

**SE202 - Probability Random Process and Numerical Methods**

P. Pages : 2

**GUG/S/25/13912**

Time : Three Hours



Max. Marks : 80

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- Notes :
1. All questions carry equal marks.
  2. Assume suitable data wherever necessary.
  3. Use of non-programmable calculator is permitted.
  4. All questions are compulsory

1. a) In a Binary communication channel A is the input and B is the output. Find  $P(A/B)$  and  $P(A/B')$  if  $P(A) = 0.4$ ,  $P(B/A) = 0.9$  and  $P(B'/A') = 0.6$  8
- b) If two dices are thrown, then prepare probability distribution of random variable. What is the probability that the sum is
- i) Greater than 8 ii) Neither 7 or 11.
- OR**
2. a) 
$$\text{Let } f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & \text{otherwise} \end{cases}$$
 8
- Then find i) between 0.2 and 0.8 ii) between 0.6 and 1.2
- b) The average rate of phone calls received is 0.7 calls per minute at an office. Determine probability that
- i) There will be at least one call in a minute
- ii) There will be at least three calls during 5 minutes. 8
3. a) Let X be a random variable giving the number of aces In a random draw of four cards from a pack of 52 cards. Find the probability function and the distribution function For X. 8
- b) Find the moment generating function for the uniform Distribution  $f(x) = \frac{1}{b-a}; a \leq x \leq b$ . 8
- Also find first two Moment about the origin. Also find mean and variance.
- OR**
4. a) If X is a continuous random variable given by 8
- $$f(x) = \begin{cases} A[1-|1-x|], & 0 < x < 2 \\ 0, & \text{otherwise} \end{cases}, \text{ then find}$$
- i) find A and ii) Distribution function of X.
- b) Let X be a random variable having density function 8
- $$f(x) = \begin{cases} cx, & 0 \leq x \leq 2 \\ 0, & \text{otherwise} \end{cases} \text{ find}$$
- i) The constant C ii)  $P\left(\frac{1}{2} < x < \frac{3}{2}\right)$
5. a) Suppose that 5% of man and 0.25% of woman have grey hair. A grey haired person is selected at random. What is the probability of this person being male. Assume that there are equal numbers of male and females. 8

- b) Verify central limit theorem in the case where  $X_1, X_2, \dots, X_n$  are independent and identically distributed with Poisson distribution. 8

**OR**

6. a) The joint probability function of two discrete random variable  $X$  and  $Y$  is given by 8
- $$f(x, y) = \begin{cases} cxy, & x = 1, 2, 3 \text{ and } y = 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

Find

- i) Constant  $C$
  - ii)  $P(1 \leq x \leq 2, y \leq 3)$
  - iii) Find marginal probability function of  $X$  and  $Y$ .
  - iv) Determine whether  $X$  and  $Y$  are independent.
- b) Prove the central limit theorem for the independent and identically variables 8
- $$x_k = \begin{cases} 1, & \text{prob } 1/2 \\ -1, & \text{prob } 1/2 \end{cases}$$

7. a) A bag contain 1 red and 7 white marbles a marble is drawn from the bag and its colour is observed then, the Marble is put back into the bag and the contents are thoroughly mixed. Using Poisson approximation, find the Probability that in 8 such drawing, a red is selected exactly 3 times. 8

- b) Let  $X$  and  $Y$  be random variables having joint density function 8

$$f(x, y) = \begin{cases} \frac{3x(x+y)}{5}, & 0 \leq x \leq 1, 0 \leq y \leq 2 \\ 0, & \text{otherwise} \end{cases} \quad \text{find}$$

- i)  $E(X)$
- ii)  $E(Y)$
- iii)  $\text{Var}(X)$
- iv)  $\text{Var}(Y)$

**OR**

8. a) 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.

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

9. a) Find the mean square value of the process whose power spectral density is 8

$$\frac{w^2 + 2}{w^4 + 13w^2 + 36}.$$

- b) Find the average power of the random process  $\{x(t)\}$ , if its Power spectral density is given by 8
- $$s(w) = \frac{8}{(w^2 + 9)^2}.$$

**OR**

10. a) 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

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

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