

Duration: 3hr.

Max. Marks: 80

Instructions:

- (1) Question one is Compulsory.
- (2) Assume suitable data wherever required but justify it.
- (3) Solve any THREE from Question No. 2 to 6.
- (4) Figure to the right indicate full marks.

- Q1 (a)** From a standard deck of playing cards, a single card is drawn. The probability that the card is king is $4/52$, then calculate posterior probability $P(\text{King}|\text{Face})$, which means the drawn face card is a king card. **05**
- (b)** Describe the Centroid method of defuzzification. Include its formula and discuss its advantages and disadvantages compared to other defuzzification methods. **05**
- (c)** List down different applications of Deep Learning. And explain it **05**
- (d)** Compare and contrast Bagging and Boosting with their application **05**
- Q2 (a)** How do you explain random forest? Does random forest need pruning, explain in detail? **10**
- (b)** Describe how cognitive computing can be applied in healthcare. Provide specific examples of tasks or problems that cognitive computing can help address, and explain the potential benefits. **10**
- Q3 (a)** Explain how an autoencoder can be used for dimensionality reduction. Include a brief description of how the encoder and decoder parts of the network work in this context. **10**
- (b)** List three industries where data science is extensively used and briefly describe one application in each industry. **10**
- Q4 (a)** Using Mamdani fuzzy model design a fuzzy logic controller to determine the wash time of domestic washing machine. Assume the inputs are dirt and grease on clothes. Use three descriptors for each input variable and five descriptor for output variables. Derive necessary membership functions and required fuzzy rules for the application. **10**

- (b) What is a Markov Decision Process (MDP)? List its primary components. Explain in detail. **10**
- Q5 (a)** What is cognitive computing, and how does it differ from traditional computing? List the process of building a cognitive application. **10**
- (b) Describe the architecture of a typical CNN. What are the main components, and how do they contribute to the network's performance in image recognition tasks? **10**
- Q6 (a)** Let's consider a binary classification problem where we have built a classifier to predict whether a transaction is fraudulent (positive class) or legitimate (negative class). After training the classifier and testing it on a dataset, we obtain the following confusion matrix: **10**
- | | Actual Legitimate | Actual Fraudulent |
|----------------------|-------------------|-------------------|
| Predicted Legitimate | 850 | 30 |
| Predicted Fraudulent | 20 | 100 |
- Calculate Accuracy, Precision, Recall and F1-score.
- (b) Briefly explain Data science for Multimodal applications. **10**