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328352(28)

B. E. (Third Semester) Examination, April-May 2020

(New Scheme)

(Et & T Branch)

PROBABILITY and RANDOM VARIABLES

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *All the units are compulsory. All the question should be answered in a sequence. Attempt any two from three question of 7 marks from each unit. Part (a) is compulsory and carries 2 marks.*

Unit-I

1. (a) State Parseval's theorem? 2

(b) Find out the fourier transform of signam function? 7

(c) Define fourier series and explain its properties? 7

(d) Find out the fourier series of full wave rectifier? 7

Unit-II

2. (a) Define conditional probability? 2

(b) A student is known to arrive late for a class 40% of the time. If the class meet five times each week, Find : 7

(i) The probability the student is late for atleast 3 classes in a given week.

(ii) The probability the student will not be late at all during a given week.

(c) A missile can be accidentally launched, if two relays 'A' and 'B' bath have failed. The probabilities of 'A' and 'B' failing are known to be 0·01 and 0·03 respectively. It is also known that B is more likely to fail (probability 0·06). If a has failed. 7

(i) What is the probability of an accidental missile launch.

(ii) What is the probability that A will fail. If B has failed.

(d) Explain set operations in detail. 7

Unit-III

3. (a) Explain central limit theorem. 2

(b) Assume that the time of arrival of birds of a particular place on a migratory route as measured in days from the Ist day of the year (i.e. January 1 is the first day) is approximated as a gaussian random variable 'X' with $a_x = 200$ and $\sigma_x = 20$ days. 7

(i) What is the probability the birds arrive after 160 days but on or before the 210^{th} day.

(ii) What is the probability the birds will arrive after 231^{th} day.

(c) Define random variable? Explain distribution function with its properties? 7

(d) Assume that the height of clouds above the ground at some location is a gaussian random variable X with $a_x = 1830\,\text{m}$ and $\sigma_x = 460\,\text{m}$. Find the probability that clouds will be heigher than 2750 m? 7

Unit-IV

4. (a) What do you understand by a random process? 2

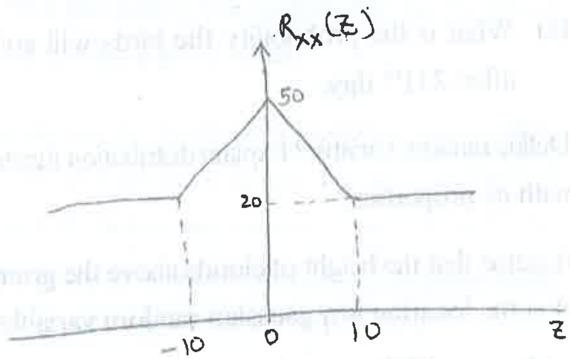
(b) Explain Auto correlation function and its properties? 7

(c) For a stationary ergodic random process having the auto correlation function shown in the figure. 7

(i) $E[X(t)]$

(ii) $E[X^2(t)]$

(iii) σ_{x^2}



(d) A random process is defined by 7

$$y(t) = x(t)\cos(w_0 t + \theta)$$

where,

$X(t)$ is a wide sense stationary random process that amplitude modulate a carries of constant angular frequency ω_0 with a random phase θ independent of $X(t)$ and uniformly distributed on $(-\pi, \pi)$:

(i) Find $E[y(t)]$

(ii) Find the auto correlation on of $y(t)$

Unit-V

5. (a) What do you mean by rms bandwidth? 2

(b) Find the cross correlation function corresponding to the cross-power spectrum.

$$S_{xy}(w) = \frac{6}{(9+w^2)(3+jw)^2}$$ 7

(c) Assume a random process has a power spectrum

$$S_{xx}(w) = \begin{cases} 4-(w^2/9) & , \quad |w| \le 6 \\ 0 & , \quad \text{elsewhere} \end{cases}$$ 7

(d) Explain power density spectrum with its property? 7