8)
- (b) Discuss the characteristics and applications of artificial neural networks in modern computing systems. (7)
2. Explain the working of a single-layer and multi-layer neural network with suitable diagrams. (15)

UNIT-II

3. (a) Explain the architecture and training process of a Hopfield network. (8)

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(b) Explain the concept of image classification using neural networks. (7)

4. What are Bi-directional Associative Memories (BAM)? Explain their structure, training, and retrieval process with a suitable example. (15)

UNIT-III

5. Discuss the working principle of a Hopfield network using electro-optical matrix multipliers. (15)

6. Discuss the architecture, classification operation, and characteristics of ART networks in detail. (15)

UNIT-IV

7. (a) Explain the architecture of CNNs with suitable diagram and mathematical expressions. (8)

(b) Discuss various optimization techniques used in training deep neural networks. (7)

8. (a) What is LSTM network? How does it overcome the vanishing gradient problem? (7)

(b) Explain the role of Regularization and Dropout techniques in improving the performance of deep learning models. (8)

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COMPUTER ARCHITECTURE

Paper-ES-CS-AIML-309A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions in all selecting at least *one* question from each unit.

UNIT-I

1. (a) Explain the Von Neumann architecture in detail with a neat diagram. (7)
- (b) Explain the functional units of a computer system and describe how they interact during instruction execution. (8)
2. Describe Booth's multiplication algorithm with an example. How is it better than the conventional multiplication algorithm? (15)

UNIT-II

3. (a) Explain the concept of stored program organization. (7)
- (b) Describe the common bus system using a block diagram. (8)

4. Differentiate between hardwired and micro-programmed control unit. Explain with diagrams.

(15)

UNIT-III

5. Explain various addressing modes with suitable examples.

(15)

6. (a) Discuss the CISC and RISC architectures. Compare their features and design philosophies.

(8)

- (b) Explain the concept of instruction pipelining and identify factors that cause pipeline hazards.

(7)

UNIT-IV

7. (a) What is Direct Memory Access (DMA)? Explain the DMA transfer process with a neat diagram.

(8)

- (b) Write short notes on DMA controller and priority interrupt system.

(7)

8. Explain the modes of data transfer and compare programmed I/O with interrupt-driven I/O.

(15)

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ARTIFICIAL INTELLIGENCE AND
MACHINE LEARNING

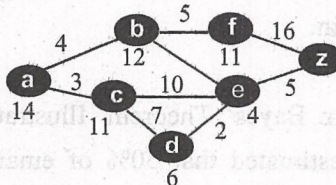
Paper : PC-CS-AIML-311A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Define Artificial Intelligence and list the task domains of Artificial Intelligence. (7)
- (b) Explain the Knowledge-based agents with an algorithm and explain the TELL and ASK functions used for same. (8)
2. (a) State and explain algorithm for Best First Search Algorithm with an example. (7)
- (b) Apply the A* search to find the solution path from a to z. Heuristics are with nodes, and cost is with edges. Write all steps as well as open and closed lists for full marks. (8)



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UNIT-II

3. (a) Describe the issues of Knowledge Representation. Justify with example. (7)
- (b) Explain Backward Chaining algorithm with an example. (8)
4. (a) What do you mean by Modus Ponens and Tolens? Justify with an example. (7)
- (b) Write short notes on the following :
- (i) Rule based system.
 - (ii) Game Tree.
 - (iii) Minmax Algorithm.
 - (iv) Frames. (2×4=8)

UNIT-III

5. (a) Consider two fuzzy subsets of the set $X, X = \{a, b, c, d, e\}$ referred to as A and B. $A = \{1/a, 0.3/b, 0.2/c, 0.8/d, 0/e\}$ and $B = \{0.6/a, 0.9/b, 0.1/c, 0.3/d, 0.2/e\}$
- Find :
- (i) Complement.
 - (ii) Union.
 - (iii) Intersection. (4+4+4=12)
- (b) Discuss the application of Artificial Intelligence. Explain. (3)
6. (a) Explain Bayes' Theorem. Illustrate with the formula. It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam

emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive (a non-spam email detected as spam) is 5%. If an email is detected as spam, then what is the probability that it is in fact a non-spam email? (7)

- (b) Explain the frame-based knowledge representation. Justify with example. (8)

UNIT-IV

7. (a) Give an example of how specific clustering methods can be integrated, for example, where one clustering algorithm is used as a preprocessing step for another. (7)

- (b) What is a labelled dataset? How is it used in supervised learning? Give an example. (8)

8. Suppose that the data mining task is to cluster the following eight points with (x, y) representing location into three clusters: $A_1(2, 10)$, $A_2(2, 5)$, $A_3(8, 4)$, $B_1(5, 8)$, $B_2(7, 5)$, $B_3(6, 4)$, $C_1(1, 2)$, $C_2(4, 9)$: The distance function is Euclidean distance. Suppose initially we assign A_1 , B_1 , and C_1 as the center of each cluster, respectively. (a) Write down k-means algorithm (b) Apply k-means algorithm for the three cluster centers after the first round execution (c) Find the final three clusters.

[4+6+5= 15]

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47394

BT-7/D-25

UNIVERSAL HUMAN VALUES-II :

UNDERSTANDING HARMONY

Paper-HSS-403A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions selecting at least *one* question from each unit.

UNIT-I

1. Define value education and skill education. Discuss their order of priority in your life. Discuss the guidelines for value education. (5+5+5=15)

2. What does a fulfilling life mean to you? List out the top five desires which comes to your mind while thinking of fulfilling life. Connect these desires to your basic aspirations. (7+8=15)

UNIT-II

3. List your 10 desires and classify them based on Self or body. Differentiate between various sources of imagination. Classify your desires based on the source of their imagination. (5+5+5=15)

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4. Discuss your program of self regulation in detail with suitable examples. Discuss the harmony of self also. (10+5=15)

UNIT-III

5. Discuss the concept of right, over and under evaluation within self. How this evaluation leads to harmony/disharmony in human self? Discuss the feeling of trust as foundation value of the relationship.

(8+7=15)

6. Write short notes on :

(a) Affection and Care.

(b) Love as complete value.

(c) Justice in relationship.

(5+5+5=15)

UNIT-IV

7. Discuss the concept of existence as coexistence. Discuss the strategy to achieve universal human order through human values.

(8+7=15)

8. Discuss the various orders of nature with their properties. Discuss the harmony between them and role of human being in maintaining this harmony.

(8+7=15)

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47420

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DATA SCIENCE WITH R PROGRAMMING

Paper : PC-CS-AIML-401A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Explain any two benefits of data science in big data implementations. Illustrate with practical examples. (8)
- (b) Define Data Science. Explain its historical evolution and how it relates to other fields. (7)
2. (a) Explain different data types and forms used in Data Science. Illustrate with examples the importance of data preprocessing in any one practical scenario. (8)
- (b) Explain data integration and data reduction. Illustrate discretization with a suitable example. (7)
3. (a) Explain descriptive statistics with reference to measures of central tendency and dispersion. (8)

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- (b) What is data visualization? Explain any three data visualization libraries or tools and their use cases. (7)
4. (a) Describe conditional probability and Bayesian probability. Illustrate with a scenario in data science. (8)
- (b) Define measures of frequency, central tendency, dispersion, and position with examples. (7)
5. (a) Write short notes on strings in R. How are strings read and manipulated? Give examples. (7)
- (b) Describe basic syntax, reserved words, constants, and operators in R. How do comments help in R scripting? (8)
6. (a) Describe the concept of Data Frames in R. How is data type conversion performed in R? (8)
- (b) Explain data type conversion in R with an example and specify its importance in data analysis. (7)
7. (a) Discuss the steps involved in reading and writing external data files using R. (8)
- (b) Describe the process for installing and loading the xlsx package in R. Why is data import from Excel important in Data Science? (7)

8. (a) Briefly explain linear regression, logistic regression and clustering methods in machine learning for data science. (8)
- (b) Write a short note on data science applications in Healthcare OR Ecommerce with a relevant case study. (7)
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Total Pages : 3

47422

BT-7/D-25

ROBOTICS AND INTELLIGENT SYSTEMS

Paper : OE-CS-AIML-401

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Explain the main characteristics of robots and describe their roles in the manufacturing industry. 8
- (b) A factory considers deploying mobile robots for material handling. List and justify four basic tasks these robots must perform, and discuss two major challenges in robotics that impact reliability on the shop floor. 7
2. (a) Discuss the major challenges that researchers and engineers face in the field of robotics today. 8
- (b) Trace the history of robotics from its inception to the modern era. Discuss the key characteristics that define a robot. 7

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3. (a) How do degrees of freedom (DOF) influence robot classification? 8
- (b) Discuss the role of actuators and drive systems in robot components. Differentiate between hydraulic and electric actuators with examples. 7
4. (a) What is the function of sensors and transducers in a robot? Describe the working principle of any two types of sensors used in modern robotics. 8
- (b) Outline the components of a robot's end effector and manipulator. 7
5. (a) Discuss the significance of knowledge acquisition and computational intelligence in the development of intelligent systems. 7
- (b) Explain Bayesian updating for uncertainty in robotics, with an example involving sensor error. 8
6. (a) What is "conflict resolution" in a rule-based system? Describe at least two different strategies used to resolve conflicts when multiple rules can be fired simultaneously. 8
- (b) Compare and contrast forward-chaining and backward-chaining strategies used in rule-based systems. 7

7. (a) Explain the concepts of fuzzy sets and fuzzy logic in the context of possibility theory. How do fuzzy systems differ from traditional binary logic systems? 9
- (b) Design a two-rule Mamdani system for mobile robot speed control with input "distance to obstacle" and output "speed", including membership functions and rule base; outline defuzzification choice. 6
8. (a) Explain data abstraction, inheritance, and encapsulation in object-oriented systems. 8
- (b) What is the Unified Modelling Language (UML)? Describe its role in object-oriented system design and analysis. 7
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BT-7/D-25

SOFT COMPUTING

Paper-PE-CS-AIML-417A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. Discuss the major areas and real-world applications of Soft Computing. Explain how these areas contribute to intelligent system design? (15)
2. Explain in detail the difference between Hard Computing and Soft Computing with suitable examples. Discuss how Soft Computing techniques overcome the limitations of Hard Computing. (15)

UNIT-II

3. (a) Explain the working of Backpropagation Neural Networks (BPNN). (8)
- (b) Discuss different activation functions and

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learning rules used in Neural Networks with suitable examples. (7)

4. Describe in detail the Adaptive Resonance Theory (ART) and Self-Organizing Maps (SOM). Compare their learning approaches and applications. (15)

UNIT-III

5. What are membership functions in fuzzy systems? Explain their significance and different methods of determining membership value. (15)

6. Explain Fuzzy Logic and Fuzzy Sets in detail. Discuss their properties and operations with suitable examples. (15)

UNIT-IV

7. Explain the working principle of Genetic Algorithms (GA). Discuss the role of selection, crossover, and mutation operators in GA optimization. (15)
8. Write short notes on the following :
- (a) Genetic Fuzzy Rule-Based Systems.
 - (b) Bitwise Operation in GA.
 - (c) Multi-level Optimization and Convergence in GA. (15)

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BT-7/D-25

DEEP LEARNING

Paper : PE-CS-AIML-423A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Explain the process of building a machine learning algorithm with a suitable example.
(b) Discuss the Maximum Likelihood Estimation (MLE) technique and its role in machine learning models. (15)
2. Differentiate between Gradient Descent and Stochastic Gradient Descent. Illustrate their convergence behavior. (15)

UNIT-II

3. Compare different activation functions: ReLU, LReLU, and EReLU. Discuss their advantages and disadvantages. (15)

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4. (a) Describe Restricted Boltzmann Machines (RBM). How are they used in unsupervised training of neural networks?
- (b) Discuss various applications of Deep Learning in real-world problems such as image recognition and NLP. (15)

UNIT-III

5. Explain the architectural overview of CNNs. Describe the function of layers and filters in CNNs. (15)
6. Describe the working of convolution and pooling layers with suitable diagrams and examples. (15)

UNIT-IV

7. Explain the architecture and working of DenseNet and PixelNet. Highlight their differences from conventional CNNs. (15)
 8. What are Long Short-Term Memory (LSTM) networks? Explain their internal structure and applications. (15)
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47431**BT-7/D-25****WORKING WITH RASPBERRY PI &
ARDUINO PLATFORM****Paper : PE-CS-AIML-425A****Time : Three Hours]****[Maximum Marks : 75**

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Explain the basic structure and working of Microcontroller. How does it differ from a Microprocessor in terms of design and purpose. (8)
- (b) Discuss the functioning of an IOT system with neat diagram. Describe how data is collected, processed and transmitted in IOT. (7)

2. (a) What is an Embedded System? Explain the basic components of an Embedded System. (8)
- (b) Write in detail the responsibilities of MQTT and HTTP protocols used in IoT. (7)

UNIT-II

3. (a) Discuss the working of Arduino and how digital and analog pins are used for interfacing with external devices. (8)
- (b) Discuss the logical and Bitwise operators in Arduino with their syntax and examples. (7)
4. (a) Write a short note on the data types used in Arduino programming. Give suitable examples. (5)
- (b) Discuss the development of an Arduino-based home security and monitoring system. Explain how sensors and actuators are interfaced with Arduino. (10)

UNIT-III

5. (a) Describe the pin layout of Raspberry Pi and explain the function of power, ground and communication pins. (8)
- (b) Explain the control statements used in Python with examples. (7)
6. (a) What is NumPy? Explain its features and advantages in Python programming. (7)
- (b) Discuss the role of CPU, GPU and memory in the SoC of Raspberry Pi. (8)

UNIT-IV

7. (a) Discuss the role of sensors and actuators in Raspberry Pi-based automation systems with suitable examples. (10)
- (b) Describe the working of a PIR motion sensor with Raspberry Pi. (5)
8. (a) Explain the step-by-step process to interface a stepper motor with Raspberry Pi. (8)
- (b) Explain how a Raspberry Pi Camera Module can be used for object detection in robotics. (7)
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Total Pages : 2

BT-8/D-25

48426

OPTIMIZATION METHOD IN ML

Paper-PC-CS-AIML-402A

Time allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Define convex sets and explain convexity-preserving operations with suitable examples. 8
(b) What are KKT conditions? Explain their role in convex optimization problems. 7
2. Differentiate Linear Programming (LP), Second-Order Cone Programming (SOCP) and Semi-Definite Programming (SDP) with examples. 15

UNIT-II

3. (a) Explain the working of the gradient descent method with its properties. 7
(b) Derive and explain the mathematical formulation of the Frank-Wolfe method and discuss its applications. 8

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4. Explain in detail the concept of Moreau–Yosida regularization and its significance in convex optimization. 15

UNIT–III

5. (a) What is the Alternating Direction Method of Multipliers (ADMM)? Explain its key steps? 8
(b) Discuss the concept of primal and dual decomposition in optimization. 7
6. Explain in detail the Augmented Lagrangian method and its application in constrained optimization problems. 15

UNIT–IV

7. Discuss Langevin dynamics and its applications in non–convex optimization and deep learning. 15
8. (a) Explain the concept of Polyak Juditsky averaging and its role in optimization. 7
(b) Elaborate Stochastic Variance Reduced Gradient (SVRG) method. 8

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Total Pages : 2

BT-8/D-25

48432

IMAGE PROCESSING AND RECOGNITION

Paper-OE-CS-AIML-410

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. Discuss the fundamentals of Image formation. What is the Image geometry perspective transformation? Explain in detail. 15
2. Explain the Digital image sampling and quantization in detail. 15

UNIT-II

3. Define the Segmentation. Explain the region growing and relaxation methods of Segmentation. 15
4. What do you understand by Classification? Explain the supervised and unsupervised techniques of Classification in detail. 15

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UNIT-III

5. What do you understand by pattern recognition? Explain the terms expectation, mean, covariance, normal distribution, multivariate normal densities and chi-square test. 15
6. Describe maximum-likelihood estimation. Explain the Bayes' rule and Naïve Bayes classifier. 15

UNIT-IV

7. Explain the Principal Component Analysis and Fisher Linear Discriminant Analysis techniques in detail. 15
8. Describe the Gaussian Mixture Models in detail. 15

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Total Pages : 3

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48438

NATURAL LANGUAGE PROCESSING

Paper-PE-CS-AIML-426A

Time Allowed : 3 Hours]

[Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks.

UNIT-I

1. (a) Discuss the advantages and limitations of using Semantic Networks of Natural language understanding.
(b) Explain the importance of Pragmatic Analysis in Interpreting user intent.
2. (a) What are Frames ? Explain how frames are used to represent knowledge about a Classroom scenario ?
(b) Differentiate between Lexical, syntactic and Semantic ambiguities with examples.

UNIT-II

3. (a) Show that the grammar $S \rightarrow S+S \mid S*S \mid a$ is ambiguous. Convert the above grammar into an unambiguous grammar that enforces operator precedence (* over+) and left associativity.

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- (b) What is a knowledge base in Prolog ? Explain the concept of backtracking in Prolog.
4. (a) Differentiate between Left-associative grammar and Right-associative grammar with parsing examples.
- (b) Explain the difference between a Regular Language and a Context-Free Language (CFL). Provide an example of a language that is CFL but not Regular.

UNIT-III

5. (a) Compare and contrast ATN and RTN in terms of expressive power, control mechanisms, and computational efficiency.
- (b) How is the Earley algorithm different from a CYK parser ? Discuss.
6. (a) Illustrate how Earley's algorithm performs bottom-up parsing with top-down prediction.
- (b) What are the main steps of the CKY algorithm ? Explain the bottom-up parsing strategy in the context of CKY.

UNIT-IV

7. (a) Describe how speech recognition and natural language understanding can be integrated into an ITS ?

- (b) Discuss the Architecture of an Intelligent Word Processor.
8. (a) Compare Intelligent Tutoring Systems (ITS) and Learning Management Systems (LMS) in terms of adaptability and Intelligence.
- (b) Define Lexical ambiguity and Syntactic ambiguity in translation.