B.E. Electronics & Communication/Telecommunication Engineering (Model Curriculum)
Semester - IV

SE202 - Probability Random Process and Numerical Method

P. Pages : 3 **GUG/S/23/13912**

Time : Three Hours Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Use of non-programmable calculator is permitted.

1. a) The chance that a doctor A will diagnose a disease X correctly is 60%. The chance that a patient will die by his treatment after correct diagnosis is 40% and the chance of death by wrong diagnosis is 70%. A patient of doctor A, who had disease X died. What is the chance that his disease was diagnosed correctly. **8**

b) An Urn A contains 10 white and 3 black balls, while another urn B contains 3 white and 5 black balls. Two balls are transferred from Urn B to Urn A and then a ball is drawn from Urn A What is the probability that this ball is white? **8**

OR

2. a) Find the probability of getting a total of 7 **8**

i) At least once

ii) At the most twice in the five tossess of a pair of fair dice.

b) The average rate of phone calls received is 0.7 calls per minute at an office. Determine probability that **8**

i) There will be at least one call in a Minute.

ii) There will be at least three calls during 5 minutes.

3. a) A random variables X has the following probability function. **8**

X	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

b) A Random variable X has density function. **8**

$$f(x)=\begin{cases} Cx^2, & 1\le x\le 2 \\ Cx, & 2<x<3 \\ 0, & \text{otherwise} \end{cases}$$

Find

i) The constant C

ii) $p(x>2),\ p\left(\frac{1}{2}<x<\frac{3}{2}\right)$

iii) The distribution function of x.

OR

4. a) The joint probability function of two discrete random variable x and y is given by **8**

$$p(x,y)=\begin{cases} C(2x+y) & , 0 \le x \le 2 \\ & 0 \le y \le 3 \\ 0 & , \text{otherwise} \end{cases}$$

i) Find the constant C

ii) Find

$p(x \ge 1,\ y \le 2),$

$p(x=2,\ y=1)$

b) Let x be the Random variables with the following distribution and let $y = x^2$. **8**

X	-2	-1	1	2
P(x)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

Find

i) The probability distribution of y

ii) The joint probability distribution of x and y

5. a) From a Sack of fruit containing 3 oranges, 2 apples and 3 bananas, a random sample of 4 pieces of fruit is selected. If x is the number of orange and y is the number of apples in the sample find **8**

i) The joint probability distribution of x and y

ii) $p(x+y \le 2),\ p(y=0/x=2)$

b) Let x and y be continuous random variable having joint density function **8**

$$f(x,y)=\begin{cases} C(x^2+y^2) & 0 \le x \le 1,\ 0 \le y \le 1 \\ 0 & \text{otherwise} \end{cases}$$

Find (i) Constant C

(ii) $p(\frac{1}{4} < x < \frac{3}{4})$

(iii) The marginal distribution function of x and y

(iv) Determine whether x and y are independent

OR

6. a) Find the characteristics function of x whose density function is given by **8**

$$f(x)=\frac{\lambda^n}{(n-1)!}\, x^{n-1}\, e^{-\lambda x} \quad x \ge 0 \ \ n \text{ is a positive integer}$$

b) Let $f(x,y)=\begin{cases} e^{-(x+y)} & x \ge 0,\ y \ge 0 \\ 0 & \text{otherwise} \end{cases}$ **8**

Be the joint density function of x and y

i) Marginal density function of x and y

ii) Conditional density function of x given y

7. a) Prove the central limit theorem for the independent and identically distributed variables. **8**

$$X_k = \begin{cases} 1 & \text{Pub } \frac{1}{2} \\ -1 & \text{Pub } \frac{1}{2} \end{cases}$$

b) Consider a random variable ω uniformly distributed over [0, 1] and the sequence $x_n(\omega)$ defined as **8**

$$x_n(\omega) = \begin{cases} \sqrt{n} & \text{Far } \omega < 1/n \\ 0 & \text{otherwise} \end{cases}$$

Nate that $p(x_n = a_n) = 1/n$ and $p(x_n = 0) = 1 - 1/n$ does the sequence converge in Probability in mean square.

OR

8. a) Verify central limit theorem for a random variable x which is binomially distributed with mean np and standard deviation $\sqrt{npq}$. **8**

b) Find the probability of getting between 2 heads to 4 heads in 10 tosses of fair coin using. **8**

i) Binomial distribution

ii) The normal approximation to the Binomial distribution.

9. a) Two random process $\{x(t)\}$ and $\{y(t)\}$ are given by **8**

$$x(t) = A\cos(\omega t + \theta)$$

$$y(t) = A\sin(\omega t + \theta)$$

Where A and ω are constants and θ is a uniform random variables over $(0, 2\pi)$. Find the cross-correlation function x(t) and y(t) and verify the shift of y(t) in one direction is equivalent to a shift of x(t) in other direction.

b) The random binary transmission process $\{x(t)\}$ is a WSS process with zero mean and auto-correlation function $R_X(\tau) = 1 - \frac{|\tau|}{T}$ where T is constant. Find the mean and variance of the time average of $\{x(t)\}$ over (0, T) is $\{x(t)\}$ mean ergodic? **8**

OR

10. a) Calculate the power spectral density of a stationary random process for which the autocorrelation is $R(z) = Ae^{-\beta|z|}$, $A > 0$, $\beta > 0$. **8**

b) A random process is described by $x(t) = A\sin t + B\cos t$ where A and B are independent random variables with zero means and equal standard deviation. Show that the process is stationary of the second order. **8**

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