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

Nov – Dec. 2023
Program: B.Tech Scheme :II
Examination: TY Semester: V
Course Code: EXC504 and Course Name: Random signal Analysis_
Date of Exam: 07/12/2023 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 Baye's theorem	02	CO 1	R
ii)	Define discrete and continuous random variable.	02	CO 2	R
iii)	Define normal distribution	02	CO 2	R
iv)	State one function of one random variable.	02	CO 3	R
v)	Explain raw Moments of random variable.	02	CO 4	R
vi)	Define covariance and correlation coefficient of two random variables X and Y	02	CO 4	R
vii)	State the conditions to check the strict sense stationary of the random process.	02	CO 5	R
viii)	Define steady state probability	02	CO 6	R
Q.2	Solve any four questions out of six.	16		
i)	In a communication system, a zero is transmitted with probability 0.4 and a one is transmitted with probability 0.6. Due to noise in the channel, a zero can be received as one with probability 0.1 and as a zero with probability 0.9. Similarly, one can be received as zero with probability 0.1 and as a one with probability 0.9.If a one is observed ,calculate probability that one was transmitted?	04	CO1	Ap
ii)	State any four properties of Distribution Function.	04	CO2	R
iii)	If probability density function of X is $f(x) = e^{-x}$, $x > 0$ $= 0$, elsewhere Find probability density function of $Y=X^3$	04	CO3	Ap
iv)	If X and Y are two independent random variables and another	04	CO4	Ap

	auxiliary random variable W=Y if Z=X+Y then Compute the probability density function of (Z,W).			
v)	A random process given by $X(t)= A \cos (w_0 t+\theta)$ where θ is uniformly distributed over $(0,2\pi)$, show that process is mean-ergodic.	04	CO5	Ap
vi)	Define transition probability matrix(tpm). Explain tpm with an example.	04	CO6	R
Q.3	Solve any two questions out of three.	16		
i)	A certain test for a particular cancer is known to be 95% accurate .A person submits to the test and the result is positive. Suppose that a person comes from a population of 1,00,000 where 2000 people suffer from that disease. Compute probability that the person under test has that cancer.	08	CO1	Ap
ii)	The joint pdf of random variable X, Y is given by $f(x,y) = c\, e^{-(x+y)}$ ..... $0<x<\infty$,$0<y<\infty$ $f(x,y) = 0$ ....elsewhere i)evaluate value of c ii)Evaluate the marginal pdf and conditional pdf of X and Y. iii)Also check whether X and Y are independent.	08	CO4	Ap
iii)	If a random process $\{x(t)\}$ is given by $X(t) = A\sin(wt+\theta)$ where θ is uniformly distributed over $(-\pi ,\pi)$,prove that $\{x(t)\}$ is WSS.	08	CO5	Ap
Q.4	Solve any two questions out of three.	16		
i)	Determine mean and variance of Binomial distribution	08	CO2	R
ii)	Compute first four moments of random variable X whose probability density function is given by f(x) $= (4/81)*x*(9-x^2)$; $0\le x\le 3$ =0 ; elsewhere	08	CO3	Ap
iii)	If the initial state probability distribution of a Markov Chain is $P^0 = (5/6, 1/6)$ and if the transition probability matrix is given by $\begin{bmatrix} 0 & 1 \\ 1/2 & 1/2 \end{bmatrix}$ Estimate the probability distribution of the chain after two steps. Elaborate the significance of the Markov Chain.	08	CO6	Ap

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