Total No. of Questions: 21

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

IT3EA10 Pattern Recognition

Programme	:	B.Tech.	**Branch/Specialisation**	:	IT
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

Marks CO BL

Q1. In Bayes Decision Theory, what does the prior probability represent? **1 1 2**

- ○ The probability of making a correct decision
- ◉ The probability of an event occurring before observing the data
- ○ The likelihood of an event given some evidence
- ○ The probability of the observed data occurring

Q2. Which of the following algorithms is commonly used for classification in supervised learning? **1 1 1**

- ○ K-Means
- ○ Hierarchical clustering
- ◉ Support vector machine
- ○ DBSCAN

Q3. In the Gaussian case of MLE, which parameters are estimated for a normal distribution? **1 2 1**

- ◉ Mean (μ) and Variance (σ^2)
- ○ Mean (μ) and Median
- ○ Standard Deviation (σ) and Range
- ○ Mode and Interquartile Range

Q4. What is the main advantage of using a Hidden Markov Model (HMM)? **1 2 1**

- ○ It provides a deterministic approach to sequential data
- ◉ It efficiently models sequences with hidden states
- ○ It eliminates all uncertainties in time-series data
- ○ It can only be used for classification problems

Q5. What is the primary goal of dimensionality reduction? **1 3 1**

- ○ To increase the number of features in a dataset
- ○ To improve model accuracy by adding more dimensions
- ◉ To reduce the number of input variables while retaining important information
- ○ To create completely new data points

Q6. The K-Nearest Neighbors (K-NN) algorithm is classified as a: **1 3 1**

- ◉ Supervised learning method
- ○ Parametric algorithm
- ○ Unsupervised clustering . . algorithm
- ○ Deep learning technique

Q7. Which of the following is NOT a type of clustering algorithm? **1 4 1**

- ○ Hierarchical clustering
- ○ K-Means clustering
- ◉ Decision trees
- ○ Agglomerative clustering

Q8. In K-Means clustering, the number of clusters (K) is: **1 4 1**

- ○ Automatically determined by the algorithm
- ◉ Fixed and set by the user
- ○ Equal to the number of data points
- ○ Always greater than 10

Q9. What is the primary objective of a Support Vector Machine (SVM)? **1 5 1**

- ○ Minimize the number of support vectors
- ◉ Maximize the margin between different classes
- ○ Minimize the Euclidean distance between points
- ○ Perform hierarchical clustering

Q10. Optical Character Recognition (OCR) is primarily used for: **1 5 1**

- ○ Speech recognition
- ◉ Converting handwritten or . printed text into digital text
- ○ Identifying biometric fingerprints
- ○ Image segmentation

Section 2 (Answer all question(s))

Marks CO BL

Q11. What is the difference between supervised and unsupervised learning? **4 1 2**

Rubric	Marks
1 mark for each 4 differences	4

Q12. (a) Explain the process of constructing a Decision Tree. Discuss how entropy and information gain are used in the splitting process with an example. **6 1 3**

Rubric	Marks
Explain the process of constructing a Decision Tree.	3
Discuss how entropy and information gain are used in the splitting process with an example.	3

(OR)

(b) What are different steps involved in pattern recognition task. Discuss each step in detail.

Rubric	Marks
Steps	3
Explanation of any 3 steps	3

Section 3 (Answer all question(s))

Marks CO BL

Q13. Explain how the Gibbs Sampling algorithm helps in approximating probability distributions. **4 2 1**

Rubric	Marks
Algorithm	4

Q14. (a) Explain the working of Hidden Markov Models with an example. Write down the Forward-Backward Algorithm of training HMMs with example. **6 2 2**

Rubric	Marks
Explanation	3
Algorithm with example	3

(OR)

(b) Derive the maximum likelihood estimation formula for a Gaussian distribution.

Rubric	Marks
Derivation	6

Section 4 (Answer all question(s))

Marks CO BL

Q15. Explain the curse of dimensionality and its effect on machine learning models. **3 3 2**

Rubric	Marks
Any 3 effects	3

Q16. (a) Explain the working of Principal Component Analysis (PCA) with mathematical formulation and an example. **7 3 3**

Rubric	Marks
Maths Steps	3.5
Example	3.5

(OR)

(b)

Data Points	Feature 1	Feature 2	Class Label
D1	2	4	1
D2	3	5	1
D3	4	6	2
D4	5	7	2
D5	8	9	2

Consider above dataset of 5 data points. Using k-nn with k=3 calculate class label for data (7,10).

Rubric	Marks
Complete numerical	7

Section 5 (Answer all question(s))

Marks CO BL

Q17. What are the main steps involved in the K-Means clustering algorithm, with example? **5 4 2**

Rubric	Marks
Algorithm	2.5
Example	2.5

Q18. (a) Describe the agglomerative clustering algorithm. Explain different linkage methods. **5 4 2**

Rubric	Marks
Algorithm	2.5
Different linkage	2.5

(OR)

(b) Define clustering and its types with examples.

Rubric	Marks
Definition	2
1 mark for each 3 types	3

Section 6 (Answer any 2 question(s))

Marks CO BL

Q19. Explain the working of Support Vector Machines (SVM) with an example. How does it classify data points? **5 5 1**

Rubric	Marks
Working	2.5
Classification Process	2.5

Q20. How does speech recognition work? Explain with suitable diagram. **5 5 1**

Rubric	Marks
Speech Recognition working	3
Diagram	2

Q21. Explain working of face recognition system with suitable diagram. **5 5 1**

Rubric	Marks
Working	3
Diagram	2

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