(03 HOURS)                                                                                     (MAX. MARKS : 80)

**Note:** 1. Question **No. 1** is compulsory.
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

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| Q.1 | | Answer the following **(Any four)** | |
| | a. | Implement AND function using Mc-Culloch-Pitts neuron)? | 05 |
| | b. | Discuss the limitations of deterministic approaches and how probabilistic reasoning addresses these limitations with example. | 05 |
| | c. | Discuss different activation function used in Neural Network | 05 |
| | d. | Compare between ANN and RNN. | 05 |
| | e. | Describe the role of utility and expected utility in decision theory with example. | 05 |
| | f. | Differentiate between Fuzzyness and Probability | 05 |
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| Q.2 | a. | Explain the component of ANN architecture | 10 |
| | b. | Explain the role of representing knowledge in taxonomies and ontologies, and how advanced analytics can be applied to cognitive systems. | 10 |
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| Q.3 | a. | Explain different types of membership functions used in fuzzy logic with suitable examples. Differentiate between crisp sets and fuzzy sets in terms of their structure, interpretation, and applicability in real-world scenarios. | 10 |
| | b. | Using Mamdani fuzzy model design a fuzzy model controller to determine the wash time of domestic washing machine. Assume the inputs are dirt & grease on cloths. Use three descriptors for each input variable & five descriptors for output variables. Derive necessary membership functions & required fuzzy rules for the application. | 10 |
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| Q.4 | a. | Explain Architecture of CNN in detail. List any two applications of it | 10 |
| | b. | What is Bayesian Belief Network? Explain inferencing with example. | 10 |
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| Q.5 | a. | Explain any 4 Metrics for evaluating classifier performance. Discuss any two cross validation methods | 10 |
| | b. | How Bagging and Boosting handle bias-variance trade-off differently, and analyze their effectiveness in dealing with noisy data and overfitting. Explain with algorithmic such as Random Forest and AdaBoost." | 10 |
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| Q.6 | a. | Explain the role of machine learning in multimodal applications. Discuss how different data modalities (text, audio, image, and video) are integrated to improve the performance and user experience of these systems with real time applications. | 10 |
| | b. | Define Defuzzification? Explain any two methods of Defuzzification | 10 |

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