K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Feb - March 2024

Supplementary Program: B. Tech.	Scheme :II
Examination: TY	Semester: V
Course Code: EXC504 and Course Name: Random signal Analysis	
Date of Exam: 07/03/2024 Duration: 2.5 Hours	Max. Marks: 60

Instructions:
(1)All questions are compulsory.
(2)Draw neat diagrams wherever applicable.
(3)Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	State Total probability theorem	02	CO 1	U
ii)	If f(x)=k(1+x),$2 \le x \le 5$, Compute value of k.	02	CO 2	Ap
iii)	State any two properties of probability density function.	02	CO 2	R
iv)	Define expectation of a discrete and continuous random variable	02	CO 3	R
v)	Define Moment Generating function of a discrete and continuous random variable.	02	CO 4	R
vi)	Define central moments of a random variable.	02	CO 4	R
vii)	State the conditions to check the wide sense stationary (WSS) of the random process.	02	CO 5	R
viii)	The Markov process is a random process: Justify / contradict.	02	CO 6	R
Q.2	Solve any four questions out of six.	16		
i)	A box I contains 5 white ball and 6 black balls. Another box II contains 6 white balls and 4 black balls. A box is selected at random and then a ball is drawn from it . what is probability that the ball drawn will be white?	04	CO1	Ap
ii)	The transmission time x of messages in a communication system obeys following exponential probability law with parameter λ. $f(x)= K. e^{-\lambda x}$, x > 0. Estimate value of K and cumulative distribution function of x.	04	CO2	U,R
iii)	If probability density function of X is f(x) = 2x, $0 \le x \le 1$ = 0 , elsewhere Find probability density function of $Y=8X^3$	04	CO3	Ap
iv)	State and prove Central Limit Theorem.	04	CO4	U,Ap

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v)	Define autocorrelation function and state any two properties of autocorrelation function.	04	CO5	R
vi)	Transition probability of matrix of a Markov chain with three states 1,2,3 is given by $\begin{bmatrix} 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0.2 & 0.3 & 0.5 \end{bmatrix}$ Compute limiting probabilities.	04	CO6	Ap
Q.3	Solve any two questions out of three.	16		
i)	For a certain communication channel, Probability that '0' is received as '0' is 0.8while probability that '1' is received as '1'is 0.95, if probability of transmitting '0'is 0.45. then find i) a '1'is received ii)'1'was transmitted given that '1' was received.	08	CO1	Ap
ii)	The joint pdf of random variable X, Y is given by $f(x,y) = k\,e^{-3x-5y}$ ..... $x\geq0, y\geq0$ $f(x,y) = 0$ ....elsewhere a) Find value of k, b) Evaluate the marginal pdf of X and Y c)compute E[X/Y] and E[Y/X] d) Are X and Y are independent.	08	CO4	Ap
iii)	If a random process {x(t)} is given by $X(t) = 10\cos(100t+\theta)$ where θ is uniformly distributed over $(-\pi, \pi)$,prove that {x(t)} is correlation ergodic.	08	CO5	Ap
Q.4	Solve any two questions out of three.	16		
i)	Suppose that in a certain region, a daily rainfall (in inches) is a continuous random variable x with probability density function f(x) is $f(x)= \frac{3}{4}*(2x-x^2)$, $0<x<2$ $= 0$, elsewhere Calculate probability that on a given day in this region, rainfall is i) not more than 1 inches ii) greater than 1.5 inches iii) Between 0.5 and 1.5 inches.	08	CO2	Ap
ii)	If X and Y are two independent random variables and if Z=X / Y then find the probability density function of Z.	08	CO3	Ap
iii)	State and prove chapmann Kolmogorov equation.	08	CO6	U,R

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