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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-3 EXAMINATION- JUNE -2016

Ph.D

COURSE CODE: 13M1WEC132 MAX. MARKS: 35

COURSE NAME: Mathematical Techniques for Engineering

COURSE CREDITS: 03 MAX. TIME: 2 HRS

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Each question carrier five marks.*

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1. Give the properties of probability density function and cumulative distribution function. The joint probability density function of the random variables X and Y is given by $f_{XY} = Ce^{-(ax+by)}u(x)u(y)$ where a, b and C are constants. Find the value of C. Find $P(X \leq 1, Y \leq 1)$.Specify whether the random variables are independent or not. $u(t)$ is a unit step function of t.
2. Find the values of b and c for which the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 3 & b \\ 0 & b & c \end{bmatrix}$ has $[1 \quad 0 \quad 1]^T$ as an eigen vector.For these values of b and c calculate the Eigen values and the matrix A.
3. A periodic function$f\ (t)$, of period 2π, is defined within the period $-\pi < t < \pi$ by $f(t) = \begin{cases} 0\ (-\pi < t < 0) \\ 1 (0 < t < \pi) \end{cases}$. Using the Fourier series coefficients of $f(t)$, together with Parseval's theorem, show that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \pi^2/8$
4. Solve the difference equation $y_{k+2} + 2y_k = 0, k \geq 0$ given that $y_0 = 1$ and $y_1 = \sqrt{2}$.
5. Obtain the inverse Laplace transform of $\frac{s-3}{(s-1)^2(s-2)}$
6. What do you mean by Ergodic random process? Obtain the relationship between the power spectral density and auto correlation function.
7. Define the following briefly.
   a. Conditional probability.
   b. Orthogonality and orthonormality.
   c. Linear dependence and linear independence.
   d. Region of convergence for Laplace transform.
   e. Conditions for the existence of Fourier series expansion.