

BT-4/M-26

44229

MATHEMATICS FOR MACHINE LEARNING

Paper-BS-CS-AIML-202M

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 data set contains information about patients and heart disease. Explain how data science techniques can be used to (i) analyze the data set, (ii) identify the patterns and (iii) predict disease. 15
2. (a) What Are the Applications of Supervised Machine Learning in Modern Businesses? 7½
(b) What are the 5 C's for ethical consideration in Data science and AI development. Discuss in brief. 7½

UNIT-II

3. (a) The probability that a ship of a company being destroyed on a certain voyage is 0.02. The company owns 6 ships for the voyage, find the probability of (i) losing one ship, (ii) losing at most two ships (iii) losing none? 7½
(b) The contents of the urn A are 1 white, 2 black, 3 red balls, content of urn B are 2 white, 1 black and 1 red balls, content of urn C are 4 white, 5 black, 3 red balls. One urn is chosen at random and two balls drawn. They happen to be white and red. What is the probability that they come from urn I OR II? 7½

4. (a) A random variable X has the following probability distribution :

$X:x$	0	1	2	3	4	5	6	7	8
$P(x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

Determine the value of a , mean, variance, standard deviation.

What is the smallest value of x for which $P(X \leq x) > 0.5$? $7\frac{1}{2}$

- (b) From the following data find whether there is any significant liking in the habit of taking soft drinks among the categories of employees :

Employee soft drinks	Clerks	Teachers	Officers	total
Pepsi	10	25	65	100
Thumps up	15	30	65	110
Coca cola	50	60	30	140
Total	75	115	160	350

Given that χ^2 for 4 d.f at 5% level of significance is 9.488. $7\frac{1}{2}$

UNIT-III

5. (a) Find the rank of the following matrix

$$\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$$

$7\frac{1}{2}$

- (b) Investigate for consistency of the following equation and hence find the solution $4x - 2y + 6z = 8$, $x + y - 3z = -1$, $15x - 3y + 9z = 21$. $7\frac{1}{2}$

6. (a) Check whether the given vectors $\{(1, 1, 0, -3), (1, 2, 1, 0), (0, 1, 2, 3), (1, 2, 3, 4)\}$ are LI or LD. $7\frac{1}{2}$

- (b) Find the eigen value and eigen vector of the given matrix

$$\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}. \quad 7\frac{1}{2}$$

UNIT-IV

7. (a) Diagonalize the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. $7\frac{1}{2}$

- (b) Find an LU decomposition of $\begin{bmatrix} 3 & 1 & 6 \\ -6 & 0 & -16 \\ 0 & 8 & -17 \end{bmatrix}$. $7\frac{1}{2}$

8. Find a singular value decomposition for $A = \begin{bmatrix} 1 & 0 & 1 \\ -1 & 1 & 0 \end{bmatrix}$. 15
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44230

INTELLIGENT SYSTEMS

Paper-PC-CS-AIML-204A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. (a) Explain Strong and Weak AI. 7.5
(b) Explain the terms Symbolic and Sub-symbolic AI. 7.5
2. Differentiate between NP-hard and NP-complete problems in detail with examples. 15

UNIT-II

3. (a) Explain Bayesian Learning in brief. 7.5
(b) Explain the term Factor analysis. 7.5
4. Explain any two heuristic search techniques with examples. 15

UNIT-III

5. Explain the architecture of Rule-Based Intelligent Systems. 15
6. Discuss uncertainty handling methods in AI. 15

UNIT-IV

7. Explain Fuzzy set and Fuzzy logic in detail. 15
8. Explain the following terms :
- (a) Natural language processing.
 - (b) Information retrieval. 15
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44231

DATABASE MANAGEMENT SYSTEM
Paper-PC-CS-AIML-206A

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 is a foreign key constraint? Why are such constraints important? What is referential integrity? (7)
- (b) Compare and Contrast file Systems with database system. (8)
2. (a) Define the following terms: relation schema, relational database schema, domain, attribute. (7)
- (b) Explain the differences among an entity, an entity type, and an entity set. (8)

UNIT-II

3. (a) Consider the SAILOR DATABASE :
Sailors (sid:string, sname:string, rating:integer, age:real)
Boats (bid:integer, bname:string, colour:string)
Reserves (sid:integer, bid:integer, day:date)
Based on the above schemas answer the following queries.
Based on the above schema Write the corresponding SQL queries for the following:
(i) Find the colours of boats reserved by 'Lubber'.

- (ii) Find the names of sailors who have reserved at least one boat
 - (iii) Find the names of sailors who have reserved a red or green boat
 - (iv) Find the names of the sailors who have reserved both a Red boat and a Green boat.
 - (v) Find names of sailors who have reserved all boats. (10)
- (b) What is a trigger? How to create it? Discuss various types of triggers. (5)
4. (a) What is Entity set? and also define Relationship set. List and explain the symbols used to draw ER Diagram. (7)
- (b) Write Short notes on the following :
- (i) Ternary relationship.
 - (ii) Weak entity set.
 - (iii) Grouping.
 - (iv) Aggregation. (2×4=8)

UNIT-III

5. (a) What is functional dependency? Explain its usage in database design. (7)
- (b) What is normalization? Differentiate between first normal form and second normal form. (8)
6. (a) Explain 3NF & BCNF. What is the difference between them? (7)
- (b) What is multi valued dependency? State and explain fourth normal form based on this concept. (8)

UNIT-IV

7. (a) Outline Wait/Die and Wound/Wait Schemes in transaction management. (7)
(b) Explain Concurrency control with locking methods. (8)
 8. (a) List and explain various issues while transactions are running concurrently in DBMS. (7)
(b) How the use of 2PL would prevent interference between two transactions? (8)
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44232

INTERNET AND WEB TECHNOLOGY

Paper-PC-CS-AIML-208A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. (a) Explain the role and responsibilities of an Information Architect in web development. (7)
(b) Discuss the process of organizing websites and intranets. Explain different organizational challenges with suitable examples. (8)
2. (a) Describe different types of navigation systems used in website design. (8)
(b) Explain conceptual design and high-level architecture blueprint in web application development. (7)

UNIT-II

3. (a) Explain the basic structure of an XHTML document with syntax rules. (7)
(b) Discuss the syntactic differences between HTML and XHTML with examples. (8)
4. (a) Explain CSS selector forms and property value formats. (7)

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- (b) Describe the CSS box model and explain conflict resolution in cascading style sheets. (8)

UNIT-III

5. (a) Explain the general syntactic characteristics of JavaScript and its object-oriented features. (8)
- (b) Describe control statements, arrays, and functions in JavaScript with suitable examples. (7)
6. (a) Explain object creation and modification in JavaScript. (7)
- (b) Discuss pattern matching using regular expressions and error handling in JavaScript. (8)

UNIT-IV

7. (a) Explain Python data types and expressions with examples. (8)
- (b) Discuss control statements and string handling in Python programming. (7)
8. (a) Explain the use of lists and dictionaries in Python. (7)
- (b) Describe program design using functions and classes in Python with examples. (8)
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44233

OPERATING SYSTEM
Paper-PC-CS-AIML-210A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. (a) Compare batch OS, multi-programmed OS and time sharing OS. 10
(b) Discuss the role of system calls in resource management. 5
2. Describe different types of protection in operating system. Also, compare protection and security in OS context. 15

UNIT-II

3. Consider the following set of processes, with the length of the CPU burst time given in milliseconds. Draw the Gantt chart illustrating the execution of these processes using FCFS, SJF (preemptive), Round robin (time quantum = 2), Priority. Calculate the average turnaround time, average waiting time. 15

Process	Arrival Time	Burst Time	Priority
PI	0	10	2
P2	1	6	3
P3	2	12	1
P4	3	15	4

4. (a) Define critical section problem. Why do race conditions occur? 5
- (b) Discuss producer consumer problem with message passing. 10

UNIT-III

5. Given reference string : 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2
Number of frames : 3
Compute Page faults for FIFO, LRU, and Optimal page replacement algorithm. Also, state advantages and disadvantages of each algorithm. 15
6. What are the necessary conditions for deadlock? Explain deadlock avoidance using Banker's Algorithm with suitable example. 15

UNIT-IV

7. Compare sequential, direct, and indexed file access methods with suitable example of each. 15
8. Illustrate the organization of UNIX files. Describe the mechanisms that safeguard files against corruption and security breaches. 15
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44234

SOFTWARE ENGINEERING

Paper-PC-CS-AIML-212A

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 is meant by Software Engineering? Describe the important characteristics of software. 8
- (b) Explain the Spiral Model with neat and clean diagram. How does it handle risk effectively? 7
2. (a) What is Software Development Life Cycle (SDLC)? Discuss requirement analysis and design phases in SDLC. 8
- (b) Differentiate between Waterfall Model and V-Model. 7

UNIT-II

3. (a) What is SRS document? Explain the structure of SRS as per IEEE standards. 8
- (b) Describe various requirement elicitation techniques in detail.
4. (a) Define Software Risk Management. Discuss different types of risks in software projects. 8
- (b) What is the role CEI-CMM model in software process? Discuss its limitation also. 7



UNIT-III

5. (a) Discuss the concept of cohesion in modular design. Explain various levels of cohesion. 8
- (b) Explain Function-Oriented Designing technique in software engineering. Discuss its advantages and limitations. 7
6. (a) Explain the role of Cyclomatic Complexity and the COCOMO model in software effort estimation. 7
- (b) Compare Function Point (FP) and Lines of Code (LOC) as software size estimation methods with an example. 8

UNIT-IV

7. (a) Discuss the need and challenges of Software Maintenance in software process. 8
 - (b) Explain Acceptance Testing in software engineering and discuss its different types. 7
 8. (a) Differentiate between Structural Testing and Functional Testing. 7
 - (b) Why is software maintenance considered the most expensive phase of the software life cycle? Discuss. 8
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46307

HUMAN-COMPUTER INTERACTION

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 reasoning and problem-solving in HCI. 7
- (b) What are interaction frameworks in HCI ? 8
2. (a) Explain processing and networking in HCI systems. 7
- (b) Discuss the role of memory in human information processing. 8

Unit II

3. Discuss usability engineering and evaluation techniques in HCI. 15
4. Describe prototyping techniques and their role in software development. 15

Unit III

5. (a) Discuss socio-organizational issues in system design. 8
- (b) Discuss the role of communication and collaboration models in HCI. 7
6. (a) Explain mobile design principles and tools used for developing mobile interfaces. 8
- (b) Write a short note on Hypertext and WWW in HCI. 7

Unit IV

7. (a) Explain the process of designing web interfaces with suitable examples. 8
- (b) Write a short note on Contextual Tools. 7
8. (a) Discuss the uses of UI elements in web applications. 8
- (b) Explain modern web interface design approaches. 7



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46308

APPLIED MACHINE LEARNING

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 role of data representation and domain knowledge in Machine Learning. 8
- (b) Explain the concept of bias and variance in supervised learning. How do they affect model performance ? 7
2. Define performance metrics in Machine Learning. Explain in detail the concept of a confusion matrix and derive the formulas for accuracy, precision, recall, and F1-score. Illustrate each metric with a suitable numerical example and discuss their significance in real-world classification problems. 15

Unit II

3. (a) Discuss Multiple Linear Regression. Explain its mathematical formulation, assumptions, and limitations with a suitable example. 8
- (b) Explain Fisher's Linear Discriminant and discuss its advantages over simple linear classifiers. 7
4. (a) Describe Decision Tree Learning. Explain entropy and information gain with formula derivation. 8
- (b) Describe the Random Forest Algorithm. Explain bagging and feature randomness in detail. 7

Unit III

5. (a) Explain the K-Nearest Neighbor (KNN) algorithm. Discuss distance metrics and the effect of choosing different values of K. 8
- (b) What is Linear Discriminant Analysis (LDA) ? Derive the linear discriminant function for binary classification. 7
6. Describe the fundamental principles of Support Vector Machines (SVM). Explain the concept of margin, support vectors, and linear discriminant functions in binary classification. 15

Unit IV

7. (a) Explain the concept of Unsupervised Learning. Discuss its objectives, characteristics, and differences from supervised learning. 8
- (b) Describe the K-Means clustering algorithm. Discuss the advantages and limitations of KMeans clustering. 7
8. Write short notes on the following : 15
- (a) Expectation-Maximization (EM) algorithm
- (b) Random Projections
- (c) Principal Component Analysis.



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46309

EXPERT SYSTEMS

Time : Three Hours]

[Maximum Marks : 75

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

Unit I

1. (a) Explain Blind Search strategies. Discuss Breadth First Search and Depth First Search with suitable examples. 7
- (b) Describe Heuristic search techniques. Explain Hill Climbing and A* algorithm in detail. 8
2. (a) Explain Min-Max algorithm and its role in game playing. 7
- (b) Discuss Alpha-Beta pruning and AO* algorithm. How do they improve search efficiency ? 8

Unit II

3. (a) Define Expert System. Differentiate between Expert Systems and Conventional Programs. 7

- (b) Explain the architecture of an Expert System including Knowledge Base, Inference Engine and Explanation Facility. 8
4. (a) Discuss Forward Chaining and Backward Chaining with suitable examples. 7
- (b) Explain various types of problems handled by Expert Systems such as diagnosis, prediction, planning and control. 8

Unit III

5. (a) Explain techniques of Knowledge Representation used in Expert Systems. 7
- (b) Discuss the stages involved in the development of an Expert System. 8
6. (a) What is Knowledge Engineering ? Explain its importance in building Expert Systems. 7
- (b) Describe system-building aids and support facilities used in Expert System tools. 8

Unit IV

7. (a) Explain the process of building an Expert System including tool selection and knowledge acquisition. 7
- (b) Discuss common difficulties and pitfalls encountered during Expert System development. 8
8. (a) Discuss problems faced while dealing with domain experts during Expert System development. 7
- (b) Present a detailed case study of any one Expert System. 8



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46310

SOFTWARE TESTING

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 complete Software Testing Life Cycle (STLC) in detail. Discuss its phases, deliverables and interrelationship with SDLC models. 9
- (b) Explain the evolution of software testing from traditional debugging to modern quality assurance practices. 6
2. (a) Compare and contrast Verification and Validation with practical case illustrations. 7
- (b) Discuss the objectives, principles and limitations of software testing. Can testing ensure absence of defects ? Justify your answer critically. 8

Unit II

3. (a) Explain Equivalence Class Partitioning in detail. Design test cases for a banking transaction module. 8
- (b) Discuss Cyclomatic Complexity. Explain different methods to compute it and its significance in white-box testing. 7
4. (a) Compare Functional Testing and Structural Testing in terms of objectives, techniques, coverage and limitations. 8
- (b) Explain Data Flow Testing. Discuss definition-use (DU) pairs and anomalies with suitable examples. 7

Unit III

5. Explain Regression Testing in detail. Discuss selective regression testing and test suite minimization techniques. 15
6. (a) What is Risk-Based Testing ? Describe risk identification, assessment and mitigation strategies in software projects. 8
- (b) Differentiate between Debugging and Testing. Explain debugging strategies. 7

Unit IV

7. (a) Explain the Capability Maturity Model (CMM) and its levels. 9
- (b) Discuss quality assurance vs quality control with suitable examples. 6
8. Describe ISO-9000 standards and Capability Maturity Model (CMM). Compare their approaches toward quality assurance. 15



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46311

COMPUTER VISION

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 is Computer Vision ? Give real world applications of Computer vision. 7
- (b) Explain the difference between analog and digital image. Explain the process of converting analog image to digital. 8
2. (a) What do you mean by digital image processing ? Explain various steps in detail. 7
- (b) Implement various methods of image zooming on given image : 8

50	50	50
50	100	100
50	50	50

Unit II

3. (a) Write short notes on the following : 8
- (i) Morphological Filtering
 - (ii) Hough Transform.
- (b) What do you mean by edge ? How edge is detected in any image processing system ? Explain First Order Derivation and Second Order Derivation methods of edge detection 7
4. (a) What do you mean by image segmentation and explain various algorithm of image segmentation. 7
- (b) Explain Fourier Transform and how it used in image enhancement. 8

Unit III

5. (a) How shape features extract from image, explain in detail ? 8
- (b) Explain various CVIP tools used in feature extraction. 7
6. (a) How Histograms are used for feature extraction ? Explain in detail. 8

- (b) Explain the terms : 7
- (i) Feature Vector
 - (ii) Data Preprocessing.

Unit IV

7. (a) Explain the working principle of k-Means and k-Medoids clustering algorithms. 8
- (b) What is the difference between supervised, unsupervised and semi supervised classification ? Give one real world example. 7
8. (a) Describe the role of Bayes, KNN and CNN classifiers in pattern recognition. Compare their strength and difference. 8
- (b) What is Dimensionality Reduction ? Explain in detail. 7



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46313

PROJECT MANAGEMENT

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 software project management and explain the categorization of software projects with examples. 8
- (b) Explain the concept of project portfolio management and its significance. 7
2. (a) What is cost-benefit evaluation technology in software project planning ? Discuss with examples. 7
- (b) What are the steps involved in stepwise project planning ? Explain with a suitable diagram. 8

Unit II

3. (a) What are software process models ? What factors influence the choice of a process model ? 8

- (b) Explain the working of software model which is used for Risk Analysis. 7
- 4. (a) What are the various ways to estimate software development costs ? 7
- (b) Explain COCOMO II in detail. Why is it used in project management ? 8

Unit III

- 5. (a) Explain objectives of activity planning in software projects management. 7
- (b) What are Network Planning Models ? Which network planning models are commonly used and why are they important ? 8
- 6. (a) What is the Critical Path (CPM) method ? What are its main steps in project management ? 7
- (b) What is the PERT technique ? Which role does Monte Carlo simulation play in project risk analysis ? 8

Unit IV

- 7. (a) What are the five phases of a project management framework ? 9
- (b) Explain the process of earned value analysis (EVA) in project monitoring. 6

8. (a) Explain the term prioritizing monitoring. Which techniques are used for prioritizing monitoring and contract management ? 8
- (b) What is contract management ? Which role does software configuration management play in project control ? 7



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47420

DATA SCIENCE WITH R PROGRAMMING

Paper-PC-CS-AIML-401A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any *five* questions by selecting atleast *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Define Data Science. Explain the Data Science process in detail.
(b) Discuss the benefits and uses of Data Science and Big Data in real-world applications. (7+8=15)
2. (a) Explain different types of data and forms used in Data Science.
(b) Describe various data preprocessing operations. (7+8=15)

UNIT-II

3. (a) Explain different types of data visualization with examples.
(b) Discuss popular data visualization tools and libraries used in data science. (7+8=15)
4. (a) Define descriptive statistics. Explain measures of central tendency and dispersion.
(b) Explain conditional probability and Bayesian probability with suitable examples. (7+8=15)

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UNIT-III

5. (a) What is R Programming? Discuss its advantages and disadvantages.
- (b) Explain basic R syntax including variables, operators and comments with examples. (7+8=15)
6. (a) Explain different data types in R with examples.
- (b) Describe vectors, lists, matrices and data frames in R with suitable examples. (7+8=15)

UNIT-IV

7. (a) Explain how to read and write CSV files in R.
- (b) Describe the steps to connect R with Microsoft Excel using the xlsx package. (7+8=15)
8. (a) Explain Linear and Logistic Regression methods.
- (b) Discuss classification and clustering methods in machine learning with examples. (7+8=15)
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47394

UNIVERSAL HUMAN VALUES-II :

UNDERSTANDING HARMONY

Paper-HSS-403A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. Discuss the process of self exploration and one aspect in your life which you have self explored. Discuss natural acceptance and experiential validation in detail. (10+5=15)
2. Discuss in detail the meaning of happiness and prosperity. Discuss the current status of both in today's society. Discuss the methods to achieve both in detail. (6+4+5=15)

UNIT-II

3. Discuss the proposal of co-existence of Self and Body. Differentiate both based on their needs, activities and response in detail. (5+10=15)
4. Discuss the concept of sanyam and health as its natural outcome. Discuss the concept of body as instrument of self in detail. (9+6=15)

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UNIT-III

5. Discuss the minimum and complete content of respect. Discuss the feeling of glory, gratitude and reverence in detail.
(9+6=15)
6. Differentiate the effort for excellence and effort for competition with suitable examples. Discuss the concept of harmony in society in detail.
(6+9=15)

UNIT-IV

7. Discuss the concept of harmony in complete nature. Discuss the steps to reach world family order through right understanding.
(10+5=15)
 8. Write short note on :
 - (a) Existence as coexistence.
 - (b) Professional ethics.
 - (c) Holistic technologies and production systems.
(5+5+5=15)
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47422

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 history and key characteristics of robotics. Discuss any two major milestones in its development. (8)
- (b) Describe the application of robots in the manufacturing and medical industries. What are the main advantages and disadvantages of using robots in these fields? (7)
2. (a) Explain the different types of robot mechanisms with suitable diagrams. (8)
- (b) Explain the basic tasks of a robot and list the challenges in robotics. (7)
3. (a) How do degrees of freedom (DOF) influence robot classification? Explain how DOF affects the robot's workspace and flexibility. (8)
- (b) Describe the main components of a robot system including power source, controllers, manipulator, and end effector. Explain how these components work together. (7)

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47427

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. Define Soft Computing and explain its role in solving complex, imprecise, and uncertain real-world problems. 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) Describe in detail the Adaptive Resonance Theory (ART). 7
4. Differentiate Single Layer Perceptron and Multilayer Perceptron (MLP). How does counter propagation and adaptive resonance improve learning performance? 15

UNIT-III

5. Describe Fuzzification and Defuzzification methods. Explain how they are used in real-time fuzzy control systems. 15

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6. Discuss the role of membership functions and fuzzy inference systems in Soft Computing. Illustrate with examples of lambda-cuts and rank ordering. 15

UNIT-IV

7. Explain the working principle of Genetic Algorithms (GA). Discuss the steps involved in the GA process with the help of a flowchart. 15
8. What is a Genetic Fuzzy Rule-Based System? Explain its structure and applications. Discuss hybrid GA-Neuro-Fuzzy systems with examples. 15
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47430

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. Describe the architecture of a Multilayer Perceptron (MLP) and explain the working of the Backpropagation algorithm. 15
2. What is the Curse of Dimensionality? Discuss its impact on machine learning models and possible remedies. 15

UNIT-II

3. Explain the concepts of representation learning and how deep architectures improve it. 15
4. Compare different activation functions: ReLU, LReLU, and EReLU. Discuss their advantages and disadvantages. 15

UNIT-III

5. Discuss the motivation behind CNNs and how parameter sharing reduces model complexity. 15
6. Compare and contrast popular CNN architectures such as ResNet and AlexNet. 15

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UNIT-IV

7. Explain the architecture and working of DenseNet and PixelNet. Highlight their differences from conventional CNNs. 15
 8. Explain the Encoder-Decoder sequence-to-sequence architecture with an example of machine translation. 15
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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) Explain convex relaxation and its application in optimization problems. 7
- (b) Explain the Karush-Kuhn-Tucker (KKT) conditions for constrained optimization problems. 8
2. Discuss in detail different types of convex programming such as LP, SOCP and SDP with examples. 15

UNIT-II

3. (a) Explain proximal gradient methods and their role in optimization. 7
- (b) Write short notes on mirror descent and Frank Wolfe method. 8

4. (a) Differentiate gradient descent and Nesterov's accelerated gradient method. 8
- (b) Derive the update rules for gradient descent and discuss its convergence properties. 7

UNIT-III

5. (a) What is the Douglas Rachford splitting method? Explain its application. 8
- (b) Discuss the concept of primal and dual decomposition in optimization. 7
6. (a) Write short notes on Alternating Direction Method of Multipliers (ADMM). 7
- (b) Describe monotone operators and their importance in optimization. 8

UNIT-IV

- 7 Discuss stochastic and non-convex optimization techniques and their relevance in deep learning. 15
8. (a) Elaborate stochastic variance reduced gradient (SVRG) method. 7
- (b) Write short notes on dual averaging and Langevin dynamics. 8

Roll No.

Total Pages : 2

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48427

ENTREPRENEURSHIP AND START-UPS

Paper-HSS-404A

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. Define the Entrepreneurship and explain its concept in detail. Discuss its importance in modern economies. 15
2. Discuss the various types of Entrepreneurs and also explain the common myths associated with Entrepreneurship. 15

UNIT-II

3. Discuss in detail the skills and traits required to become a successful entrepreneur. 15
4. Analyze any successful entrepreneur's journey and highlight the key factors behind their success. 15

UNIT-III

5. What is a Business model? Explain its components and importance in detail. 15

6. Describe the concept of Lean Start-ups and explain how they help in building successful businesses? 15

UNIT-IV

7. Explain the role of central and state-level institutions in supporting small business enterprises. 15
8. Explain the role of Industry associations and other agencies in the development of Entrepreneurship. 15

Roll No.

Total Pages : 2

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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 digital image processing. What is Stereo imaging? Explain the elements of Visual perception in detail. 15
2. Explain the serial and parallel image processing. Also explain Wiener filter. 15

UNIT-II

3. Explain the line and edge detection approaches to segmentation. 15
4. What do you understand by Skeleton detection? Explain its techniques in detail. 15

UNIT-III

5. What do you understand by learning and adaptation?
Explain the design principles of pattern recognition systems. 15
6. Explain the normal density and discriminant functions.
Also discuss parameter estimation methods. 15

UNIT-IV

7. Explain the dimension reduction methods in detail. 15
8. Describe and differentiate between the Hidden Markov
Models and Gaussian Mixture Models in detail. 15

Roll No.

Total Pages : 2

BT-8/M-26

48435

NEURAL NETWORK AND FUZZY LOGIC SYSTEMS

Paper-PE-CS-AIML-420A

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. What is ANN ? Explain different models of ANN. Also explain different learning rules used in ANN. 15
2. (a) Differentiate single layer and multilayer feed forward networks. 7
- (b) Differentiate Auto-associative and Hetero-associative memory 8

UNIT-II

3. What are basic building blocks in Fuzzy logic? Explain concept of classical sets and also explain operations on classical sets. 15
4. Write short notes on the following : 15
- (a) Fuzzy Membership functions.

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(b) Crisp set.

(c) Fuzzifier.

UNIT-III

5. Discuss how Fuzzy relations formed based on Cartesian product? Explain various operations and properties over a Fuzzy relation. 15
6. Explain importance of Defuzzification in Fuzzy logic. How does the Lambda-cut (or alpha-cut) method work for Defuzzification. 15

UNIT-IV

7. (a) What is Network optimization? Explain in detail. 7
- (b) How pattern recognition can be done in Fuzzy systems? Explain in detail. 8
8. (a) Explain fuzzy logic control system in detail. 10
- (b) Write various industrial applications of Neural networks.. 5

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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) Explain how Conceptual Dependency represents meaning Independent of Language. Using Conceptual Dependency theory, represent the following sentence: "Ravi gave a book to Neha".
- (b) Define Semantic Analysis and explain its purpose in NLP. What is Pragmatics in the context of language understanding?
2. (a) What is Lexical Analysis and how does it differ from Morphological Analysis?
- (b) What is Natural Language Processing (NLP)? List the main components of an NLP system.

UNIT-II

- 3: (a) Construct a CFG that generates the language
 $L = \{a^n b^n \mid n \geq 1\}$.
- (b) Explain the role of knowledge representation in Prolog.
How can it be used for AI reasoning?
4. (a) What is a Grammar in the context of automata theory?
List its four components. State the four types of
Grammars as per Chomsky hierarchy.
- (b) Differentiate between Left Associative Grammar and
Right Associative Grammar in the context of
Arithmetic expressions.

UNIT-III

5. (a) Describe the structure and working of a Recursive
Transition Network with an example.
- (b) Define the terms predictor, scanner, and completer
in Earley's algorithm.
6. (a) Explain how recursion helps RTNs represent nested
syntactic structures.
- (b) Write a pseudo-code of the CKY algorithm. Describe
the structure of the CKY parse table.

UNIT-IV

7. (a) Differentiate between a Computer-Assisted Instruction system and an Intelligent Tutoring System.
(b) Define speech recognition. What are its major applications in AI systems?
8. (a) What is an Intelligent Word Processor? How does it differ from a traditional word processor?
(b) Explain the architecture of a Machine translation system.