

2056

B.E. (Electronics and Communication Engineering)**Fourth Semester****EC-407: Probability and Random Processes****Time allowed: 3 Hours****Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

- Q.1a) When are two events said to be independent? Explain with an example.
- b) Why are noise signals often modeled as WSS?
- c) Find the Hilbert transform of $x(t)=\cos(\omega t)$. Suppose a coin is flipped 3 times. What is the probability of getting two tails and one head?
- d) A signal is band limited to 4 kHz. Find information rate if entropy is 2 bits/symbol.
- e) What is white noise? Why it is considered as ideal noise. (5×2)

Section - A

- Q.2a) Let X be a continuous random variable with pdf (4)

$$f(x, y) = k(x + y), x = 1, 2; y = 1, 2$$

Determine the constant k; (ii) Check independence

- b) Discuss the following: communication channel as a filter, Uniform distribution, OSI model. (6)
- Q.3a) Bayes theorem is a combination of addition and multiplication theorem. Justify with the suitable mathematics. (5)
- b) Define the Poisson process. When is Poisson distribution used instead of binomial distribution? A system receives 8 packets/sec. Find probability of zero packets in 1 sec. (5)

- Q.4a) If X is a continuous random variable with pdf (7)

$$f(x) = kx^2 ; 0 < x < 1$$

Find k and $E[X]$.

Prove linearity: $E[aX+b]=aE[X]+b$.

- b) Axiomatic approach of probability theory overcomes the limitations of classical approach. (3)
- Discuss with suitable examples.

Section - B

- Q.5a) Apply the Huffman Coding to find the efficiency for the given probabilities: 0.5, 0.25, 0.15, 0.1. (5)

- b) What are discrete memoryless channels? Find the capacity of the Binary Symmetric Channel when probability p is given as 0.6. (5)

- Q.6a) Determine the capacity of a Gaussian Channel. (5)

- b) What is conditional entropy? (5)

Derive expression for mutual information: $I(X;Y)=H(X)-H(X|Y)$ where H represent the entropy and X, Y are transmitter and receiver respectively.

- Q.7a) Define noise factor and noise figure. Derive their relationship. (5)

- b) What is the impact of gain on noise contribution in cascaded systems? (5)

x-x-x