

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

Supplementary Exam (August 2023)
(B.Tech) Program: _EXTC _Scheme II
Examination:TY Semester: V
Course Code:EXC504 and Course Name:Random signal Analysis

Date of Exam:12/08/23

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 Bayes theorem	02	CO 1	U
ii)	State any two properties of probability density function	02	CO 2	R,U
iii)	Define discrete and continuous random variables.	02	CO 2	R
iv)	Define moment generating function of random variable.	02	CO 3	R
v)	What is covariance of random variable between x and y.	02	CO 4	R
vi)	State any two properties of Joint Density function.	02	CO 4	R
vii)	What is SSS and WSS.	02	CO 5	R
viii)	What is Transition probability matrix.	02	CO 6	R
Q.2	Solve any four questions out of six.	16		
i)	State and Prove Total probability theorem.	04	CO 1	R,U
ii)	If $f(x)=k(1+x)$, $2 \leq x \leq 5$ Compute k and $P(X < 4)$.	04	CO 2	Ap
iii)	If a random variable x has a uniform distribution in $[2,-2]$, calculate probability distribution of $y=3x+2$.	04	CO 3	Ap
iv)	State any four properties of Joint density function	04	CO 4	R,U

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v)	Define autocorrelation function .also state any three properties of autocorrelation function.	04	CO 5	R,U
vi)	The Transition Probability matrix of a Markov Chain is $P = \begin{bmatrix} 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0.2 & 0.3 & 0.5 \end{bmatrix}$ Compute limiting probabilities.	04	CO 6	Ap
Q.3	Solve any two questions out of three.	16		
i)	A box I contains 5 white ball and 6 black balls. Another box II contains 6 white balls and 4black balls. A box is selected at random and then a ball is drawn from it . i) what is probabilitythat the balldrawn will be white? ii)Given that the balldrawn is white, calculate the probability that it came from box I?	08	CO 1	Ap
ii)	Random Variable X and Y have joint probability density function $f(x,y)=x+y, 0 \leq f(x,y) \leq 1$ i)prove that given function is a probability density function ii) Estimate the marginal density functions of X and Y.	08	CO 4	Ap
iii)	A random process is given by $x(t)=\cos(\omega t + \theta)$ where θ is uniformly distributed in the interval $-\pi$ to π ,compute mean and variance of random process.	08	CO 5	Ap
Q.4	Solve any two questions out of three.	16		
i)	Define binomial distribution and compute its mean and variance.	08	CO2	R,Ap
ii)	If X and Y are two independent random variable and if $Z = X+Y$ then compute probability density function of Z.	08	CO 3	Ap

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iii)	<p>The Transition Probability matrix of a Markov Chain $\{X_n\}$, $n=1,2,\dots$ having three states 1, 2 and 3 is</p> $P = \begin{bmatrix} 0.2 & 0.5 & 0.3 \\ 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \end{bmatrix}$ <p>The Initial Probability distribution is $p^{(0)} = (0.6, 0.3, 0.1)$ Calculate i) $P(X_2 = 2)$ ii) $P(X_2 = 3)$ iii) $P(X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2)$</p>		CO3	3
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