Name: Enrolment No:	

UPES

Mid Semester Examination, March 2024

Programme Name : BTech-CSE-MINOR
Semester : VII
Course Name : Pattern Recognition and Anomaly Detection **Time: 02 hrs**
Course Code : CSAI4004P **Max. Marks: 100**
Nos. of page(s) : 2

SECTION A (6 Marks *5 = 30 Marks)
Answer all questions

S. No.		Marks	CO
Q 1	Explain the role of machine learning in pattern recognition. Discuss the key steps involved in building a pattern recognition system.	**6**	**CO1**
Q 2	Discuss the concept of overfitting in pattern recognition models. Describe the way using which overfitting can be prevented?	**6**	**CO1**
Q 3	Discuss the difference between discrete and continuous random variables. Provide examples of each. Define any one probability distribution of each kind of variables.	**6**	**CO1**
Q 4	Define entropy in information theory? Explain its significance in machine learning and pattern recognition.	**6**	**CO2**
Q 5	What is the Kullback-Leibler (KL) divergence? Explain its role in measuring the difference between probability distributions.	**6**	**CO1**
SECTION B (15 Marks *3 = 45 Marks) **Attempt any three questions**			
Q 6	A call center receives an average of 5 calls per minute. Using the Poisson distribution, compute the probability that the center will receive exactly 8 calls in a minute. Also, calculate the probability of receiving more than 10 calls in a minute. Explain how the Poisson distribution models such random events.	**15**	**CO2**
Q 7	Discuss the mathematical formulation, how polynomial functions are used to model data, and the role of the degree of the polynomial.	**15**	**CO1**
Q8	Derive the MLE for a Gaussian distribution and explain its importance in model parameter estimation.	**15**	**CO1**
Q 9	Given a set of classified and misclassified data, compute precision, recall, and F1-score. Discuss how these metrics help in evaluating pattern recognition models.	**15**	**CO2**
SECTION C (25 Marks * 1 = 25 Marks) **Attempt any one question**			
Q 10	a) Discuss the importance of pattern recognition in the field of medical imaging, particularly in the early detection of tumors. Highlight how timely and accurate diagnosis can impact patient outcomes and treatment plans. b) Using tumor detection in MRI scans as a specific example, explain the role of machine learning algorithms in the pattern recognition	**25**	**CO1**

	process. Detail the different stages of the system to achieve the complete system in place.		
Q 11	a) For a dataset of 100-coin tosses, compute the probability of getting exactly 60 heads. b) The time between arrivals at a bus stop follows an exponential distribution with a mean of 5 minutes. Compute the probability that a person waits more than 8 minutes for the next bus. Also, calculate the probability of waiting less than 3 minutes. c) Given the probability distribution P(X)={0.4,0.3,0.2,0.1} for a discrete random variable X, calculate the entropy H(X). d) A fraud detection system is evaluated on a dataset of 10,000 transactions, where 200 transactions are fraudulent. The model predicts 180 fraudulent transactions, out of which 150 are actual fraud cases. Calculate the true positives, false positives, false negatives, and true negatives. Compute the precision, recall, accuracy, and F1-score for the fraud detection system.	**25**	**CO2**