APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER M.TECH DEGREE EXAMINATION
Electronics and Communication Engineering
(Telecommunications)
04 EC 6803 Random processes and Applications

Time: 3 hrs | Max. Marks: 60

PART A

(Answer all questions. Each question carry 3 marks).

1. Describe continuous, discrete and mixed random variables (3)
2. Given that $B = \{X \leq 10\}$ compute $F_X(x/B)$ (3)
3. Show that $E(X+Y) = \mu_1 + \mu_2$ for jointly normal independent random variables (3)
4. Prove that sum of two Poisson process is a Poisson process (3)
5. Write a short note on white noise (3)
6. If $X_1, X_2....X_n$ are Poisson variate with parameter $\lambda = 2$. Use central limit theorem to estimate $P(120 \leq S_n \leq 160)$ where $S_n = X_1 + X_2 + ...X_n$ and $n = 75$ (3)
7. If the random variable X is uniformly distributed over$(-\sqrt{3}, \sqrt{3})$compute $P[|x-\mu| \geq \frac{3\sigma}{2}]$ and compare it with the upper bound obtained by Tcheycheff's inequality (3)
8. Define WSS periodic process. (3)

PART B

(Each full question carries 6 marks).

9. In a communication system a zero or one is transmitted with $P(X=0) = \rho_0, P(X=1) = 1-\rho_0$ .Due to noise in channel zero can be received as 1 with probability β. A one is observed . What is the probability that one is transmitted (6)

OR

10. The daily wages of 1000 workers are normally distributed around a mean of Rs 70 and and with a standard deviation of rs 5. Estimate the number of workers whose daily wages will be (i) between 70 and 72 (ii)between 69 and 72 (iii) more than 75 (6)
11. Let X be a Bernoulli r.v with $P(X=0) = p$ and $P(X=1) = q$ and $f_X(x) = p\delta(x) + q\delta(x-1)$ and $F_X(x) = pU(x) + qU(x-1)$ where $U(x)$ is the unit step function. Calculate $F_Y(y)$ and $f_Y(y)$ for $Y = X - 1$ (6)

OR

12. If X and Y are independent random variables each following $N(0,2)$ .Prove that $Z = X/Y$ following Cauchy's distribution (6)
13. Find the expectation of $Y = X^2$ with $X \sim N(0, \sigma^2)$ (6)

OR

14. Find the moment generating function and its two moments of Binomial distribution (6)

15. A vector X has covariance matrix $\begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ (6)
design a transformer circuit that consist of adder and multipliers that will generate from X a new random vector Y whose components are uncorrelated

OR

16. Let $X = (X_1, X_2, X_3)^T$ denote the position of particle inside a sphere of radius 'a' centered about the origin. Assume that at the instant of observation, the particle is equally likely to be any where in the sphere $f_X(X) = \frac{3}{4}\pi a^3$, $\sqrt{x_1^2 + x_2^2 + x_3^2} < a$, 0 else where. Compute the probability that particle lies within a sub sphere of radius $2a/3$ contained within the larger sphere (6)

17. State and prove chebyshev inequality. (6)

OR

18. The life time of a certain brand of an electric bulb may be considered a random variable with mean 1200h and standard deviation 250h. Find the probability , using central limit theorem that average lifetime of 60 bulbs exceeds 1250h (6)

19. (i)Define Ergodicity. (6)
(ii)State and prove Mean-Ergodic theorem

OR

20. Prove that the random process $\{X(t)\}$ with constant mean is mean-ergodic if (6)
$\lim_{n\to\infty}[\frac{1}{4T^2}\int_{-T}^{T}\int_{-T}^{T} C(t_1, t_2)dt_1 dt_2] = 0$