Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
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Question Paper Code: 20012

M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026
First Semester
Computer Science and Engineering
P23MA101 – MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
(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

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	The probability mass function of random variable x is $P(X=x)=q^{x-1}p, x=1,2,3,\ldots$. Find the moment generating function.	2	K1	CO1
2.	If a random variable X has the probability density function $f(x)$ is given by $f(x)=\begin{cases} Kxe^{-2x}, x\geq 0 \\ 0, \quad x<0 \end{cases}$ then find the value of K .	2	K2	CO1
3.	If X has mean 4 and variance 9, While Y has mean -2 and variance 5 and X and Y are independent, find $E(XY^2)$.	2	K2	CO2
4.	In a correlation analysis the equation of the two regression lines is $x+12y=9; 3y+5x=26$. Find the mean value of X and Y.	2	K2	CO2
5.	If T is an unbiased estimator for θ, show that T^2 is a biased estimator for θ^2.	2	K1	CO3
6.	Write any two properties of Maximum Likelihood Estimators.	2	K1	CO3
7.	Define a binary tree. When is it called a full binary tree?	2	K1	CO4
8.	Define Eulerian graph.	2	K1	CO4

9. Determine the two-person zero-sum game $\begin{matrix} & PlayerB \\ PlayerA & \begin{bmatrix} 1 & 3 \\ 0 & -4 \end{bmatrix} \end{matrix}$ is strictly determinable. — 2 — K2 — CO5

10. Define Maximin-Minimax Criterion. — 2 — K1 — CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	A random variable X has the following probability distribution	8	K3	CO1

x	-2	-1	0	1	2	3
$p(x)$	$3K$	$1/4$	K	$1/8$	$2K$	$1/16$

Find K, $P[(X \leq 3)/(X > 1)]$, $P(|X| > 2)$, and $E[X]$.

ii. Let X denotes the amount of toleration of radiation by an individual. Assume X is a normal variate with mean 500 roentgen and standard deviation 150 roentgen. Above what dosage level will only 5% of those exposed to radiation survive? — 8 — K3 — CO1

(OR)

b) i. A continuous random variable X has a probability density function $f(x) = 3x^2, 0 \leq x \leq 1$. Find K and α such that — 8 — K3 — CO1

a. $P(X \leq K) = P(X > K)$

b. $P(X > \alpha) = 0.1$

ii. It is known that the probability that an item produced by a certain machine will be defective is 0.05. If the produced item was sent to the market in packets of 20, find the number of packets containing at least, exactly and at most two defective items in a consignment of 1000 packets. — 8 — K3 — CO1

12. a) Find the correlation between X and Y if the joint probability density of X and Y is $f(x,y) = \begin{cases} \frac{1}{6} & ; 0 \leq y \leq \frac{4}{3}x, \ 0 \leq x \leq 3 \\ 0 & ; \ other\ wise \end{cases}$ — 16 — K4 — CO2

(OR)

b) The joint probability density function of the random variable (X, Y) is given by — 16 — K4 — CO2

$$f(x,y) = \begin{cases} k\left(x^2 + \frac{xy}{3}\right) & ; 0 < x < 1, \ 0 < y < 2 \\ 0 \ ; & other\ wise \end{cases}$$

Find

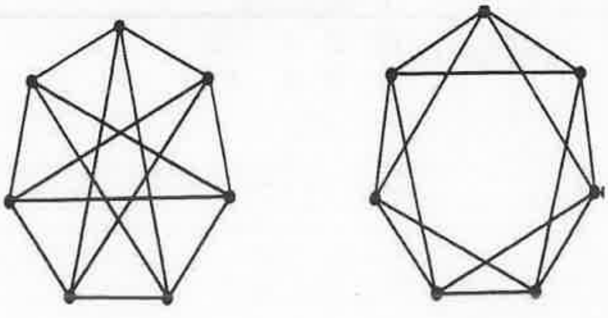
1) k
2) $P(X < 1)$
3) $P(Y < X)$
4) $P\left(Y < \frac{1}{2} \middle| X < \frac{1}{2}\right)$
5) $P(X + Y \geq 1)$
6) The conditional density functions.

13. a) What is meant by unbiased estimator? Prove that for a random sample $(x_1, x_2, ... x_n)$ of size n drawn from a give large population (μ, σ^2), $s^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$ is not an unbiased estimator of the parameter σ^2, but $\frac{ns^2}{n-1} = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$ is an unbiased estimator of σ^2. 16 K3 CO3

(OR)

b) If "t" is an unbiased estimator of θ. Show that "t^2" is a biased estimator of θ^2, but if "t" is a consistent estimator of θ, then "t^2" is also a consistent estimator of θ^2. 16 K3 CO3

14. a) i. Show that the two graphs in Figs. (a) and (b) are isomorphic 8 K3 CO4

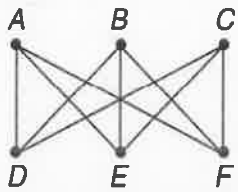


(a) (b)

ii. Prove that a tree with n vertices has $n - 1$ edges. 8 K3 CO4

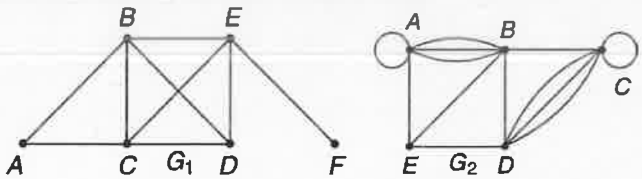
(OR)

b) i. Find an Euler path and a Hamiltonian path if it exists, If it does not exist, explain why? 8 K3 CO4



G_1

ii. Find the number of vertices, the number of edges and the degree of each vertex in the following undirected graphs. Verify also the handshaking theorem in each case. 8 K3 CO4



15. a)	i.	Solve the game whose payoff matrix is given by Player B Player A $\begin{bmatrix} 1 & 3 & 1 \\ 0 & -4 & -3 \\ 1 & 5 & -1 \end{bmatrix}$.	8	K4	CO5
	ii.	Two players A and B match coins. If the coins match, then A wins two units of value, if the coins do not match then B wins two units of value. Determine the optimum strategies for the players and the value of the game.	8	K4	CO5

(OR)

b)	Use graphical method in solving the following game Player B Player A $\begin{bmatrix} 2 & 2 & 3 & -2 \\ 4 & 3 & 2 & 6 \end{bmatrix}$.	16	K4	CO5