SO - 93

Seat No.	

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M.Tech. (Semester - I) (E & TC) (CBCS) Examination, January - 2024

RANDOM PROCESS (Elective - I)

Sub. Code : 72043

Day and Date : Wednesday, 03 - 01 - 2024 **Total Marks : 70**

Time : 10.30 a.m. to 01.30 p.m.

Instructions : **1)** **Figures to the right indicate full marks.**
2) **Assume suitable data wherever necessary.**
3) **All questions are compulsory.**

Q1) **Attempt any two of the following :** **[12]**

a) Explain Baye's theorem.

b) A dodecahedron is a solid object with 12 equal faces it is frequently used as a calendar paper weight with one month placed on each face. If such a calendar is randomly placed on a desk the outcome is taken to be month of upper face.

i) What is the probability of outcome being February?

ii) What is the probability of outcome being January or April or August?

iii) What is the probability that the outcome will be a month with 31 days?

c) In case of Bernoulli's trials find out probability of obtaining exactly 'm' successes out of 'n' numbers of trials.

Q2) **Attempt any two of the following :** **[12]**

a) Elaborate the concept of population mean and variance of estimate.

b) Assume that vehicles on a highway have height that is uniformly distributed between 4 & 14 feet. This highway has underpass that has clearance of only 12 feet.

i) Write the conditional PDF of heights of vehicles given that they have passed through underpass.

ii) Find the conditional mean height of vehicles given that they pass through the underpass.

iii) Find the conditional mean height of vehicles given that they could not be pass through the underpass.

c) Explain probability density function of uniform random variable and Gaussian random variable.

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Q3) **Aattempt the following :** **[11]**

a) Explain wide sense stationary and Ergodic random process.

OR

Variable x is a random variable that is uniformly distributed between +3 and –3. Variable y is another random variable that is uniformly distributed between + 6 and -6. '*x*' and '*y*' are statistically independent and added to obtain $z = x + y$. Find correlation coefficient **ρ** associated with random variable *x* and *z*.

b) Explain the conditions when two random variable are said to be

i) Correlated

ii) Uncorrelated

iii) Orthogonal

Q4) **Attempt any two of the following :** **[12]**

a) Find autocorrelation function of random process given by $X(t) = A\sin\omega t$.

b) Define cross spectral density? Explain its properties.

c) A random process is given by $X(t) = A\sin\omega_0 t$,where ω_0 is a constant and A is a random variable uniformly distributed over (–1,1) Check whether the process is stationary or not?

Q5) **Attempt any two of the following :** **[12]**

a) Explain classification of states.

b) Explain Continues Time Markov Chain

c) Explain Chapman -Kolmogorov equation

Q6) **Attempt the following :** **[11]**

a) What is a queuing system? Explain single server and multiple server queuing system.

OR

Discuss performance measures of M/M/1/α single server queuing system.

b) Customers arrive at a clinic according to Poission process with a mean interval of 25 minutes. The physician needs on an average 20 minutes for a patient to examine.

i) Find the expected number of patients at the clinic and in the queue.

ii) Find the percentage of patients who are not required to wait.

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