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

FEB - 2025
~~Nov – Dec 2024~~ Supplementary Exam.

.Program: B. Tech. Scheme- IIB /II
Regular & Backlog Examination: TY Semester: V
Course Code: EXC504 and Course Name: Random Signal Analysis
Date of Exam: ~~27/11/2024~~ 04/02/2025 Duration: 02.5 Hours Max. Marks: 60

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

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any **two** questions out of three: (05 marks each)	10		
a)	A box contains 7 red ball and 3 black balls and Another box contains 4 red balls and 5 black balls. One ball is transferred from the first box to second box and then a ball is drawn from the second box. If this ball happens to be red, Calculate the probability that a black ball was transferred.		1	Ap
b)	State any five properties of Distribution function		2	U
c)	If probability density function of X is $f(x) = e^{-x}$, $x>0$. Compute probability density function of $Y=X^3$.		3	Ap
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	Random Variable X and Y have joint probability density function $f(x,y)= (x-y)^2 / 40$, $-1<x<1, -3<y<3$ $= 0$, elsewhere Determine Marginal probability density function of X and Y.		4	Ap
b)	state five properties of autocorrelation function.		5	U
c)	Transition probability(p) 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 OR Steady state probabilities.		6	Ap

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Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	In a communication system, '0' is transmitted with probability 0.45 and a one is transmitted with probability 0.55. Due to noise in the channel, transmitted 1 is received as a 0 and vice versa. If the probability that a transmitted 0 is correctly received as 0 is 0.9 and probability that a transmitted 1 is correctly received as 1 is 0.8.. i) if a one is observed, compute the probability that a zero was transmitted? ii) Compute probability that '1'was transmitted given that '1' was received? iii) compute probability that error has occurred		1	Ap
b)	If X=cos θ , Y = sin θ ,where θ is uniformly distributed over (0,2π) prove that i) X and Y are uncorrelated. ii) X and Y are not independent.		4	Ap
c)	Compute autocorrelation function and power spectral density of random process {x(t)} is given by X(t) = acos(bt+θ) where a and b are constant and θ is uniformly distributed over (-π ,π) .		5	Ap
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	Compute mean, variance, moment generating function of binomial distribution.		2	Ap
b)	If X and Y are two independent random variables and if Z=X + Y then calculate the probability density function of Z.		3	Ap
c)	State and prove chapmann Kolmogorov equation.		6	Ap

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