DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: B. Tech.   **Branch : Electronics/EXTC/EXTC(sandwich)**   **Semester :IV**

Subject Code & Name: BTBS404/BTETC404 Probability Theory and Random Processes

Max Marks: 60   **Date:24/08/2022**   **Duration: 3.45 Hr.**

Instructions to the Students:
1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks

Q. 1 Solve Any Two of the following.

A) **1)** Explain the axiomatic definition of probability along with axioms.   (L1/CO1)   **6**

2) A card is drawn at random from 52 cards. Find the probability of its being

     i. an Ace

     ii. a Six or a Heart

     iii. Neither a Nine nor a Spade

B) A discrete RV has following probability distribution   (L1/CO1)   **6**

x	0	1	2	3	4	5	6	7	8
P(x)	k	3k	5k	7k	9k	11k	13k	15k	17k

Find the value of k, P(X<3) and distribution function of X.

C) A fair coin is tossed 4 times. Define the sample space corresponding to this random experiment. Also give the subsets corresponding to the following events and find the respective probabilities.   (L1/CO1)   **6**
   i. More Heads than Tails are obtained
   ii. Tails occurred on the even numbered tosses

Q.2 Solve Any Two of the following.

A) Define the following terms along with examples   (L1/CO2)   **6**
   i. Joint Probability
   ii. Conditional Probability
   iii. Independence

B) A continuous random variable X that can assume any value between $x = 2$ and $x = 5$ has a density function given by $f_X(x) = k(1 + x)$. Find the value of $p(X < 4)$.   (L1/CO2)   **6**

C) One out of 5 students at a local college say that they skip breakfast in the morning. Find the mean, variance and standard deviation if 10 students are randomly selected.   (L2/CO2)   **6**

Q. 3 Solve Any Two of the following.

A) Find the covariance matrix for given data $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$, covariance matrix= $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$. (L1/CO3) **6**

B) In café, customer arrives at rate of 2 per minute. Find the probability of arrival of 5 customers in 1 minute using Poisson distribution. (L2/CO3) **6**

C) Show if given inner product is valid or not. If $\alpha = (a_1, a_2,), \beta = (b_1, b_2,) \in V_2(R)$. (L1/CO3) **6**

Prove: $\langle \alpha, \beta \rangle = a_1 b_1 - a_2 b_1 - a_1 b_2 + 4a_2 b_2$

Q.4 Solve Any Two of the following.

A) Prove that if there is convergence in probability then there is convergence in distribution. (L1/CO4) **6**

B) Explain the difference between Weak law of large numbers and Strong law of large numbers. (L1/CO4) **6**

C) Explain in detail with proof Central limit theorem. (L1/CO4) **6**

Q. 5 Solve Any Two of the following.

A) **1)** Define Autocorrelation function with all its properties. (L1/CO5) **6**

2) If $X(t)$ is WSS process with autocorrelation $R(\tau) = Ae^{-\alpha|\tau|}$ then determine the second order moment of RV $X(8) - X(5)$.

B) Explain in brief Strict Sense Stationary (SSS) process and Wide Sense Stationary (WSS) process. (L2/CO5) **6**

C) Define random process along with its classification. Also define Mean, Autocorrelation and Autocovariance in terms of random process. (L1/CO5) **6**

*** End ***