

Roll No.

Total Pages : 03

BT-4/M-24

44220

INTERNET AND WEB TECHNOLOGY

PC-CS-AIDS

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. How to determine that a website needs a search system ?
Also discuss the anatomy of search system. 15
2. Identify the basic uses of Architectural Page Mockups in order to design efficient Information Architecture. 15

Unit II

3. Write HTML code for a single web page design for the following : 15
 - (i) To divide web page in four sections with 25% each
 - (ii) To display five different images and all five images are moving from top to bottom
 - (iii) To add a video that has width of 520 pixels by 440 pixels
 - (iv) To create a nested list.

- (v) To create a form having three checkboxes, three radio buttons and one submit button.
4. What is CSS ? Explain all different methods, how is CSS implemented within HTML with example. 15

Unit III

5. (i) What is Prompt Box ? Write a code for its implementation.
- (ii) Write code for embedding javascript code in HTML 5. 15
6. (i) How are switch statements implemented in JavaScript ?
- (ii) Write a code for implementing ternary operator. 15

Unit IV

7. Write a single Python program to execute the following : 15
- (i) Both ways to end a loop
- (ii) Use split() function
- (iii) Multiple inheritance
- (iv) Range() and xrange() function
- (v) Python namespace.
8. Write a single program to execute the following : 15
- (i) Whether a number is whole or not

- (ii) Different functions to retrieve rows from a table
- (iii) What are *args ?
- (iv) Difference between List and Tuples with example
- (v) Apply Del() and remove() on List.

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DATABASE MANAGEMENT SYSTEM

PC-CS-AIDS-210A

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) With the help of suitable example, differentiate between file-based information system and database management system.
- (b) What is data independence ? Discuss the same with the help of three schema architecture.
2. (a) What do you mean by entity relationship model ? Draw the various symbols used in E-R model.
- (b) Discuss the concept of generalization and aggregation with the help of an example.

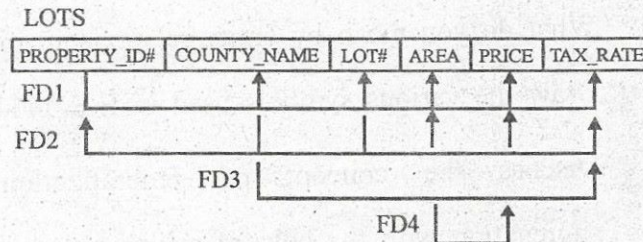
Unit II

3. (a) What is relational algebra ? Explain various relational algebra operators with suitable example of each.
(b) What do you mean by relational calculus ? Explain along with its various types.
4. (a) With the help of suitable syntax, discuss three commands each of DDL, DML, and DCL.
(b) What are Views ? How a view is different from a table ? Give the syntax to create, delete and drop the view.

Unit III

5. What do you mean by functional dependencies ? Also, discuss the various anomalies while designing a database. Discuss the same with the help of suitable example.
6. What is Normalization ? Why is it required ? Explain various normal forms with the help of given example.

Explain :



Unit IV

7. What is Serializability ? Discuss the same along with its various types. Also, check whether that the given schedule is conflict serializable or not :

	Transaction T ₁	Transaction T ₂	Transaction T ₃
Time ↓	read_item(X); write_item(X);		read_item(Y); read_item(Z);
	read_item(X); write_item(X);	read_item(Z);	read_item(Y); read_item(Z);
		read_item(Y); read_item(Y); read_item(X); read_item(X);	

8. (a) Discuss Basic Time Stamp Ordering concurrency control algorithm.
- (b) What is database recovery ? Explain shadow paging recovery method with the help of suitable example.

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OPERATING SYSTEM

PC-CS-AIDS-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. What is an operating system ? Discuss essential properties of the following type of operating systems :
 - (a) Multi-programmed operating systems.
 - (b) Time sharing operating systems.
 - (c) Distributed operating systems.
2. Explain the following :
 - (a) System calls.
 - (b) Different types of protection.
 - (c) Virtual machine.

Unit II

3. Consider the following set of processes, with arrival time, length of the CPU burst time, and priority (lower number

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means higher priority). Draw the Gantt chart and then calculate the average waiting time for Shortest Job First, Shortest remaining time next, and priority (preemptive case only).

Process	Arrival Time (msec)	Burst Time (msec)	Priority
P1	0	10	5
P2	0	5	2
P3	2	3	1
P4	5	20	4
P5	10	3	3

4. (a) What do you mean by communication primitives ? Explain in detail inter process communication along with its various design issues.
- (b) What do you mean by critical section problem ? Give the criteria to measure the performance of critical section problem.

Unit III

5. What is Deadlock ? Consider the following snapshot of a system :

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	0	1	2	0	0	1	2	2	1	0	0
P1	2	0	0	0	2	7	5	0				
P2	0	0	3	4	6	6	5	6				
P3	2	3	5	4	4	3	5	6				
P4	0	3	3	2	0	6	5	2				

Answer the following questions using the Banker's algorithm :

- (a) What is the content of the matrix Need ?
- (b) Is the system in a safe state, justify ?
- (c) Can a request (0,1,0,0) from process P3 be safely granted immediately ? Justify your answer.

6. (a) What do you mean by page replacement ? Explain various page replacement algorithms along with their advantages and disadvantages.
- (b) Using LRU and optimal page replacement algorithm, determine the number of page faults when reference to pages occur in the following order :
1, 2, 4, 5, 2, 1, 2, 4.

Assume that the main memory can accommodate 3 pages and the main memory already has the pages 1 and 2, with page 1 having been brought earlier than page 2.

Unit IV

7. What is disk scheduling ? Suppose that a disk has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 98. The queue of pending requests, in FIFO order, is 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms ?
- (a) FCFS.
 - (b) SSTF.
 - (c) C-SCAN.

8. Write short notes on the following :

- (a) File allocation methods.
- (b) General graph directory.
- (c) Domain of protection.

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44226

MATHEMATICS FOR MACHINE LEARNING
BS-CS-AIML

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 machine learning ? Discuss the history of machine learning. $7\frac{1}{2}$
- (b) What are the three stages of building a model in machine learning ? $7\frac{1}{2}$
2. (a) What are the applications of supervised machine learning in modern businesses ? $7\frac{1}{2}$
- (b) Discuss the Data set which are useful for machine learning algorithm. $7\frac{1}{2}$

Unit II

3. (a) There are three coins. One is a two headed coin (having head on both faces), another is a biased coin that comes up heads 75% of the time and third

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is an unbiased coin. One of the three coins is chosen at random and tossed, it shows heads. What is the probability that it was the two headed coin ?

7½

- (b) Five defective bulbs are accidentally mixed with twenty good ones. It is not possible to just look at a bulb and tell whether or not it is defective. Find the probability distribution of the number of defective bulbs, if four bulbs are drawn at random from this lot.

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 :

7½

- (i) not more than three,
(ii) at least three of them will be busy ?

- (b) If the variance of the Poisson distribution is 2, find the probability for $r = 1, 2, 3, 4$ form the recurrence relation of the Poisson distribution.

7½

Unit III

5. (a) Use Gauss Jordan method to find the inverse of the

matrix $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$.

7½

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

6. (a) Check whether the vectors $\{(1, -2, 5, -3), (0, 7, -9, 2), (0, 0, 1, 0), (0, 0, 0, 1)\}$ are LI or LD. 7½

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

matrix :
$$\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$
 7½

Unit IV

7. (a) Which of the following matrix is diagonalizable over and why ? 7½

(i)
$$\begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(ii)
$$\begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 3 \end{bmatrix}$$

(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

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44227

INTELLIGENT SYSTEMS

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) What distinguishes NP-complete problems from NP-hard problems in the context of artificial intelligence ? 7
- (b) Discuss the role of knowledge bases and data-driven approaches in AI problem-solving, and provide examples of how each is utilized in real-world AI applications. 8
2. (a) Differentiate between neat and scruffy AI approaches, providing examples of each and discussing their respective advantages and limitations. 8

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- (b) Compare and contrast symbolic AI and sub-symbolic AI techniques. 7

Unit II

3. (a) How does Best First Search differ from other heuristic search algorithms such as Hill Climbing and Beam Search ? 8
- (b) Discuss the principles of Tabu Search and how it overcomes limitations of other local search algorithms by incorporating memory-based mechanisms. 7
4. (a) Describe the principles of Principal Component Analysis (PCA) and Independent Component Analysis (ICA) and how they are used for dimensionality reduction and feature extraction in high-dimensional data sets. 8
- (b) Discuss the basic concepts of information theory and Bayesian learning and explain how they are applied in optimization algorithms. 7

Unit III

5. (a) Contrast forward-chaining and backward-chaining as data-driven and goal-driven strategies, respectively in the context of intelligent systems. 7

- (b) How does knowledge acquisition contribute to the development of intelligent systems and what are the primary methods used to gather and represent knowledge effectively ? 8
6. (a) How do conflict resolution mechanisms operate in intelligent systems and what strategies are employed to handle conflicts that arise during the reasoning process ? 8
- (b) Discuss the role of computational intelligence in the design and implementation of intelligent systems. 7

Unit IV

7. (a) Explain the importance of Unified Modeling Language (UML) in software engineering and how it aids in visualizing and documenting complex systems. 8
- (b) How does possibility theory contribute to understanding uncertainty in decision-making processes, particularly within fuzzy sets and fuzzy logic frameworks ? 7

8. (a) Explore the key application areas of expert systems and decision support systems, highlighting their impact on various industries and domains. 8
- (b) In what ways do deep learning techniques, specifically in speech and vision applications, leverage data abstraction and advanced algorithms to achieve state-of-the-art performance ? 7

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44228

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 software engineering and why is it important ? Explain the software engineering ethics ? 7
- (b) With the neat diagram, differentiate between prototype and incremental model. 8
2. (a) Discuss about failure curves for hardware and software with a neat diagram. 7
- (b) Discuss Iterative enhancement model and evolutionary development model with reference to suitability of the software project. 8

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Unit II

3. (a) Explain the software requirement analysis and specification. Discuss various methods for requirement gathering. 8
- (b) List the different types of risk that a typical software suffer during the software development phase. Discuss the essential strategies for risk identification and risk analysis. 7
4. (a) Draw DFD (level 0, 1 and 2) for software of college management system. 9
- (b) With the neat diagram, explain the requirement elicitation and analysis process. 6

Unit III

5. (a) Explain clearly what each of the following design principles means and why is it important ? Use examples to illustrate your answer : 9
 - (i) Abstraction
 - (ii) Separation of Concerns
 - (iii) Modularity.
- (b) Explain the differences between Function-oriented-design and Object oriented-design with an example. 6

6. (a) Write short note on key activities in Object Oriented Design. 7
- (b) What is meant by modularity ? How to decide the right number of modules for a specific Software design ? 8

Unit IV

7. (a) Explain the Basis Path Testing technique with suitable example. 8
- (b) Explain briefly the three different types of software maintenances. Which type consumes maximum effort ? 7
8. (a) A program reads three numbers, A, B and C with a range [1, 50] and prints the largest number. Design the test cases for this program using equivalence class partitioning technique. 8
- (b) Explain, how does Regression testing differ from the Stress testing ? 7

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46307

BT-6/M-24

HUMAN COMPUTER INTERACTION

Paper-PC-CS-AIML-302A

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 importance of reasoning and problem-solving abilities of humans in the design of user interfaces for interactive systems.
(b) Define interaction models and explain how they guide the design of user interfaces in software systems.
2. (a) Analyze the principles of ergonomics in interface design and their importance for creating user-friendly computer systems.
(b) Compare different interaction paradigms and their implications for interface design and user engagement.

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UNIT-II

3. (a) Explain the significance of interactive design basics in the development of user-friendly interfaces, providing examples of how process and scenario considerations influence design decisions.
(b) Discuss the principles of screen design and the factors to consider when designing screens for different types of applications and user tasks.
4. (a) Analyze the role of HCI in the software development process, including its integration with software lifecycle models and usability engineering methodologies.
(b) What do you mean by universal design in HCI? Explain its goals and principles for creating inclusive and accessible interfaces for diverse user-populations.

UNIT-III

5. (a) Explain the concept of cognitive models in human-computer interaction (HCI) and discuss how they influence the design of user interfaces.
(b) Discuss the importance of communication and collaboration models in HCI, highlighting their role in supporting effective interaction among users and between users and systems.

6. (a) Explain the concept of mobile application frameworks and provide examples of popular frameworks used for developing mobile apps. Also, define and differentiate between various types of mobile applications.
- (b) Identify and describe the essential elements of mobile design, such as screen layout, navigation patterns, and touch gestures.

UNIT-IV

7. Explain the concept of designing web interfaces, highlighting the key principles and considerations involved in creating effective and user-friendly web experiences. Also, compare different interaction techniques used in web interface design, such as drag and drop, direct selection, and contextual tools.
8. (a) Explain the concept of virtual pages in web interface design, discussing how they can be utilized to create dynamic and interactive user experiences.
- (b) Provide any one example of real-world case studies in web interface design, highlighting successful design solutions

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46308

BT-6/M-24

APPLIED MACHINE LEARNING

Paper-PC-CS-AIML-304A

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 is the significance of domain knowledge when applying machine learning algorithms to real-world problems? (8)
(b) Explain the role of basic linear algebra in various machine learning techniques. (7)
2. (a) What is supervised learning? How do bias and variance impact the performance of supervised learning models? (8)
(b) What are some commonly used metrics for assessing regression accuracy in supervised learning tasks? (7)

UNIT-II

3. (a) How does multiple linear regression differ from simple linear regression, and when is it more appropriate to use? (8)
(b) What is logistic regression, and how is it utilized in classification tasks? (7)

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4. (a) What is Gradient Descent, and how is it used to optimize models in machine learning? (8)
- (b) Explain Bayesian reasoning as a probabilistic approach to inference and its applications in machine learning. (7)

UNIT-III

5. (a) What are the underlying principles of the K-Nearest Neighbor (KNN) algorithm, and how does it classify data points based on their proximity to other instances? (8)
- (b) Describe the Linear Discriminant Analysis (LDA) algorithm and its application in dimensionality reduction and classification tasks. (7)
6. (a) What are the foundational principles behind Support Vector Machines (SVMs), and how do they differ from other machine learning algorithms? (8)
- (b) How can a multiclass classification problem be effectively decomposed into a series of binary classification tasks? Explain using suitable example. (7)

UNIT-IV

7. Provide an overview of basic clustering methods, such as K-means clustering and Gaussian mixtures clustering, and discuss their respective advantages and limitations. (15)

8. (a) What is Principal Component Analysis and How it Works? (8)
- (b) Explain the concept of unsupervised learning and how it differs from supervised learning. (7)
-

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46309

BT-6/M-24

EXPERT SYSTEMS

Paper : PC-CS-AIML-306A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. (i) What is blind search? Why it is called blind search?
List various blind search strategies. 7
- (ii) Differentiate A algorithm and AO* algorithm. 8
2. (i) What is predicate logic? What are different ways
of representing predicate logics? 8
- (ii) Define frame. How Knowledge Representation is
presented using Frame? 7

UNIT-II

3. (i) Differentiate expert system and conventional
programs with example. 7
- (ii) How diagnosis and debugging activity is carried
out in expert system. 8

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4. (i) Write short notes on acquisition module frame. 7
(ii) Differentiate forward and backward chaining. 8

UNIT-III

5. (i) Discuss different steps involved in building expert system. 7
(ii) Discuss various techniques knowledge representation in expert system. 8
6. (i) Write and explain various stages in development of expert system. 7
(ii) How the tools are selected for building expert system? List various tools used for building expert system. 8

UNIT-IV

7. (i) What are the common pitfalls that occur during the planning of an expert system? 7
(ii) What are the different problems that can occur during the different phases of the development of an expert system? 8
8. Write short notes on :
(i) MYCIN.
(ii) DENDRAL. (2×7½=15)

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46310

BT-6/M-24

SOFTWARE TESTING

Paper-PC-CS-AIML-308A

Time : Three Hours]

[Maximum Marks : 75

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

UNIT-I

1. (a) Explain effective Software testing with suitable example. Why it is hard to implement?
(b) Discuss the limitations of testing by taking suitable example. (7+8=15)
2. (a) How verification can be done at requirement, High level design and low level design? Explain with suitable example.
(b) Differentiate among error, fault and failure by taking suitable example. Also list the different types of test cases. (7+8=15)

UNIT-II

3. (a) Why Graph metrics is important in testing process? Also show its use to calculate Cyclomatic Complexity with suitable example.
(b) Why the mutation testing is important in testing process? (10+5=15)

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4. (a) What is the scope of cause effect graphing technique?
Illustrate with suitable example.
(b) How boundary value analysis is used for testing process? (7+8=15)

UNIT-III

5. (a) What are the steps involved while performing slice based testing?
(b) How can we perform risk analysis in effective manner? (7+8=15)
6. (a) Elaborate various level of testing involved in testing process.
(b) Define the need of domain testing in testing process. (7+8=15)

UNIT-IV

7. (a) What are the various quality models? Explain McCall model in detail.
(b) Describe all the quality factors of Boehm Model? Where does the Boehm model is used. (7+8=15)
8. Write short note on the following :
(a) Buddy Testing.
(b) Exploratory Testing.
(c) Agile Testing. (5×3=15)

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COMPUTER VISION

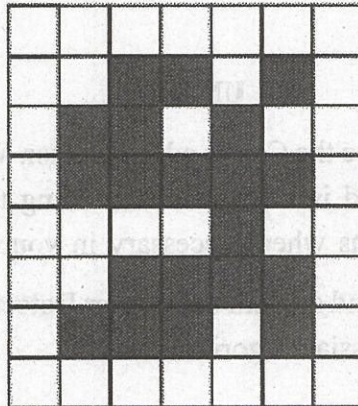
Paper : PC-CS-AIML-310A

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) State the different limitations of a pinhole camera and how to overcome these limitations. Write a short note on thin lenses. (7)
- (b) Given below is a binary image where dark pixels denote object pixels. (2+3+3=8)



Binary Image

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- (i) Use 4-connectedness and 8-connectedness to sketch the distinct objects in the binary image.
- (ii) Write down the expression for the first order moments of a binary image. Use these expressions to compute the centroid of the object in the binary image given above. You may assume that the top left pixel has coordinates $(0, 0)$.
- (iii) Write down the expressions for the second order moments of a binary image.
2. (a) Explain the different components of a vision system. How is conversion from affine to Euclidean images performed? (7)
- (b) What is Computer Vision? Why is vision so difficult? Provide six real-world examples of computer vision and explain. (8)

UNIT-II

3. (a) Describe the Canny edge detector. What are the steps involved in edge detection using this detector. Use diagrams where necessary in your explanation. (7)
- (b) Write and explain the Corner Detector and Laplacian of Gaussian algorithm. (8)

4. (a) Explain how the Fourier Transform is used for image enhancement by applying frequency domain filters, such as high-pass filtering, high-boost filtering, and homomorphic filtering. What is (are) the main task(s) for the above 3 filters as far as image processing is concerned? (7)
- (b) Explain Hough Transform with Example. Why is the need Morphological in Computer Vision? Justify with a Neat Diagram. (8)

UNIT-III

5. (a) What is meant by a pose? How can you hypothesize a correspondence between a collection of image features and a collection of object features, using pose consistency? (7)
- (b) Write short notes :
(i) CVIP Tool.
(ii) Data Preprocessing.
(iii) Feature Analysis.
(iv) Feature Vectors. (2+2+2+2= 8)
6. (a) What are similarity measures? State any 3 examples for distance functions that can be used as similarity measures. (7)
- (b) What are proximity measures? State two properties of a dissimilarity measure. Mention any *two* examples for dissimilarity measures, with equations. (8)

UNIT-IV

7. (a) State the K-Means algorithm for clustering. Apply K-Means algorithm on the following data set to obtain two clusters : (1, 1), (1.5, 2), (3, 4), (5, 7), (3.5, 5), (4.5, 5) and (3.5, 4.5). (7)
- (b) What is BRDF? How are areas sources different from line sources? Explain Minimum Squared Error Method (MSE) for Classification. (8)
8. (a) What do you mean by dimensionality reduction and explain its importance in machine learning? Discuss the difference between linear and non-linear dimensionality reduction techniques. (7)
- (b) Explain Principal Component Analysis (PCA) and its objectives. How does Linear Discriminant Analysis (LDA) differ from PCA? (8)
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OE-CS-AIML-304:Project Management

Time: 3 hours]

[Max. Marks: 75

Note- Attempt Five questions in all selecting one question from each unit. All Questions carry 15 marks each.

Unit-I

1. Answer the following questions appropriately:
 - a. What is software project Management?
 - b. Which factor is decided for the success of project.
 - c. What are the characteristics which makes software projects different from other projects?
 - d. What are the activities covered by SPM?
 - e. What are the steps involved in step wise planning?
2. What are the activities involved in project management? Explain how project can be evaluated against strategic, technical and economic criteria? Explain in detail, how cost-benefit evaluation techniques can be used to choose the best among competing project proposals.

Unit-II

3. Explain in brief about the effort and cost Estimation techniques in project Development. Also explain in detail, the Internal Rate of Return (IRR) method for measuring the profitability of a project.
4. Discuss the spiral software development life cycle model with diagrammatic illustration. What are spiral model strengths and deficiencies? Explain in brief Agile Methods.

Unit-III

5. Define risk identification and ranking. Describe how to evaluate the risk involved in a project. What is the significance of project risk matrix give example. Suggest appropriate strategies for minimizing the potential cost.
6. "The objective of software project planning is to provide a framework that enables the manager to make reasonable estimates of: Resources, Cost and Schedule." Elaborate this statement and describe network techniques like Forward pass, Backward Pass and Critical Path Method.

Unit-IV

7. What are the different types of visualizing progress explain in detail? Outline the use of Gantt charts and timeline charts in visualizing project progress with suitable diagrams.
8. Explain Framework for Project Management and control. Also explain the earned value

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47420

BT-7/M-24

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) Discuss the benefits of data sciences and big data using suitable examples. (8)
(b) Explain the historical evolution of data science. (7)
2. (a) What do you mean by big data ? How it is different from traditional data. (7)
(b) Explain the following data processing operations :
Data cleaning.
Data integration.
Data transformation.
Data reduction. (8)

UNIT-II

3. (a) What do you mean by Data Visualization? Discuss its various types. (8)
(b) Discuss various tools for Data Visualization. (7)

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4. (a) Discuss the role of statistics & probability in data science. (7)
(b) Explain the Bayes theorem, how it is useful in calculating conditional probability. (8)

UNIT-III

5. (a) Discuss basic data types in R programming. (8)
(b) Write a R program to get all prime numbers up to a given number. (7)
6. (a) Write a R program to count number of NA values in a data frame column. (8)
(b) What do you mean by reserved words? Discuss commonly used reserved words in R programming. (7)

UNIT-IV

7. (a) What do you mean by Linear Regression. Explain its implementation in R programming. (8)
(b) Discuss Hidden Markov Model & its applications in detail. (7)
8. (a) What is the importance of CSV files in machine learning. (7)
(b) Explain the procedure to connect R program to any external interface. (8)

BT-8/M-24

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 the concept of Convexity-preserving Operations. Describe three such Operations and Illustrate each with a simple example. $7\frac{1}{2}$
- (b) Briefly describe Second-order Cone Programming (SOCP) and Semi-definite Programming (SDP). Provide one example for each that highlights their formulation. $7\frac{1}{2}$
2. (a) State the Karush-Kuhn-Tucker (KKT) conditions for a constrained optimization problem. Discuss the significance of these conditions in Convex optimization. $7\frac{1}{2}$
- (b) Define the concept of duality in Convex Optimization. Explain the Primal and Dual problems and describe the Weak and Strong Duality Theorems. $7\frac{1}{2}$

48426/K/1000/100

P. T. O.

UNIT-II

3. (a) Explain the Basic Gradient Descent Algorithm. Define the Sub-gradient method and explain how it differs from the standard gradient descent method. Provide an example of a function where the Sub-gradient method is applicable. 8
- (b) Describe Nesterov's Accelerated gradient method. Explain how it improves the convergence rate over Standard gradient descent and provide the update equations. 7
4. (a) Discuss the Mirror Descent method. Explain the concept of Bregman divergence and how it is used in the update rule of Mirror descent. 7
- (b) Explain the Proximal Gradient method. Derive the proximal operator and provide an example of its use in optimizing a non-smooth objective function. Discuss Moreau-Yosida regularization. Define the Moreau envelope and proximal mapping, and explain their significance in optimization. 8

UNIT-III

5. (a) Explain the Augmented Lagrangian method for solving constrained optimization problems. Derive the Augmented Lagrangian function and discuss how it modifies the standard Lagrangian approach. 8

- (b) Describe the Alternating Direction Method of Multipliers (ADMM). Explain the step-by-step procedure of ADMM and illustrate with a simple example how it decomposes the problem into smaller subproblems. 7
6. (a) Elaborate the Douglas-Rachford Splitting method. Derive the iteration steps involved and explain how this method can be applied to find a zero of the sum of two Monotone operators ? 7
- (b) Discuss the concepts of Primal and Dual decomposition in the context of optimization. Explain how these decompositions help in solving large-scale optimization problems and provide an example where they are particularly useful. 8

UNIT-IV

7. (a) Elaborate the concept of dual averaging in Stochastic optimization. Derive the update rule for dual averaging and discuss its convergence properties. 7½
- (b) Describe the Polyak-Juditsky averaging method. How does it differ from traditional Stochastic Gradient Descent (SGD), and what are its advantages? 7½
8. (a) Elaborate the Stochastic Variance Reduced Gradient (SVRG) method. Explain how SVRG improves the convergence rate of SGD and outline the key steps in the SVRG algorithm. 7½
- (b) Discuss the application of Non-convex optimization methods in deep learning. 7½

Roll No.

Total Pages : 2

BT-8/M-24

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. Write a detailed note on classification of Entrepreneurs. 15
2. What is Entrepreneurship? Discuss the Myths and Misconceptions about it. 15

UNIT-II

3. What are Design Thinking Tools ? How can design thinking help foster an Entrepreneurial Mindset? 15
4. Discuss the stages of Entrepreneurial Decision Process. What are the key factors that influence Entrepreneurs' Decision Making? 15

UNIT-III

5. Write a note on value proposition with its importance and how to create it ? Also differentiate between Conventional logic and Value innovation logic with proper examples. 15

48427/K/939/100

P. T. O.

6. Explain Business model canvas and write its benefits. Also discuss the key building blocks of Business Model Canvas. 15

UNIT-IV

7. Discuss the State Level Institutions supporting Entrepreneurs. 15
8. Explain the MSME Schemes for promotion of Entrepreneurship Development. 15

Roll No.

Total Pages : 2

BT-8/M-24

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 fundamental steps in digital image processing. 15
2. How is Image Restoration Performed? Also explain constrained and unconstrained restoration methods. 15

UNIT-II

3. Define Segmentation. Explain the region growing approaches to Segmentation. 15
4. What do you understand by Shape analysis? Describe different kinds of Shape descriptors in detail. 15

UNIT-III

5. What do you understand by Pattern recognition? Explain the Design principles of it. 15

48432/K/1094/100

P. T. O.

6. Describe conditional probability. Explain the Bayes' rule and Naïve Bayes classifier. 15

UNIT-IV

7. What do you mean by Dimensionality Reduction? Differentiate between PCA and LDA in detail. 15
8. Describe Hidden Markov Models (HMM) in detail. 15

Roll No.

Total Pages : 2

BT-8/M-24

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. Define neural networks. Explain architecture of back Propagation network and back propagation learning method in detail. 15

UNIT-II

3. Define fuzzy set and Classical set. Explain various operations on Classical sets and Fuzzy sets with suitable examples. 15
4. Differentiate Fuzzy set and Crisp set. Explain various fuzzy membership functions with suitable examples. 15

48435/K/1095/100

P. T. O.

UNIT-III

5. Explain importance of Defuzzification in fuzzy logic. Explain various Defuzzification techniques. 15
6. Discuss how fuzzy relations formed. Explain various operations and properties over a fuzzy relation. 15

UNIT-IV

7. Write short notes on the following : 15
 - (a) Machine Intelligence.
 - (b) Pattern recognition.
 - (c) Person identification.
8. (a) Explain fuzzy logic control system in detail. 10
(b) Write various Industrial applications of Neural Networks. 5

BT-8/M-24

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 are the basic building blocks of CD theory? Convert "John gave Mary a book" into CD representation.
- (b) What is pragmatic analysis? How does pragmatic analysis differ from other linguistic analyses, such as syntactic or semantic analysis?
2. (a) What are Minsky frames, and what role do they play in cognitive science and artificial intelligence? Differentiate between declarative and procedural frames.
- (b) Write a note on applications of NLP.

UNIT-II

3. (a) What is an ambiguous grammar in the context of Formal Language Theory? How does ambiguity manifest in the rules of a Grammar?

48438/K/1096/100

P. T. O.

- (b) Describe the four levels of the Chomsky Hierarchy. What are the defining characteristics of each level? Discuss.
- 4. (a) What are the different Sections in a PROLOG Program? Discuss.
- (b) Write a note on Propositional and Predicate logic and discuss the Robinson's Resolution Principle.

UNIT-III

- 5. (a) What are Augmented Transition Networks (ATNs)? What are the main components of an ATN? How do transitions and states interact in these network models?
- (b) Describe the key steps involved in Earley's algorithm for Parsing. How does Earley's algorithm handle ambiguity in grammars during parsing?
- 6. (a) What is Tomita's algorithm, and how does it relate to Earley's algorithm? What problem does Tomita's algorithm address in parsing?
- (b) How are semantic networks organized hierarchically? Explain how inheritance and specialization are represented in semantic networks?

UNIT-IV

- 7. (a) How does NLP facilitate machine translation between Languages? Discuss.
- (b) How does NLP contribute to Information Retrieval tasks, such as Search Engine? Discuss.

8. (a) How do question answering systems leverage NLP to provide accurate and relevant answers to user queries?
- (b) How does NLP facilitate the analysis of Social media content, including text, images, and videos?