SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: M.E – Applied Electronics
Title of the paper: Transforms and Probabilities
Semester: I — Max.Marks: 80
Sub.Code: 735101(2008) — Time: 3 Hours
Date: 14-05-2009 — Session: FN

PART - A (6 X 5 = 30)

Answer ALL the Questions

1. Define a discrete fourier transform and its inverse.

2. Define the Continuous Wavelet transform and the inverse of it.

3. For a random variable $X, M_X(t) = \frac{1}{81}(e^t + 2)^4$, find $P\{X \le 2\}$.

4. The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda = \frac{1}{3}$. What is the probability that the repair time exceeds 3 hours.

5. If A and B are independent events, prove that $\overline{A}$ and B are also independent events.

6. A stationary random process $X = \{X(t)\}$ with mean 3 has auto – correlation function $R(z) = 16 + 9e^{-|z|}$. Find the standard deviation of the process.

PART – B (5 x 10 = 50)

Answer All the Questions

7. Find the DFT for $x(n) = a^n \, for 0 < a < 1$.

(or)

8. Find the DFT of a finite length sinusoidal sequence given by $x(n) = \cos\left(\frac{2\pi rn}{N}\right), 0 \le n \le N-1$

9. State and prove any two properties of the continuous wavelet transform.

(or)

10. Find the scaling and wavelet coefficients of the function $y = x^2$, $0<x<1$ by taking the starting scale as $j_0 = 1$.

11. Find the moment generating function of exponential distribution and hence find its mean and variance.

(or)

12. The joint density function of random variables X and Y is $f(x, y) = 2, 0 < x < y < 1$, find the marginal and conditional probability density functions. Are X and Y independent?

13. Show that the random process *X(t)* and *Y(t)* defined by $X(t) = A\cos w_0 t + B\sin w_0 t, Y(t) = B\cos w_0 t - A\sin w_0 t$ are jointly wide-sense stationary if *A* and *B* are uncorrelated zero mean random variables with the same variance.

(or)

14. If $\{X(t)\}$ is a WSS process with autocorrelation function $R_{XX}(\tau)$ and if $Y(t) = X(t+a) - X(t-a)$, show that

$$R_{YY}(\tau) = 2R_{XX}(\tau) - R_{XX}(\tau + 2a) - R_{XX}(\tau - 2a)$$

15. Customer arrive at a watch repair shop according to a Poisson distribution at a rate of one customer per every 10 minutes and the service time is an exponential random variable with mean 8 minutes. Find the average number of customers and also the average waiting time a customer spends in the system.

(or)

16. Trains arrive at the yard every 15 minutes and the service time is 33 minutes. If the line capacity at the yard is limited to 4 trains, find the probability that the system is empty and also the average number of trains in the system.