	UPES

UPES
End Semester Examination, December, 2023

Course: STATISTICAL MODELLING FOR COMPUTER SCIENCES   Semester : 1st
Program: M.Tech.   Time   : 03 hrs.
Course Code: CSEG 7003   Max. Marks: 100
Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Describe basic postulates/axioms of Probability. How is probability of an event obtained from statistics? Describe the sample set of an event where a dice is being tossed, a coin is being flipped and a letter from {a,b,c,d,e} is being drawn randomly. Remember, all these are being done simultaneously.	4	CO1
Q 2	Define prior probability. Illustrate posterior probability. Describe them both with examples and illustrations.	4	CO2
Q 3	Demonstrate the equivalence of two different versions of Baye's theorem- $$P(B|A) = \frac{P(A|B)P(B)}{P(A|B)P(B) + P(A|B^c)P(B^c)}$$ and $$P(B|A) = \frac{P(A|B)P(B)}{P(A)}.$$	4	C02
Q 4	Define conditional probability. Please explain it with examples and diagrams. Describe its applications to computer science problems?	4	C02
Q 5	Define independence of two or more events. Describe it using probability and diagrams. Prove that If E and F are independent then so are E and F_C	4	C01

SECTION B
(4Qx10M= 40 Marks)

Q 6	Demonstrate hypothesis testing in action. Describe its utility in real life problem solving.	10	C03
Q 7	Outline the concept of joint distributions. Please illustrate and explain the idea	10	C03

	of joint probability density functions and joint cumulative probability distribution function.		
Q 8	Define Covariance and explain it with examples. How does it connect with concordance/coherence?	**10**	**C04**
Q 9	Describe Markov's inequality. Illustrate it with proof and examples. Or Outline the connection of Statistical Machine Learning with Information Theory.	**10**	**C04**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Describe and illustrate a convex set and a convex function. Outline the role of convexity in optimization and its application to machine learning via Maximum likelihood estimation. Provide detailed examples and diagrams. or Describe cones, tangential cones and normal cones? Provide their clear Mathematical definitions with diagrams and applications to optimization.	**20**	**CO6**
Q 11	Describe stochastic processes in detail with illustrations. What is the difference between probability of an event and a stochastic process? Clarify it with examples. or Describe the concept of Entropy and Cross-Entropy. Outline their relationship with Maximum Likelihood Estimation (MLE).	**20**	**C05**