AIML 4th/ Lib.

Roll No. ..... Total Pages : 3

BT-4/J-25 **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) Discuss the purpose, example, properties and analysis of different level of measurement. 7½

(b) What are the Three Stages of Building a Model in Machine Learning? 7½

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) Three persons A, B and C have applied for a job in a private company. The chance of their selections is in the ratio 1:2:4. The probabilities that A, B and C can introduce changes to improve the profits of the company are 0.8, 0.5 and 0.3 respectively. If the change does not take place, find the probability that it is due to the appointment of C. 7½

(b) A discrete random variable X has the probability function

$$P(X = x)\begin{cases} k(1-x)^2 & x = -1, 0, 1 \text{ and } 2 \\ 0 & \text{otherwise} \end{cases}$$

Find k, $E(X)$, $E(X^2)$. 7½

4. (a) Assume that on the average one telephone number out of fifteen called between 2 P.M. and 3 P.M on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called :

(i) not more than three,

(ii) at least three of them will be busy? 7½

(b) The average number of acres burned by forest and range fires in a large New Mexico country is 4,300 acres per year, with a standard deviation of 750 acres. The distribution of the number of acres burned is normal.

(i) What is the probability that between 2,500 and 4,200 acres will be burned in any given year?

(ii) What number of burnt acres corresponds to the 38th percentile? 7½

UNIT–III

5. (a) Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 0 & -2 \\ 2 & 0 & 2 & 2 \\ 4 & 1 & 3 & 1 \end{bmatrix}$. 7½

(b) Show that the equations $-2x + y + z = a$, $x - 2y + z = b$, $x + y - 2z = c$ have no solution unless $a + b + c = 0$. In which case they have infinitely many solutions? 7½

6. (a) Check whether the given vectors {(1,6,2, –3), (1,3, –2,2), (0,0,4,0), (0,0,0,8)} are LI or LD. 6

(b) Find the eigen value and eigen vector of the given matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. 9

UNIT–IV

7. (a) Which of the following matrix is diagonalizable over R and why?

(i) $\begin{bmatrix} 2 & 1 & 4 \\ 0 & 2 & 3 \\ 0 & 0 & 1 \end{bmatrix}$, (ii) $\begin{bmatrix} -1 & 2 & 3 \\ 0 & -2 & 4 \\ 0 & 0 & 3 \end{bmatrix}$. 7½

(b) Find an LU decomposition of $\begin{bmatrix} 3 & 1 & 6 \\ -6 & 0 & -16 \\ 0 & 8 & -17 \end{bmatrix}$. 7½

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

Roll No. ..... Total Pages : 5

BT-4/J-25 **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. All questions carry equal marks.

UNIT–I

1. (a) Discuss the characteristics of AI problem. Whether Towers of Hanoi problem be classified P or NP-Hard or NP-Complete AI problem? Justify your answer. (7)

(b) Compare and Contrast between :

(i) Neats and Scruffy.

(ii) Symbolic and Non-Symbolic AI. (8)

2. How does Knowledge Base AI enhance knowledge management, and what role do intelligent, context-aware responses play in improving decision-making? In what terms are they better and worse in comparison to traditional databases. (15)

UNIT–II

3. (a) Examine the beam search algorithm in context of machine learning? A language model is generating

sentences using Beam Search with a beam width of 3. The model predicts the following probabilities for the first word :

Word	Probability
"AI"	0.5
"Machine"	0.3
"Deep"	0.2

For each selected word, the model predicts the next word probabilities :

Previous Word	**Next Word**	**Probability**
"AI"	"is"	0.6
"AI"	"can"	0.4
"Machine"	"learning"	0.7
"Machine"	"is"	0.3
"Deep"	"neural"	0.8
"Deep"	"learning"	0.2
Previous Sequence	**Next Word**	**Probability**
"AI is"	"powerful"	0.7
"Machine learning"	"is"	0.5
"Deep neural"	"networks"	0.6

Compute the new sequence scores and determine the best sentence generated using Beam Search. (8)

(b) Write an algorithm to solve 4-queen problem using hill climbing. (7)

4. (a) Consider the two-dimensional pattern (2,1), (3,5), (4,3), (5,6), (6,7), (7,8). Compute the principal component using PCA algorithm. (7)

(b) Using the PSO algorithm find the minimum of function $f(x) = -x^2 + 5x + 20$. Use 4 particles with initial positions $x_1 = -9.6$, $x_2 = -6$, $x_3 = -2.6$, $x_4 = -1.1$ Assume $c_1 = c_2 = 1$. (8)

UNIT–III

5. (a) Describe the forward and backward chaining mechanism used by inference engine. (8)

(b) State few conflict resolution strategies to decide the which rule to fire. (7)

6. (a) You have three different dice with three different number ranges :

Dice 1 : 1-4

Dice 2 : 1-6

Dice 3 : 1-8

We randomly select a dice and do three subsequent rolls with that given dice. It was reported on first roll we get the number 4. On second roll and third roll we get a 2 and 5 respectively. Using these rolls, compute how likely we picked up either dice 1, 2, or 3 after each role. (7)

(b) State the Certainty principles. Define various measures of certainty. Based on the following given rules, calculate certainty factor for animal is cat.

Rule	Description	CF of Rule	CF of Observation
R	If the animal has whiskers, then it might be a cat	0.6	0.9
R2	If the	0.8	0.7
R3	If the animal has retractable claws, then it may be a cat	0.7	0.6
R4	If	0.9	0.8
R5	If the animal climbs trees easily	0.5	0.6

(8)

UNIT–IV

7. (a) Consider the fuzzy sets $\overline{A}$ and $\overline{B}$ defined on the interval X = [0, 5] of real numbers, by the membership grade functions.

$$\mu_{\overline{A}} = \frac{x}{x+1}, \mu_{\overline{B}} = 2^{-x}$$

Determine the mathematical formulae and graphs for member grade functions of each of the following sets (i) $A \cap B$ (ii) $(A \cup B)^c$. (8)

(b) What is expert system? Explain the various stages in the development of expert system tools. (7)

8. Write short notes on *three* of the following :

(a) Decision Support Systems.

(b) Natural Language Processing.

(c) Semantic Web.

(d) Information Retrieval. (5×3=15)

Roll No. ..... Total Pages : 4

44231

BT-4/J-25

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 data independence? Discuss the three-tier schema architecture and its role in achieving data independence. (7)

(b) Discuss the main characteristics of the database approach and explain how it differs from the traditional file system. Outline any two database applications and describe their key features. (8)

2. (a) How does the EER model improve upon the standard ER model? Explain its benefits and discuss the concepts of aggregation, generalization, and specialization with suitable examples. (8)

(b) Draw an ER diagram depicting the smooth functioning of a library for different departments within an academic institution, where each department contains multiple book titles. Each book

is identified by an accession code, title, author, edition, and publisher details, and is available in a finite number of copies to student members. How can issue/return transactions and book-tracing processes be performed? Make suitable assumptions and constraints for the system. Also, identify the primary keys and foreign keys. (7)

UNIT–II

3. (a) Consider the following schemas. The primary key for each relation is denoted by the underlined attribute :

LIVES (person-name, street, city)

WORKS (person-name, company-name, salary)

LOCATED-IN (company-name, city)

MANAGES (person-name, manager-name)

Write relational algebra expressions for the following queries :

(i) Find the names of all employees (i.e., persons) who work for the City Bank company (which is a specific company in the database).

(ii) Find the names and cities of all employees who work for City Bank.

(iii) Find the names, streets, and cities of all employees who work for City Bank and earn more than $10,000.

(iv) Find all employees who live in the same city as the company they work for.

(v) Find all persons who do not work for City Bank.

(vi) Find the second-largest salary earned by an employee. (6×1½=9)

(b) Explain the select, project, and division operations in relational algebra with examples. (3×2=6)

4. (a) How do domain constraints and key constraints contribute to maintaining data integrity in a relational database? Provide suitable examples to illustrate their application. (7)

(b) What is a view in a relational database, and how is it specified? Discuss different techniques for implementing views with examples. (8)

UNIT–III

5. (a) Given a relation R(A, B, C, D, E) with the following functional dependencies :

$A \rightarrow BC$, $C \rightarrow A$, $D \rightarrow E$, $F \rightarrow A$, $E \rightarrow D$,

determine whether the decomposition into $R_1(A, C, D)$, $R_2(B, C, D)$, and $R_3(E, F, D)$ is lossless. (8)

(b) Explain insertion, update, and deletion anomalies with examples. How does normalization help in reducing these anomalies? (7)

6. (a) Consider the following relation for a car dealership:

Dealership (UniqueID, Customer_name, Purchase, Address, Newsfeed, Supplier, Price)

Normalize the table so that all resulting tables are in 3NF, starting with the definitions of the various normal forms. (8)

(b) Explain Boyce-Codd Normal Form, Fourth Normal Form, and Fifth Normal Form with appropriate examples. (7)

UNIT–IV

7. (a) Explain view serializability with an example. How is it different from conflict serializability. (7)

(b) How are rollback, commit, and checkpointing operations performed on transactions? Explain. (8)

8. (a) Explain in detail the timestamp-based concurrency control techniques. (7)

(b) Demonstrate how deadlock prevention techniques like wait-die and wound-wait work with an example. (8)

Roll No. ..... Total Pages : 3

44232

BT-4/J-25

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) What is the role of an Information Architect? Discuss how they collaborate within a web development team. 8

(b) Explain the different types of navigation systems used in websites. Give examples for each. 7

2. (a) What are the key challenges in organizing information on websites and intranets? Explain with examples. 8

(b) What is the purpose of an Architectural Page Mockup? How is it different from Design Sketches? 7

UNIT-II

3. (a) Differentiate between HTML, XHTML, and HTML5 with respect to their syntax and document structure. 8

(b) Explain how forms are created in HTML? Write a sample form that collects user name and email. 7

4. (a) What is the Box Model in CSS? Explain each component with the help of a diagram. 8

(b) Define Selector Forms in CSS. Illustrate any three types with examples. 7

UNIT–III

5. (a) Write a JavaScript function to validate whether an input string is a valid email. Explain the regular expression used. 8

(b) Explain object creation and modification in JavaScript using constructors. Provide suitable examples. 7

6. (a) What are control statements in JavaScript? Explain `if-else`, `switch`, and `for` loop with examples. 8

(b) What are the common types of errors in JavaScript? How can they be handled? 7

UNIT–IV

7. (a) Explain any four built-in data types in Python with examples. 8

(b) Write a Python function to read contents from a text file and print all lines that contain the word "Python". 7

8. (a) What are classes in Python? Explain how they are used in object-oriented programming with an example. 8

(b) What is a dictionary in Python? Write a program to count the frequency of each word in a given string. 7

Roll No. ..... Total Pages : 3

44233

BT-4/J-25

OPERATING SYSTEM

Paper : PC-CS-AIML-210A

Time : Three Hours] [Maximum Marks : 75

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

1. (a) What is operating System? Explain Operating system structure. (7)

   (b) Discuss the evolution of operating systems from batch processing to modern OS. (8)

2. (a) What is the purpose of system calls, and how do system calls relate to the OS and to the concept of dual-mode (kernel mode and user mode) operation? (8)

   (b) Explain the memory hierarchy in a computer system with a neat diagram. (7)

3. (a) What two advantages do threads have over multiple processes? What major disadvantage do they have? Suggest one application that would benefit from the use of threads, and one that would not. (8)

(b) Explain the difference between preemptive and non-preemptive scheduling. Explain shortest job first scheduling algorithm. (7)

4. (a) A uniprocessor computer system has three processes, which alternate 20 ms CPU bursts with 80 ms I/O bursts. All the processes were created at nearly the same time. The I/O of all the processes can proceed in parallel. What will be the CPU utilization (over a long period of time) using FCFS and Round Robin (time quantum 10 ms) for this system? (8)

(b) Explain counting semaphores. How can they help in solving reader writer problem? (7)

5. (a) Define critical section? How critical section problem can be solved using Peterson's algorithm. (7)

(b) Discuss mapping of logical address to physical address in simple paging using neat diagram. Evaluate the maximum number of pages needed if a system supports 16 bit address line and 1 K page size. (8)

6. (a) Give the condition necessary for a deadlock situation to arise? Explain resource allocation graph. (8)

(b) When page faults will occur? Describe the actions taken by operating system during page fault. (7)

7. (a) What is a file? List the various file attributes. What are the various file operations? (9)

(b) How free-space is managed using bit vector implementation? List its advantages. (6)

8. (a) Compare the functionalities of FCFS, SSTF, C-SCAN and C LOOK with example. (12)

(b) Explain direct memory access in brief. (3)

Roll No. ..... Total Pages : 3

44234

BT-4/J-25

SOFTWARE ENGINEERING

Paper : PC-CS-AIML-212-A

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 Software Engineering? Discuss its evolving role in the modern era. 8

(b) Explain the Waterfall Model and compare it with the Spiral Model. 7

2. (a) Describe the major characteristics of Software. How does it differ from Hardware? 8

(b) What are Iterative Enhancement and RAD models? Discuss briefly. 7

UNIT–II

3. (a) What is the purpose of a Software Requirement Specification (SRS)? Explain its key components. 8

(b) Describe the IEEE standard for SRS. 7

4. (a) What is Software Quality Assurance (SQA)? Explain the SEI-CMM model. 8

(b) Write a short note on Software Risk Management and Configuration Management. 7

UNIT–III

5. (a) Explain Modularization in software design with the help of an example. 8

(b) Describe Coupling and Cohesion with suitable diagrams. 7

6. (a) What is the COCOMO model? Explain its significance in project estimation. 8

(b) Differentiate between Function-Oriented and Object-Oriented Design strategies. 7

UNIT–IV

7. (a) Describe the fundamentals of Software Construction. How is complexity minimized? 8

(b) Discuss the role of Coding standards and Structured programming in Software development. 7

8. (a) What are the various levels of Software Testing? Explain with examples. 8

(b) What is Software Maintenance? Discuss its types and cost factors. 7

AIML 6th/ Lib.

Roll No. ..... Total Pages : 02

BT-6/J-25 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. (i) Discuss the role of different components used in human intraction model. 8

   (ii) What are different I/O channels used in human interaction model ? 7

2. (i) Discuss various type memories used in HCI. 7

   (ii) What are different types of paradigms used in intraction model ? 8

Unit II

3. (i) Explain the software lifecycle based on HCI. 7

   (ii) Discuss various phases involved in universal design. 8

4. (i) Describe various design rules used in interactive design. 7

(ii) Discuss the significance of Iteration and prototype in interactive design. 8

Unit III

5. (i) Explain the framework of cognitive model. 7

(ii) What are different elements used in mobile designing ? 8

6. (i) Explain mobile information architecture. 7

(ii) Discuss different types of mobile applications. 8

Unit IV

7. (i) Discuss any one case study based on designing web interface. 7

(ii) Differentiate overlays and inlays. 8

8. Write short notes on the following : 2×7.5=15

(i) Drag and Drop

(ii) Contextual Tools.

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Roll No. ..... Total Pages : 02

BT-6/J-25 **46308**

APPLIED MACHINE LEARNING
PC-CS-AIML-304A

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. What is Machine Learning ? Explain the Diversity of data in Machine Learning. **15**

2. Explain the concept of Linear Algebra. Discuss, how linear algebra is used to solve machine learning problems ? **15**

Unit II

3. What is the significance of heuristic search in Inductive learning ? **15**

4. Describe, how is classification used for pattern recognition. Also explain how logistic regression is used in classification tasks. **15**

Unit III

5. What is KNN Algorithm ? Explain, how KNN is used for regression task. **15**

6. Discuss Linear discriminant functions are used for binary classification. **15**

Unit IV

7. What do you mean by Clustering ? Discuss the process of k means clustering. Also explain its applications. **15**

8. What is dimensionality reduction technique ? Explain Principal Component Analysis and its advantages and disadvantages. **15**

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Roll No. ..... Total Pages : 02

BT-6/J-25 46309

EXPERT SYSTEMS

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 A* algorithm. How does it improve over Best-First Search ? 7

   (b) Discuss Min-Max algorithm used in game playing. Illustrate with an example. 8

2. (a) Describe the working of Hill Climbing. What are its advantages and limitations ? 8

   (b) How are semantic nets used in knowledge representation ? Give an example. 7

Unit II

3. (a) Differentiate between conventional programs and expert systems. Give examples. 8

(b) Describe the structure and purpose of the inference engine in an expert system. 7

4. Explain the following in the context of expert systems : 15

(i) Forward and Backward Chaining

(ii) Role of Explanatory Interface in decision-making.

Unit III

5. Explain the complete process of building an expert system, from selecting a tool to implementation. Highlight the role of a knowledge engineer. 15

6. (a) What is knowledge engineering ? Discuss its significance in expert system design. 8

(b) List and describe any three system-building aids used in expert systems. 7

Unit IV

7. What are the most common difficulties encountered during expert system development ? Suggest strategies to overcome them effectively. 15

8. Present a detailed case study of a real-world expert system. Describe its purpose, design, challenges faced during development, and its impact. 15

Roll No. ..... Total Pages : 3

BT-6/J-25 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) Differentiate between Verification and Validation in the context of software testing. Explain with examples and discuss why both are essential in the software development process. **8**

   (b) What is software testing ? Describe the purpose and importance of test cases and test oracles in ensuring software quality. **7**

2. Explain the Software Development Life-Cycle (SDLC) and discuss the role of software testing in each phase. Also, provide a brief overview of software evolution in relation to testing practices. **15**

Unit II

3. (a) Define Boundary Value Analysis and Equivalence Class Testing with appropriate examples. **8**

   (b) Describe the Cause-Effect Graphing Technique used in functional testing and highlight its advantages. **7**

4. Explain the concepts of Path Testing and Cyclomatic Complexity in software testing. With the help of a control flow graph, demonstrate how Cyclomatic Complexity is calculated and how it helps in identifying independent paths. Discuss the importance of these paths in improving software quality. **15**

Unit III

5. (a) Discuss the role of test case prioritization in efficient software testing. What are the commonly followed guidelines and criteria used to determine the priority of test cases ? **8**

   (b) Define Regression Testing and explain its importance in software maintenance. **7**

6. (a) What is Integration Testing ? Explain the different types of Integration Testing with suitable examples. Also, describe the role of stubs and drivers in the integration testing process. **8**

(b) What is Debugging ? Describe its role in the software testing life-cycle. 7

Unit IV

7. Explain the Capability Maturity Model (CMM) in detail. Describe each of its five maturity levels with their key characteristics and process focus. How does CMM contribute to improving software quality and organizational process maturity ? **15**

8. Differentiate between the following software testing approaches with suitable examples : **15**
   (i) Agile Testing *vs.* Extreme Testing
   (ii) Exploratory Testing *vs.* Adhoc Testing.

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Roll No. ..... Total Pages : 03

BT-6/J-25 **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) Explain the working of a basic computer imaging system. What are the key components involved in capturing and processing an image ? **7.5**

(b) Briefly describe the significance of histogram equalization and filtering in image pre-processing. **7.5**

2. Explain the concept of binary image analysis. Discuss morphological operations such as erosion, dilation, opening and closing with suitable diagrams. **15**

Unit II

3. Describe in detail the process of edge detection. Explain the Canny edge detection algorithm with all its steps and mathematical expressions. **15**

4. (a) What is the Fourier Transform in image processing ? Mention any *two* applications of Fourier Transform in computer vision. **7.5**

   (b) What is corner detection ? Briefly describe the Harris Corner Detection method. **7.5**

Unit III

5. (a) What is feature extraction in image processing ? Why is it important in computer vision applications ? **7.5**

   (b) What is CVIPtools ? Mention any *three* image processing tasks that can be performed using it. **7.5**

6. Define and compare at least three distance/similarity measures : Euclidean, Manhattan and Cosine Similarity. In what contexts are each most appropriate in image analysis ? **15**

Unit IV

7. Describe non-parametric methods of dimensionality reduction. How do they differ from parametric methods like PCA and LDA ? **15**

8. (a) Explain the role of discriminant functions in classification. How do they help in decision-making ? **7.5**

   (b) Differentiate between supervised, unsupervised and semi-supervised classification with suitable examples. **7.5**

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Roll No. ..... Total Pages : 03

BT-6/J-25 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. Explain different phases of Project Planning. **15**

2. (a) What is Cost-Benefit Analysis in Project Management ? **9**

   (b) What are the five stages of strategic management ? **6**

Unit II

3. Which activities must be included during software process ? Explain the working of software model which is used for Risk Analysis. **15**

4. (a) What are the various ways to estimate software development cost ? 7

(b) Explain COCOMO-II in detail. Why do we use it ? 8

Unit III

5. (a) Explain some important activities that a software project manager performs during planning of software project. 8

(b) Write down the names of Network Planning Models with brief introduction. 7

6. (a) What are the essential strategies for risk identification and risk analysis ? 10

(b) What are the two methods used in critical path analysis ? 5

Unit IV

7. (a) What are the five phases of a project management framework ? 9

(b) What is a WBS in project management ? 6

8. (a) Explain the term prioritizing monitoring. 7

(b) What do you mean by Software Configuration Management (SCM) ? Explain the activities Involved in SCM. 8

AIML 7th Sem/ Lib.

Roll No. ..... Total Pages : 2

47394

BT-7/J-25

UNIVERSAL HUMAN VALUES – II :

UNDERSTANDING HARMONY

Paper : HSS-403A

Time : Three Hours] [Maximum Marks : 75

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

UNIT–I

1. Discuss the concept of happiness and prosperity for human life. Discuss the basic requirements for fulfillment of human aspiration. (7+8=15)

2. Discuss the process of self exploration with suitable examples. Define and discuss the need of value education in today's world. (9+6=15)

UNIT–II

3. Discuss the concept of co-existence of self and body in detail. Discuss the concept of desire, thoughts and expectation for harmony of the self. (8+7=15)

4. Discuss in detail the program of self regulation to maintain harmony of the body. (15)

UNIT–III

5. Discuss the nine feelings between human-human relationships in detail. (15)

6. Discuss various systems of human order in society to achieve world family. (15)

UNIT–IV

7. Discuss the concept of nature and harmony within it. Discuss the role on human being in maintaining harmony at nature level. (10+5=15)

8. Discuss the concept of coexistence in detail. Discuss the complete existence as co-existence of various units and role of human being in it. (8+7=15)

Roll No. ..... Total Pages : 3

47420

BT-7/J-25

DATA SCIENCE WITH R PROGRAMMING

Paper : PC-CS AIML-401A

Time : Three Hours] [Maximum Marks : 75

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

UNIT–I

1. (a) What do you mean by Data Science? How does data science relate to other fields? (7)

   (b) Explain the historical evolution of data science. (8)

2. (a) What do you mean by Data Preprocessing? Explain various data preprocessing operations :

   (i) Data cleaning.

   (ii) Data integration.

   (iii) Data transformation.

   (iv) Data reduction.

   (v) Data discretization. (10)

   (b) Discuss the various tools used in data science. (5)

UNIT–II

3. (a) What is Data Visualization? Discuss various Data Visualization libraries. (8)

   (b) Explain the basic and specialized data visualization tools. (7)

4. (a) Explain Statistical Data analysis and probability in detail. (7)

   (b) Define the following terms :

   (i) Conditional Probability.

   (ii) Bayesian Probability.

   (iii) Random Variables.

   (iv) Probability distribution. (8)

UNIT–III

5. (a) What is R? Explain its uses, advantages and disadvantages. (8)

   (b) Discuss various operators and its precedence in R programming. (7)

6. (a) What do you mean by Data Frames in R programming? (8)

   (b) Briefly explain the process of data type conversion in R programming. (7)

UNIT–IV

7. (a) What do you mean by Logistic Regression? Explain its implementation in R Programming. (8)

   (b) Discuss various clustering methods used in machine learning for Data Science. (7)

8. (a) Discuss the importance of CSV files in machine learning. (8)

   (b) Discuss Hidden Markov Model & its applications in detail. (7)

Roll No. ..... Total Pages : 3

47422

BT-7/J-25

ROBOTICS AND INTELLIGENT SYSTEMS

Paper : OE-CS-AIML-401

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 some of the main challenges that are faced in robotics.

   (b) Discuss the brief history of robotics.

2. Discuss the robotic applications in the following fields :

   (a) Manufacturing industry.

   (b) Rehabilitation.

UNIT–II

3. Describe the following terms :

   (a) Degree of Freedom (DOF).

   (b) Actuator drive.

   (c) Classification of the actuator based on the motion.

4. (a) Explain the principle of transducer along with suitable architecture.

(b) A mobile robot is designed for unidirectional motion with constant velocity. Design a mechanism to make the robot move in forward and reverse directions with controllable speed and suggest the sensors and motion control drives required to achieve the same.

UNIT–III

5. Describe the following terms :

(a) Knowledge acquisition.

(b) Conflict resolution.

(c) Bayesian Updating.

6. What do you mean by backward chaining? How it is different from forward chaining? Justify with the help of suitable example. Also, discuss the pros and cons of both approaches.

UNIT–IV

7. (a) Differentiate between data abstraction and encapsulation.

(b) Differentiate between static and dynamic binding.

(c) Draw and explain the fuzzy logic architecture.

8. (a) Draw and explain the component module architecture of Decision Support System (DSS).

(b) What is deep learning in robotics? How it is different from machine learning? Which one is better and why? Justify with suitable comments.

Roll No. ..... Total Pages : 2

47430

BT-7/J-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.

UNIT–I

1. (a) Explain difference between Gradient Descent and stochastic gradient descent. (7.5)

(b) Explain stages of building a model in machine learning. (7.5)

2. Explain Multilayer perceptron in detail. Also write a short note on Back propagation networks. (15)

UNIT–II

3. Explain architecture of Deep Learning. Also write some applications of deep learning. (15)

4. Write short note on :

(a) RELU

(b) ERELU

(c) LRELU

(d) Unsupervised training of neural networks. (15)

UNIT–III

5. Draw and explain architecture of Convolutional neural networks. Outline transposed and dilated convolutions with an example. (15)

6. (a) Define AlexNet. Also write applications of AlexNet. (7.5)

   (b) Draw and explain architecture of CNN. (7.5)

UNIT–IV

7. What is a bi-directional recurrent neural network? Explain architecture of Bi-directional recurrent neural network with a diagram. (15)

8. Explain Long short-term memory networks in detail. Also write some applications of Long short-term memory networks. (15)

AIML 8th/ Lib.

Roll No. ..... Total Pages : 2

BT-8/J-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 examples. 8

   (b) Explain Karush-Kuhn-Tucker (KKT) conditions and their role in Convex optimization. 7

2. Discuss various types of Convex Programming problems including LP, SOCP, and SDP in detail with suitable examples. 15

UNIT–II

3. (a) Describe the Frank-Wolfe algorithm and its Convergence characteristics. 8

   (b) What is Nesterov's smoothing technique? Where is it applied? 7

4. (a) Explain Moreau–Yosida regularization and its use in smoothing non-differentiable functions. 8

(b) Differentiate between Gradient descent and Sub-gradient methods. 7

UNIT–III

5. (a) Explain Primal and Dual decomposition with respect to Optimization problems. 8

(b) Differentiate between Douglas–Rachford splitting and ADMM. 7

6. (a) Explain Augmented Lagrangian methods in detail. 9

(b) Describe Monotone operators and their role in Operator splitting methods. 6

UNIT–IV

7. (a) Explain Stochastic Gradient Descent (SGD) and its limitations. 8

(b) Define saddle points. Why are they problematic in Non-convex optimization? 7

8. (a) Describe the SVRG algorithm. How does it reduce variance in Gradient estimation? 8

(b) Discuss the application of deep learning in solving Non-convex optimization problems. 7

Roll No. ..... Total Pages : 2

BT-8/J-25 **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. (a) What is the meaning and concept of Entrepreneurship ? 7

   (b) Discuss the role of Entrepreneurship in Economic Development. 8

2. (a) What are some common myths about Entrepreneurs ? 7

   (b) Explain the different types of Entrepreneurs. 8

UNIT–II

3. (a) What are the key traits required to be a successful Entrepreneur ? 8

   (b) How does Creative and Design Thinking influence Entrepreneurship ? 7

4. (a) Describe the Entrepreneurial decision-making process. 7

(b) Share an example of a successful Entrepreneurial story and analyze the key factors behind it. 8

UNIT–III

5. (a) What is a Business model and why is it important for Start-ups ? 7

(b) How do conventional Industry Logic and Value innovation Logic differ ? 8

6. (a) What is the Business model canvas and how is it used ? 7

(b) Explain the concept of Lean Start-ups and the process of Business pitching. 8

UNIT–IV

7. (a) What are the roles of Central and State-level Institutions in supporting Small Business Enterprises ? 7

(b) How do Industry associations contribute to Entrepreneurship development ? 8

8. (a) Discuss any one Government Scheme that supports Entrepreneurship in India. 8

(b) How can a student align their Business Plan with the available Government Support Schemes ? 7

Roll No. ..... Total Pages : 2

BT-8/J-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. With the help of block diagram explain Image Geometry perspective and transformation. Describe the Stereo imaging elements of Visual perception. 15

2. What is Image restoration? Explain Wiener filter. 15

UNIT–II

3. Describe Supervised and Unsupervised classification techniques in detail. 15

4. What are different Shape descriptors? Describe skeleton detection in detail. 15

UNIT–III

5. Define Expectation, Mean, Covariance and Normal distribution. Explain how do they help in pattern recognition? 15

6. Describe Discriminant functions. Explain their relevance in Bayesian Classifier design. 15

UNIT–IV

7. Describe Fisher Linear Discriminant Analysis method in detail. 15

8. Explain Gaussian Mixture Models. 15

Roll No. ..... Total Pages : 2

BT–8/J-25 **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. (a) Differentiate single layer and multilayer feed forward networks with suitable diagram. 10

   (b) Write applications of Artificial neural networks. 5

2. Write short notes on the following : 15

   (a) Auto-associative memory.

   (b) Hetro-associative memory.

   (c) Activation function.

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. Differentiate fuzzy set and crisp set. Explain various fuzzy membership functions with suitable examples. 15

UNIT–III

5. Explain importance of Defuzzification in fuzzy logic. Explain various Defuzzification techniques. 15

6. Define Fuzzy Inference System. Explain various characteristics of Fuzzy Inference System. Also explain functional blocks of Fuzzy Inference System. 15

UNIT–IV

7. List various Industrial applications of Fuzzy systems. How pattern recognition can be done in Fuzzy systems? Explain in detail. 15

8. Write short notes on the following : 15

   (a) Network Optimization.

   (b) Fuzzy Logic Control System.

   (c) Machine Intelligence.

Roll No. ..... Total Pages : 3

BT–8/J-25 **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) What is the role of Bayesian inference in the Noisy Channel Model? Discuss.

   (b) What is prosody and how does it affect NLP applications?

2. (a) What are Conceptual Dependency (CD) structures? Give the CD structure for the sentences: (i) Ram pulled the cart. (ii) Mohan gives the book to Sohan.

   (b) How can Frames be used to represent knowledge? Differentiate between declarative and procedural frames.

UNIT–II

3. (a) What is a rules-based deduction system? Explain forward chaining and backward chaining with examples.

(b) Explain the difference between regular and context-free grammars.

4. (a) Give an example of a left-associative grammar for arithmetic expressions. What is the difference between left associative and right-associative grammars?

(b) What is an Ambiguous grammar? How can ambiguity be resolved in a grammar?

UNIT–III

5. (a) What is a Recursive Transition Network (RTN)? How does an RTN differ from an ATN?

(b) Explain the CKY (Cocke-Kasami-Younger) parsing algorithm.

6. (a) What is Tomita's algorithm? How does Tomita's parser handle ambiguity in grammars?

(b) How does Earley's algorithm handle left recursion? Discuss.

UNIT–IV

7. (a) What is Machine translation? What are the main challenges in Machine translation?

(b) What are the limitations of using NLP in Human-computer interaction?

8. (a) Explain how NLP improves the usability of Search engines?

(b) What are the steps involved in converting speech to text using NLP? Discuss.