Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS
II SEMESTER M.TECH. (INDUSTRIAL AUTOMATION & ROBOTICS)
END SEMESTER EXAMINATIONS, JULY 2022
SUBJECT: ARITIFICAL INTELLGENCE AND EXPERT SYSTEMS [MTE 5002]
Date: 1 July 2022

Time: 3 Hours **MAX. MARKS: 50**

Instructions to Candidates:
- Answer **ALL** the questions.
- Missing data can be assumed and suitably justified.

Q. No	Question	M	CO	PO	LO	BL
1A.	If the probability mass function of a random variable is given by P(X=r) = $kr^3, where\ r = 1,2,3,4.$ Find the value of k.	**2**	**1**	**1,2**	**M1**	**3**
1B.	Define and Explain any three moments of statistics with their significances.	**3**	**1**	**1,2**	**M1**	**2**
1C.	Explain in detail the Logistics Regression Classifier and derive its cost function.	**5**	**1**	**1,2**	**M2**	**3**
2A	Explain the Basic fuzzy set operation i. Union ii. Intersection iii. Complement iv. Product	**2**	**2**	**2, 3**	**M1**	**3**
2B	Discuss Mamdani and Sugeno fuzzy inference systems (fuzzy models). Explains the steps involved, and How to Decide Whether to Apply-Mamdani or Sugeno Fuzzy Inference System?	**3**	**2**	**3,4**	**M4**	**3**
2C	Explain the assumption made by the Pearson correlation techniques and how Spearman correlation technique is different from it	**5**	**1**	**1,3**	**M3**	**3**
3A	Explain the following with an example for GA's i. Population ii. Reproduction iii. Crossover iv. Deletion	**2**	**2**	**2,3**	**M1**	**3**
3B	Justify and explain the need of Cross-Fold Validation in Machine Learning.	**3**	**3**	**1, 2**	**M4**	**3**
3C	Explain the working philosophy of following Optimizers • Nesterov Accelerated Gradient Descent • RMS-Prop • ADAM	**5**	**3**	**3, 4**	**M4**	**3**
4A	Define and explain Comprehensive learning PSO and clonal PSO.	**2**	**2**	**3,4**	**M4**	**2**
4B	Define Genetic Algorithms, Enlist and describe two applications of Genetic Algorithms (GAs).	**3**	**2**	**3,4**	**M4**	**2**
4C	With reference to Ant Colony Optimization (ACO), explain following algorithmic elements. i. Evaporation ii. Visibility	**5**	**2**	**3,4**	**M3**	**3**

	iii. Transition Probability					
5A	Distinguish between Type 1 and 2 Errors in the perspective of hypothesis testing.	**2**	**3**	**1,2,3**	**M3**	**3**
5B	Consider Table 5. B which has a sample dataset to learn a decision tree that predicts if people pass or fail (Yes or No), based on their previous GPA (High, Medium, or Low) and whether or not they studied. **Table 5. B** Estimate: 1. Draw the full decision tree that would be learned for this dataset (you do not need to show any calculations) and calculate the entropy of Passed (Entire Dataset)? 2. The entropy (Passed | GPA)? 3. The entropy (Passed | Studied)?	**3**	**3**	**3,5**	**M5**	**4**
5C	Fig 5.C.2 shows four data points for Binary Classification and a Neural Net is to be trained on these. Data points are: Negative: (-1, 0) (2, -2) Positive: (1, 0) Assume: 1. We have a single sigmoid unit (Fig 5.C.1) 2. The negative class is represented by the desired output of 0 and the positive class by the desired output of 1. 3. Weights are w0 = 0, w1 = 1, w2 = 1. Fig 5.C.1 *Fig 5.C.2* Estimate 1. The computed y value for each of the points on the diagram above? 2. The change in w2 as determined by backpropagation using a step size (η) of 1.0? Assume that the input is x = (2, −2) and the initial weights are as specified above. Show the formula you are using as well as the numerical result.	**5**	**3**	**3,5**	**M5**	**4**

GPA	Studied	Passed
L	F	F
L	T	T
M	F	F
M	T	T
H	F	T
H	T	T