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

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

Instructions: 27/06/2025
(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)	State and Prove Baye's theorem		1	U,Ap
b)	If 10% of pens manufactured by a company are defective ,compute probability that a box containing 12 pens containing i) exactly two defective pens ii) atleast two defective pens. (use binomial distribution).		2	Ap
c)	If the probability density function of X is $fx = e^{-x}$,$x>0$, calculate the probability density function of $Y= \sqrt{X}$.		3	Ap
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	State and prove central limit theorem		4	U
b)	A random process given by $X(t)=A \cos(w_o t+\theta)$, where A and w_o are constants and θ is a random variable uniformly distributed over $(0,2\pi)$.prove that X(t) is stationary.		5	Ap
c)	A raining process is considered as two states Markov Chain. if it rains ,it is considered to be in state 0 and if it does not rain, it is considered to be in states 1 and transition probability matrix of a Markov chain is given by $P=\begin{bmatrix} 0.6 & 0.4 \\ 0.2 & 0.8 \end{bmatrix}$ Compute probability that it will rain on third day given that it rains today. Also compute probability that it will rain for three days. Assume initial probabilities of state 0 and 1 as 0.4 and 0.6.		6	Ap

Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	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 particular cancer.		1	Ap
b)	Determine mean, variance and moment Generating function of Poisson Distribution		2	U,Ap
c)	The joint pdf of (X,Y) is given by $f(x,y) = x+y$; $0<x<1$, $1<y<1$ Calculate conditional mean and variance of Y given X= x		4	Ap
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	Random process is given by $X(t)=10\cos[100t+\theta]$ where θ is random variable with uniform probability distribution on the interval$[-\pi,\pi]$,show that it is a correlation ergodic process.		5	Ap
b)	If X and Yare two independent random variables and if Z=X/Y then compute the probability density function of Z.		3	Ap
c)	The transition probability of a matrix of a Markov chain with three states 0,1,2 is given by $P = \begin{bmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{bmatrix}$ And initial distribution is $P(X_0=i)=1/3, i=0,1,2$. Calculate i) $P[X_2=2]$, ii) $P[X_3=1,X_2=2,X_1=1,X_0=2]$		6	Ap

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