Reg.No.: | | | | | | | | | | | |

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]

Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 20009

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. 2026

Fourth Semester

Electronics and Communication Engineering

U23MA406 – PROBABILITY AND RANDOM PROCESSES

(Regulation 2023)

Time : Three Hours | Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

- Normal table to be permitted

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define Binomial Distribution.	2	K2	CO1
2.	If X is uniformly distributed random variable with mean 1 and variance 4/3,find $P(X<0)$.	2	K2	CO1
3.	If the joint PDF of the RV (X,Y) is given by $f(x,y)=\begin{cases} e^{-(x+y)}, & 0<x,y<\infty \\ 0 & ,otherwise \end{cases}$ Are X And Y Independent?	2	K1	CO2
4.	Write the equations of the two regression lines.	2	K1	CO2
5.	Define stationary process.	2	K2	CO3
6.	State and prove any one property of Poisson process.	2	K1	CO3
7.	Prove that $R_{XX}(-\tau)=R_{XX}(\tau)$.	2	K2	CO4
8.	State Wienar-Khinchine relation.	2	K1	CO4
9.	When will you say that a system is linear. Give an example for a linear system.	2	K2	CO5
10.	Examine whether $y(t)=x(t)-x(t-a)$ is time invariant?	2	K2	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	A random variable X has the following distribution	16	K3	CO1

x	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

i. Find the value of 'k'

ii. Find $P(X<6)$, $P(X\geq6)$ & $P(0<X<5)$.

iii. If $P(X \geq k) > \frac{1}{2}$ find the minimum value of 'k'

iv. Evaluate $P(1.5<X<4.5/X>2)$

v. Find the distribution function of x.

(OR)

b) The mileage which car owners get with a certain kind of radial tyre is a RV having an exponential distribution with mean 40,000 km. Find the probabilities that one of these tyres will last — 16 K3 CO1

i. At least 20,000 km

ii. at most 30,000 km

iii. exactly 10000 km.

12. a) The two dimensional RV (X, Y) has the density function — 16 K2 CO2

$f(x, y) = \frac{x+y}{21}$ x = 1,2,3 , y=1,2 . Find

$P(X\leq3)$, $P(Y\leq1)$, $P(X\leq3, Y\leq1)$, $P(X\leq3/Y\leq1)$ & $P(X+Y\leq4)$.

(OR)

b) From the following data, find — 16 K2 CO2

i. Two lines of regression

ii. The coefficient of correlation between the marks in Economics and Statistics

iii. The most likely marks in Statistics when the marks in Economics are 30.

Marks in Economics	25	28	35	32	31	36	29	38	34	32
Marks in Statistics	43	46	49	41	36	32	31	30	33	39

13. a) Show that the random process $X(t) = A\cos(\omega t + \theta)$ is wide sense stationary if A & ω are constant and θ is uniformly distributed random variable in $(0, 2\pi)$. — 16 K5 CO3

(OR)

	b) The transition probability matrix of the markov chain $\{X_n\}$ having 3 states 1, 2, 3 is $\begin{pmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{pmatrix}$ and the initial distribution is $P^{(0)} = (0.7\ \ 0.2\ \ 0.1)$. Find $P(X_2 = 3)$ and $P(X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2)$.	16	K3	CO3
14.	a) If X(t) and $Y(t)$ are uncorrelated random process, then find the power spectral density of Z if $Z(t) = X(t) + Y(t)$. Also find the cross-spectral density $S_{XZ}(\omega)$ and $S_{YZ}(\omega)$.	16	K5	CO4
	(OR)			
	b) i. Given the power spectral density of a continuous process as $S_{XX}(\omega) = \dfrac{\omega^2 + 9}{\omega^4 + 5\omega^2 + 4}$. Find the mean square value of the process.	8	K3	CO4
	ii. Determine the cross-correlation function corresponding to the cross-power density spectrum $S_{XY}(w) = \dfrac{8}{(\sigma + jw)^2}$.	8	K3	CO4
15.	a) Show that $S_{YY}(w) = \lvert H(\omega) \rvert^2 S_{XX}(\omega)$ *where* $S_{XX}(\omega)$ *and* $S_{YY}(\omega)$ are the power spectral density functions of the input X(t) and the output Y(t) and $H(\omega)$ is the system transfer function.	16	K5	CO5
	(OR)			
	b) Prove that {X(t)} is a WSS process then the output{Y(t)} is a WSS process.	16	K5	CO5