

4E 4131**4E 4131****B.Tech. IV Semester (Main/Back) Examination, June/July - 2015****Electronics & Communication Engg.****4EC2A Random Variables & Stochastic Processes****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 26****Instructions to Candidates:**

Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly)

Unit - I

1. a) State Bernoulli's theorem on independent trials. Also show its generalized form. (6)
- b) A fair dice is rolled 5 times. Find the probability that 1 shows twice, 3 shows twice and 6 shows once. (5)
- c) In a coin tossing experiment, if the coin shows head 1 dice is thrown and the result is recorded. But if the coin shows tail 2 dice are thrown and their sum is recorded. What is the probability that the recorded number will be 2? (5)

OR

1. a) State the theorem of total probability and Baye's Theorem on inverse probability. (6)
- b) For a certain binary communication channel. The probabilities that a transmitted '0' is Received as '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. If the probabilities that a '0' is transmitted is 0.4. Find the probability that
 - i) a '1' is received (6)
 - ii) a '1' was transmitted given that a '1' was received
- c) If at least 1 child in a family with 2 children is a boy, what is the probability that both children are boys? (4)

Unit - II

2. a) Let X be a continuous random variable with pdf

$$f_x(x) = \begin{cases} kx & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases} \quad \text{where } k \text{ is constant}$$

- i) Find and sketch corresponding $F_x(x)$
 - ii) Find $p(1/4 < x \leq 2)$
 - iii) Calculate Mean & Variance (8)
- b) A production line manufactures 1000Ω resistors that have 10% tolerance. Let X denote the resistance of the resistor assuming that X is a normal. random variable with mean 1000 and variance 2500 find the probability that a resistor picked at random will be rejected (8)

OR

2. a) Show that the Poisson distribution can be used as a convenient approximation to the binomial distribution for large 'n' and small p (8)
- b) A noisy transmission channel has a per digit error probability $P = 0.01$
- i) Calculate the probability of more than one error in 10 received digits
 - ii) Repeat(i) using the Poisson approximation (8)

Unit - III

3. a) find the coefficient of correlation between 'x' and 'y' using the following data
- | | | | | | |
|-----|----|----|----|----|----|
| x : | 5 | 10 | 15 | 20 | 25 |
| y : | 16 | 19 | 23 | 26 | 30 |
- (8)
- b) Explain the convergence concept and central limit theorem for a sequence of independent random variable (8)

OR

3. a) Find the MGF(moment generating function) of the binomial distribution and hence finds its mean and variance (8)
- b) Consider two random variable 'X' and 'Y' with joint pdf $f_{xy}(x,y)$ let $Z=X+Y$
- i) Determine the pdf of 'Z'
 - ii) Determine the pdf of 'Z' if 'X' and Y are independent (8)

Unit - IV

4. a) Consider a random process $X(t)$ defined by
 $X(t) = U \cos wt + V \sin wt - \infty < t < \infty$ where w is constant and 'u' and 'v' are random variables
- i) Show that $E(u) = E(v) = 0$ is necessary for $x(t)$ to be stationary
- ii) Show that $X(t)$ is WSS if and only if 'u' and 'v' are uncorrelated with equal variance (8)
- b) Given that the autocorrelation function for a stationary ergodic process with no periodic component is $R_{xx}(\tau) = 36 + \frac{s}{1 + 6\tau^2}$.
- Find the mean and variance of $X(t)$ (8)

OR

4. a) If $X(t)$ and $Y(t)$ are random process prove that
- i) $|R_x(z)| \leq R_x(0)$
- ii) $|R_{xy}(\tau)| \leq \frac{1}{2}[R_x(0) + R_y(0)]$
- iii) $R_x(0) \leq E[X^2(t)] \geq 0$ (8)
- b) If the WSS process $[X(t)]$ is given by $X(t) = 10 \cos(100t + \theta)$ where θ is uniformly distributed over $(-\pi, \pi)$ prove that $[X(t)]$ is correlation ergodic (8)

Unit - V

5. a) Let $Y(t)$ be the output of an LTI system with impulse response $h(t)$ when a WSS random process $X(t)$ is applied as input show that (12)
- i) $S_{yy}(w) = |H(w)|^2 S_x(w)$
- ii) $S_y(w) = H^*(w) S_{xy}(w)$ **rtuonline.com**
- b) Find the power spectral density of a WSS process with autocorrelation (4)
- $$R(\tau) = e^{-a\tau^2}$$

OR

5. a) A wide sense stationary noise process $N(t)$ has an auto correlation function $R_{nn}(\tau) = pe^{-3|z|}$ where p is constant. Find its power spectrum (8)
- b) If the cross power density function is $S_{xy}(w) = \frac{8}{(a + jw)^3}$ find cross correlation function (8)