TE - Sem V - OLD - RSA - EXTC

18/11/15

QP Code : 1631

Max. Marks: 100 **Duration: 3 Hr.**

Instructions:

(1) Question No.1 is Compulsory.
(2) Solve any four out of remaining six questions.
(3) Assume suitable data if necessary.

Q1(a) State and prove Baye's Theorem. 05

(b) Suppose X and Y are two random variables, when do we say that X and Y are 05
1) Orthogonal 2) Uncorrelated

(c) Prove that Poisson process is Markov Process. 05

(d) Define probability density function. State and prove any two properties of probability density function (p.d.f). 05

Q2(a) Box 1 contains 5 white balls and 6 black balls. Box 2 contains 6 white balls and 4 black balls. A box is selected at random and then a ball is chosen at random from the selected box. 10
1) What is the probability that the chosen ball will be a white ball?
2) Given that the ball chosen will be white, what is the probability that it came from Box1?

(b) The transmission times X of messages in a communication system obeys the following exponential probability law with parameter K. 10

$$f(x) = k\,e^{-\lambda x}\ ,x > 0$$

1) Find the value of K.
2) Find the probability density function(p.d.f) of X and cumulative density function (c.d.f) of X. sketch both functions.

Q3(a) The joint probability density function of a two dimensional random variable (X,Y) is given by $f_{xy}(x,y) = ke^{-(x+y)}, x > 0, y > 0$ 10
1) Find the value of K.
2) Find the marginal probability density functions of X and Y.
3) Check for independence of X and Y.

(b) If x and y are two independent exponential random variables and Z = X + Y, then prove that the probability density function of Z is given by convolution of their individual density functions. 10

Q4(a) Find the moment generating function of Binomial distribution and hence, find its mean and variance. 10

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(b) Let X_1, X_2....be a sequence of random variables. 10
Define 1) Convergence almost anywhere
2) Convergence in probability
3) Convergence in mean square sense
4) Convergence in Distribution
for the above sequence for a random variable X.

Q5(a) State and prove Chapman-Kolmogorov equation. 10

(b) 1) Define Central Limit Theorem and give its significance. 10
2) Define strong law of large numbers.
3) Describe sequence of random variables.

Q6(a) Explain power spectral density function. State its important properties and prove any one property. 10

(b) Show that the random process given by 10

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

where A and w_0 are constants and θ is uniformly distributed over $(0, 2\pi)$ is Wide Sense stationary(WSS).

Q7(a) Three boys A, B, C play a game of throwing a ball to each other. A always throws the ball to B and B always throw the ball to C, however C is just as likely to throw the ball to B as to A. Find the transition matrix. Show that the process is Markovian. Also classify the states. 10

(b) Write Short notes on any two : 10
1) Ergodic Process
2) Poisson Process
3) Gaussian Process