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Code No: 153BQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, December - 2019

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) What is the importance of Rayleigh distribution function? [2]
b) How interval conditioning is different from point conditioning? [2]
c) Define WSS random process. [2]
d) Define rms bandwidth of the power spectrum. [2]
e) What is meant by conditional Entropy? [2]
f) Write the conditions to be satisfied by a function to be a random variable. [3]
g) Define joint characteristic functions of two random variables. [3]
h) Determine the mean-square value of a random process with autocorrelation function: $R_{XX}(\tau) = e^{-|\tau|}$ [3]
i) Write any three properties of cross-power density spectrum. [3]
j) Write the equation of an average Noise Figure of cascaded networks. [3]

PART – B

(50 Marks)

2.a) Give Classical and Axiomatic definitions of Probability.
b) In a single through of two dice, what is the probability of obtaining a sum of at least 10? [5+5]

OR

3.a) Define conditional distribution and density functions and list their properties.
b) In a box there are 100 resistors whose resistances and tolerances are as shown in the table below. Let A be the event of drawing a 47Ω resistor, B be the event of drawing a resistor with 5% tolerance, and C be the event of drawing a 100Ω resistor. Find P(A/B), P(A/C) and P(B/C). [5+5]

	Tolerance		
Resistance (Ω)	5%	10%	Total
22	10	14	24
47	28	16	44
100	24	8	32
Total	62	38	100

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4.a) State and explain the central limit theorem.

b) Obtain the variance of Raleigh random variable. [5+5]

OR

5.a) Find the mean of Binomial random variable.

b) Identify the value of moment μ_{22}, if statistically independent random variables X and Y have moments $m_{10} = 2$, $m_{20} = 14$, $m_{02} = 12$ and $m_{11} = -6$ [5+5]

6.a) List and explain various properties of Autocorrelation function.

b) Given the Autocorrelation function of the processes:

$$R_{XX}(\tau) = 25 + \frac{4}{1 + 6\tau^2}$$

Find the mean and variance of the process X(t). [5+5]

OR

7.a) Compare the Cross Correlation Function with Autocorrelation function.

b) Assume that an Ergodic random process X(t) has an autocorrelation function:

$$R_{XX}(\tau) = 18 + \frac{2}{6 + \tau^2}[1 + 4\cos(12\tau)]$$

i) Find $|\bar{x}|$.

ii) Does this process have periodic component?

iii) What is the average power in X(t)? [5+5]

8. Compute the average power of the process having power spectral density $6\omega^2/(1+\omega^4)$. [10]

OR

9.a) If the PSD of X(t) is $S_{xx}(\omega)$. Find the PSD of dx(t)/dt.

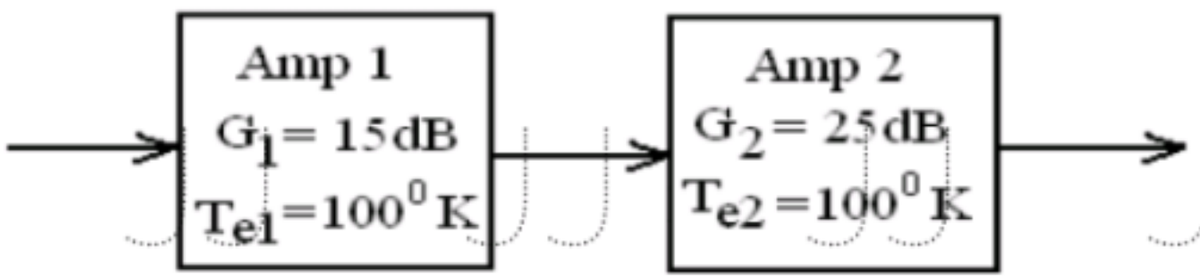
b) If $Y(t) = A\cos(\omega_0 t+\theta)+N(t)$, where '$\theta$' is a uniform random variable over $(-\pi,\pi)$, and N(t) is a band limited Gaussian white noise process with PSD=K/2. If 'θ' and N(t) are independent, find the PSD of Y(t). [5+5]

10.a) Derive noise figure in terms of network transfer function.

b) Explain Huffman coding with example. [5+5]

OR

11.a) Find the overall noise figure and equivalent input noise temperature of the circuit shown in figure. Take room temperature = 27^0C.



b) How to trade off between band width and SNR? Explain with example. [5+5]

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