Register Number

SATHYABAMA UNIVERSITY

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Course & Branch: M.E- W-AEL
Title of the Paper: Transforms and Probabilities   Max. Marks: 80
Sub. Code: 735101(2008/09)   Time: 3 Hours
Date: 03/12/2010   Session: FN

PART - A   (6 X 5 = 30)
Answer ALL the Questions

1. Write Slant transform matrix of order N x N and hence obtain the slant transform matrix for N = 4.

2. Write a note on Discrete cosine transform.

3. Define Short time Fourier transform. Write the properties of CWT.

4. Show that the moment generating function of the random variable X having the pdf $f(x)=\begin{cases}\frac{1}{3}\ for & -1<x<2\\ 0, & elsewhere\end{cases}$ is given by $M(t)=\begin{cases}\frac{e^{2t}-e^{-1}}{3t}; & t\neq 0\\ 1; & t=0\end{cases}$

5. If the probability of a defective fuse from a manufacturing unit is 2% in a box of 200 fuses, find the probability that
(a) exactly four fuses are defective
(b) more than three fuses are defective.

6. If X(t) is a random process with mean 3 and autocorrelation of $9+4e^{-0.2|t_1-t_2|}$, determine the mean, variance and covariance of the random variables Z = X(5) and W = X(8).

PART – B (5 x 10 = 50)

Answer ALL the Questions

7. Explain Walsh algorithm.

(or)

8. Write notes on the separability and the translation properties of a 2D DFT.

9. Define CWT and Show that W(a, b) = -W(-a, 1 – b), where the mother wavelet is $\psi(t)=\begin{cases} 1 & for \quad 0\le t<\frac{1}{2} \\ -1 & for \quad \frac{1}{2}\le t<1 \\ 0 & , \quad otherwise \end{cases}$

(or)

10. Explain Shannon wavelet.

11. (a) Two random variable X and Y have the following joint probability density function $f(x,y)=\begin{cases} 2-x-y; & 0\le x\le 1, \quad 0\le y\le 1 \\ 0; & otherwise \end{cases}$

Find the marginal probability density functions of X and Y.

(b) If X is a normal variable with mean 30 and standard deviation 5. Find

(i) $P(27 \le X \le 35)$ (ii) $P(X \ge 45)$ (iii) $P(|X - 30| > 5)$

(or)

12. The following table represents the joint probability distribution of the discrete random variable X, Y. (a) Evaluate Marginal distributions of X and Y (b) Find the conditional distribution of X given Y = 2 (c) Find the conditional distribution of Y given X = 3 (d) Find $P(X \le 2, Y \le 3)$ (e) Find $P(Y \le 2)$

$\frac{Y}{X}$	1	2	3

1	$\frac{1}{12}$	$\frac{1}{6}$	0
2	0	$\frac{1}{9}$	$\frac{1}{5}$
3	$\frac{1}{18}$	$\frac{1}{4}$	$\frac{2}{15}$

13. (a) Derive Wiener Khintchine relation. (6)
(b) Prove that cross correlation function $R_{XY}(\tau) = R_{YX}(-\tau)$ (4)

(or)

14. Consider a random process $X(t) = \cos(\omega t + \theta)$ where ω is a real constant and θ is a uniform random variable in $\left(0, \frac{\pi}{2}\right)$. Show that X(t) is not a WSS process. Also find the average power in the process.

15. The mean rate of arrival of planes at an airport during the peak period is 20/λr, but the actual number of arrivals in any hour follows a poisson distribution. The airport can load 60 planes/hr on an average in good weather or 30 planes/hr in bad weather, but the actual number landed in any hr follows a poisson distribution with respective averages. When there is congestion, the planes are forced to fly over the field in the stack awaiting the landing of other planes that arrived earlier.
(a) How long a plane would be flying over the field in the stack on an average in good weather ad bad weather.
(b) How long a plane would be in the stack and in the process of landing in good and bad weathers.
(c) How much stack and landing time to allow so that priority to land out of order will have to be requested only one in 20 times.

(or)

16. A group of engineers has 2 terminals available to aid in their calculations. The average computing job requires 20 mins of

terminal time and each engineer requires some computation about once ever half an hour. Assume that these are distributed according to an exponential distribution. If there are six engineers in the group, find

(a) the expected number of engineers waiting to use one of the terminals and in the computing centre and

(b) the total time lost per day.