RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

USN										

DEPARTMENT OF MATHEMATICS

Academic year 2025-2026 (Odd Semester)

Date: 12th January 2026	Improvement CIE	Max Marks: 10+50
Time: 9:00 AM to 11:00 AM	UG	Duration: 120 minutes
Semester: III BE (CD, CI, CS, CY)		
Course Title: LINEAR ALGEBRA AND PROBABILITY THEORY		Course Code: MA231TC

Scheme and Solution

Q.No.	Answer	M
1	$Var(2X-5) = 2^2 Var(X) = 4(27-5^2) = 8$	1+1
2	$\lambda = 2, P(X \geq 1) = 1 - P(X=0) = 1 - e^{-2} = 8647$ 0.8647	1+1
3	$P(X > 1 \mid Y = 2) = \frac{9/30}{14/30} = \frac{9}{14} = 0.6429$	1+1
4	$np = 9, npq = 6, p = 2/3, q = 1/3$	1+1
5	$P(X < 60) = 0.8413 \Rightarrow P\left(Z < \frac{60-50}{\sigma}\right) = 0.8413 \Rightarrow \frac{10}{\sigma} = 1 \Rightarrow \sigma = 10.$	1+1

Q.No.	Answer	M
1a	i) $P(X \geq 1) = \frac{4}{15} + \frac{3}{15} = \frac{7}{15} = 0.4667$	1
	ii) $E[X] = 0.8, E[X^2] = 1.95, Var(X) = 1.95 - 0.8^2 = 1.31, \sigma = \sqrt{1.31} = 1.1446$	4
1b	i) $f(y) \geq 0, \int_{-\infty}^{\infty} f(y)dy = \int_0^1 10(1-y)^9 dy = [-(1-y)^{10}]_0^1 = 1$	1+2
	ii) $P(Y > 0.6) = \int_{0.6}^1 10(1-y)^9 dy = [-(1-y)^{10}]_{0.6}^1 = 0.0001$	1
	Percentage of batches that are not acceptable is 0.01%	1

2

$y \backslash x$	1	2	3	4
1	$2k$	$3k$	$4k$	$5k$
2	$3k$	$4k$	$5k$	$6k$
3	$4k$	$5k$	$6k$	$7k$

Since $\sum_x \sum_y p(x,y) = 1, k = 1/54$ — 1

x	1	2	3	4
$p_X(x)$	9/54	12/54	15/54	18/54

— 1

y	1	2	3
$p_Y(y)$	14/54	18/54	22/54

— 1

2.77 25.92 2.1481 5.2592

$E[X] = 150k = 150/54, E[X^2] = 480/54, E[Y] = 116/54, E[Y^2] = 284/54$ — 4

5.926 $E[XY] = 320/54, Cov(X,Y) = -0.0412, \rho = -0.0473$ — 3

3

10/243

(i) $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x,y)dx\,dy = 1 \Rightarrow \int_0^1\int_0^1 kxy\,dx\,dy = 1 \Rightarrow \frac{k}{4} = 1 \Rightarrow k = 4$ — 2

(ii) $P(X < 0.5, Y < 1) = \int_0^{0.5}\int_0^1 4xy\,dx\,dy = 1/4$ — 1

(iii) $P(X + Y > 1) = \int_0^1\int_{1-y}^1 4xy\,dx\,dy = 2\int_0^1 y[1-(1-y)^2]\,dy = 2\int_0^1 [2y^2 - y^3]\,dy$ — 2

$= 2\left[\frac{2y^3}{3} - \frac{y^4}{4}\right]_0^1 = \frac{5}{6}$ 0.833 — 1

(v) $f_Y(y) = \begin{cases} 2y, & 0 \leq y \leq 1 \\ 0, & otherwise \end{cases}$ — 1+1

(iv) $P(Y > 0.5) = \int_{0.5}^1 2y\,dy = 3/4$ — 2

4a

$n = 24, np = \mu = \frac{50}{75} = 2/3, p = 2/72$ — 1+1

Values (X):	0	1	2	3	4	5
Frequency:	39	23	12	1	0	0
$p(x)$	0.5086	0.3488	0.1146	0.024	0.0036	0.0004
Expected Frequency	12.2064	8.3712	2.7504	0.576	0.0864	0.0096

X75 — 3, 1

38.15 26.16 8.6 1.8 0.27. 0.03

4b	X –be the number of flaws per millimeter, $\lambda = 3$ i) $P(X=4) = \frac{3^4 e^{-3}}{4!} = 0.1680$ Y –be the number of flaws per 2 millimeter, $\lambda = 6$ ii) $P(Y \geq 1) = 1 - P(Y=0) = 1 - \frac{6^0 e^{-6}}{0!} = 0.9975$	1 1 1 1
5a	$\mu = 10, f(x) = \frac{1}{10} e^{-10x}, F(x) = 1 - e^{-10x}$ $P(X > 60) = e^{-6} = 0.0025$ $P(30 < X < 60) = 1 - e^{-6} - (1 - e^{-3}) = 0.0473$ $P(X < x) = 0.5 \Rightarrow 1 - e^{-\frac{x}{10}} = 0.5 \Rightarrow -\frac{x}{10} = \ln 0.5 = -0.6931, x = 6.931$ Minutes	1 1 1+1 1+1
5b	$\mu = 24, \sigma = 3.8, Z = \frac{X-24}{3.8}$ $P(X \leq 30) = P\left(Z \leq \frac{30-24}{3.8}\right) = P(Z \leq 1.58) = 0.9429$ $P(20 < X < 40) = P(-1.0526 < Z < 4.2105) = 1 - 0.1469 = 0.8531$	1 1 2