



II B.Tech I Sem Supplementary Examination, February-2022

Probability Theory and Stochastic Processes

(ECE)

Time: 3 Hours.**Max. Marks: 70**

Note: 1. Answer any FIVE questions.

2. Each question carries 14 marks and may have a, b as sub questions.

- 1 a) Explain the concept of Baye's theorem and derive it from total probability. 7M C02 BL2
- b) Definition of a Random Variable and explain the conditions for a function to be a Random Variable. 7M C02 BL2

The probability density function of a random variable X is given by

$$f(x) = ae^{-b|x|}, -\infty < x < \infty$$

- 2 Find i) Cumulative Distribution Function $F_X(x)$ 14M C01 BL4
- ii) Derive the relationship between a and b .

- 3 a) Define mean of a Random Variable and state and prove any three properties of it. 7M C01 BL1
- b) Explain the moments about the origin. 7M C01 BL2

The Joint CDF of the random variables X and Y is given by

$$F_{XY}(x,y) = \begin{cases} (1 - e^{-ax})(1 - e^{-by}) & x \geq 0, y \geq 0, a, b > 0 \\ 0 & \text{otherwise} \end{cases}$$

- 4 i) Find Marginal CDFs of X and Y. 14M C01 BL5
- ii) Find $P(X \leq 1, Y \leq 1)$

- 5 a) State and prove the properties of autocorrelation function. 7M C03 BL1
- b) Define a Random Process and explain about its classification. 7M C03 BL2

- 6 Derive the relationship between output power spectral density and input power spectral density of an LTI System. 14M C02 BL5

- 7 a) Derive the relationship between Power Spectrum and Autocorrelation Function of Random process. Find the cross power spectral density, if 7M C03 BL5
- b) $R_{XY}(\tau) = \frac{A^2}{2} \sin(\omega_o \tau)$ 7M C03 BL5

8

State Shannon -Hartley law and explain its significance. Also, derive Shannon's limit.

14M C04 BL4

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