

- iii Calculate Karl Pearson's coefficient of correlation between the following series:

Price(Rs.)	Demand(unit)
50	90
52	86
54	83
56	81
58	76
60	70
62	67
64	65

Q.6 Attempt any two:

- If a bag contains 5 red, 6 black and 3 green balls then what is the probability of getting a red or green ball at random in single draw?
- The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively. Find $P(X=2)$.
- Find the probability that exactly 5 defective fuses will be found in a box of 200 fuses, if experience shows that 2% of such fuses are defective.

5 05 02 04 02

5 04 02 05 02

5 05 02 05 02

5 05 02 05 02

Total No. of Questions: 6

Total No. of Printed Pages: 4

Enrollment No.....

Faculty of Science

End Sem Examination Dec 2024

BT3AE02 Elementary Mathematics

Programme: B.Sc.

Branch/Specialisation: Biotechnology

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- | Ma
rks | BL | PO | CO | PSO |
|--|----|----|----|-----|
| Q.1 | 1 | 01 | 01 | 01 |
| i. If $A = \{1, 4\}$ and $U = \{1, 2, 3, 4, 5, 6\}$ then A' is - | | | | |
| (a) $\{1, 2, 3, 4, 5, 6\}$ (b) $\{2, 3, 5, 6\}$ | | | | |
| (c) $\{1, 4\}$ (d) None of these. | | | | |
| ii. The roster form of $A = \{x \mid x \in \mathbb{Z}, x^2 < 5\}$ is - | | | | |
| (a) $\{-2, -1, 0, 1, 2\}$ | | | | |
| (b) $\{0, 1, 2\}$ | | | | |
| (c) $\{1, 2\}$ | | | | |
| (d) None of these. | | | | |
| iii. By the property of logarithmic function $\log_a(x,y) = \dots$ | | | | |
| (a) $\log_a(x) \cdot \log_a(y)$ | | | | |
| (b) $\log_a(x) + \log_a(y)$ | | | | |
| (c) $\log_a(x) - \log_a(y)$ | | | | |
| (d) None of these. | | | | |
| iv. What is the value of $\log_{10}(100)$? | | | | |
| (a) 100 | | | | |
| (b) 10 | | | | |
| (c) 2 | | | | |
| (d) None of these. | | | | |



Knowledge is Power

[2]

- v. If $(3, 2)$ and $(-1, 5)$ are coordinates of any two points on a line, then its slope is given by - **1** 02 01 02 01
(a) $\frac{3}{4}$ (b) $-\frac{3}{4}$
(c) $-\frac{4}{3}$ (d) None of these

vi. The equation of a line with slope m and making an intercept c on y -axis is- **1**
(a) $y = mx + c$
(b) $y = (mx)(c)$
(c) $y = mx - c$
(d) None of these.

vii. The corelation coefficient r lies between- **1** 01 01 03 01
(a) $-1 < r < 1$
(b) $-1 < r < 0$
(c) $0 < r < 1$
(d) None of these

viii. If the mean of $6, 4, 7, p$ and 10 is 8 , Find the value of p ? **1** 02 01 04 01
(a) 15
(b) 13
(c) 10
(d) None of these.

ix. The sample space associated with a random experiment is **1** 01 01 05 01
(a) The set of all possible outcomes
(b) The set of all possible inputs
(c) The set of all outcomes and inputs
(d) None of these.

x. If the occurrence of one event does affect the occurrence of the other then events are called **1** 01 01 05 01
(a) Simple events
(b) Independent events
(c) Dependent events
(d) None of these

[3]

- Q.2** Attempt any two:

 - Define- subset, difference of two sets, De Morgan's law, Relation, constant function. **5** 02 01 01 02
 - If $A = \{4, 5, 7, 8, 10\}$, $B = \{4, 5, 9\}$ and $C = \{1, 4, 6, 9\}$ then calculate $A \cup (B \cap C)$. **5** 04 02 01 02
 - If $f(x) = x^3 - 3x^2 + 3$, then find $f(x+1)$. **5** 05 02 01 02

Q.3 Attempt any two:

 - Solve the quadratic equation $x^2 - 4x + 13 = 0$. **5** 03 02 02 02
 - Solve the pair of linear equations $2x + 3y = 13$ and $x - 2y = -4$. **5** 03 02 02 02
 - Solve the given equation graphically
 - $2x - y \geq 1$
 - $|x| \leq 3$.**5** 05 02 02 02

Q.4 Attempt any two:

 - Find the equation of the line passing through points $(3, -2)$ and $(-4, 9)$. **5** 03 01 03 02
 - If the angle between two lines is $\frac{\pi}{4}$ and slope of one of the line $\frac{1}{2}$, find the slope of the other line. **5** 04 02 03 02
 - Find the equation of the parabola whose focus is at $(-1, -2)$ and the directrix is the straight line $x - 2y + 3 = 0$ **5** 05 02 03 02

Q.5 Attempt any two:

 - Explain bar graph and pie diagram in brief. **5** 02 01 04 02
 - Calculate the Mode from the following Distribution:

class	Frequency
0-10	2
10-20	17
20-30	7
30-40	18
40-50	6
50-60	18

[2]

60-70	4
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[3]

[2]

Scheme of Marking



Faculty of Science

End Sem Examination Dec 2024

Elementary Mathematics (T) - BT3AE02 (T)

Programme: B.Sc.

Branch/Specialisation:

Note: The Paper Setter should provide the answer wise splitting of the marks in the scheme below.

Q.1	i)	(b) {2, 3, 5, 6}	1
	ii)	(a) {-2, -1, 0, 1, 2}	1
	iii)	(b) $\log_a(x) + \log_a(y)$	1
	iv)	(c) 2	1
	v)	(b) $-\frac{3}{4}$	1
	vi)	(a) $y = mx + c$	1
	vii)	(a) $x = a + by$	1
	viii)	(b) 13	1
	ix)	(a) the set of all possible outcomes	1
	x)	(c) dependent events	1
Q.2	i.		
	ii.		
	iii.		
OR	iv.		
Q.3	i.		
	ii.		
OR	iii.		
Q.4	i.		
	ii.		
OR	iii.		
Q.5	i.		
	ii.		

[3]

OR	iii.		
Q.6			
	i.		
	ii.		
	iii.		

Programme :- B.Sc
Branch :- Biotech.

Marks

Q1) MCQ's

- | | | |
|-------|-------------------------------------|---|
| i) | b) $\{2, 3, 5, 6\}$ | 1 |
| ii) | a) $\{-2, -1, 0, 1, 2\}$ | 1 |
| iii) | b) $\log_a(x) + \log_a(y)$ | 1 |
| iv) | c) (2) | 1 |
| v) | b) $-3/4$ | 1 |
| vi) | a) $y = mx + c$ | 1 |
| vii) | a) $-1 < m < 1$ | 1 |
| viii) | b) 13 | 1 |
| x) | a) The set of all possible outcomes | 1 |
| x) | c) Dependent events. | 1 |

Q2)

Subset :- A Subset is a set that contains some or all elements of another set.

1

Ex → The set of even numbers is a subset of the set of all numbers.

Difference of two Set :-

The difference of two sets A & B is the set of all elements in A that are not in B.

De-Morgan's law :-

The complement of the union of two sets is the intersection of their complements.

(2)

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Relation :- A relation is a subset of the Cartesian product of two sets. It is made up of ordered pairs (a, b) where $a \in A$ & $b \in B$. Marks

Constant function :-

A Constant functⁿ is a functⁿ having the same range for different values of the domain.

i)

$$A \cup (B \cap C) = ?$$

$$A = \{4, 5, 7, 8, 10\} \quad B = \{4, 5, 9\} \quad C = \{1, 4, 6, 9\}$$

$$(B \cap C) = \{4, 9\}$$

$$A \cup (B \cap C) = \{4, 5, 7, 8, 9, 10\} \quad \underline{\text{Ans}} \quad 2$$

(ii)

$$f(x) = x^3 - 3x^2 + 3$$

$$f(x+1) = (x+1)^3 - 3(x+1)^2 + 3$$

$$= x^3 + 1 + 3x^2 + 3x - 3(x^2 + 1 + 2x) + 3 \quad 2$$

$$= x^3 + 3x^2 + 1 - 3x^2 - 3 - 6x + 3$$

$$f(x+1) = x^3 - 3x + 4 \quad \underline{\text{Ans}} \quad 1$$

(Q3)

Marks

$$i) x^2 - 4x + 13 = 0$$

$$a = 1, b = -4, c = 13$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{+(-4) \pm \sqrt{(-4)^2 - 4 \times 13 \times 1}}{2 \times 1}$$

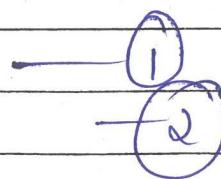
$$= \frac{4 \pm \sqrt{16 - 52}}{2}$$

$$= \frac{4 \pm \sqrt{-36}}{2}$$

The square root of a negative number $\sqrt{-36}$ does not exist in the set of real numbers, so x is not an element of the set of real numbers.

(Q3) (ii)

$$x + 3y = 13$$



$$x - 2y = -4 \quad \times 2$$

By using elimination method.

$$\begin{array}{r} 2x + 3y = 13 \\ -x - 4y = -8 \\ \hline 7y = 21 \end{array}$$

$$y = 3$$

Put the value of y in eqⁿ ①

Marks

$$2x + 3 \times 3 = 13$$

$$2x + 9 = 13$$

$$2x = 13 - 9$$

$$2x = 4$$

$$\boxed{x = 2}$$

$$\boxed{y = 3}$$

Q3(iii)

(a) $2x - y \geq 1$

Let $2x - y = 1$

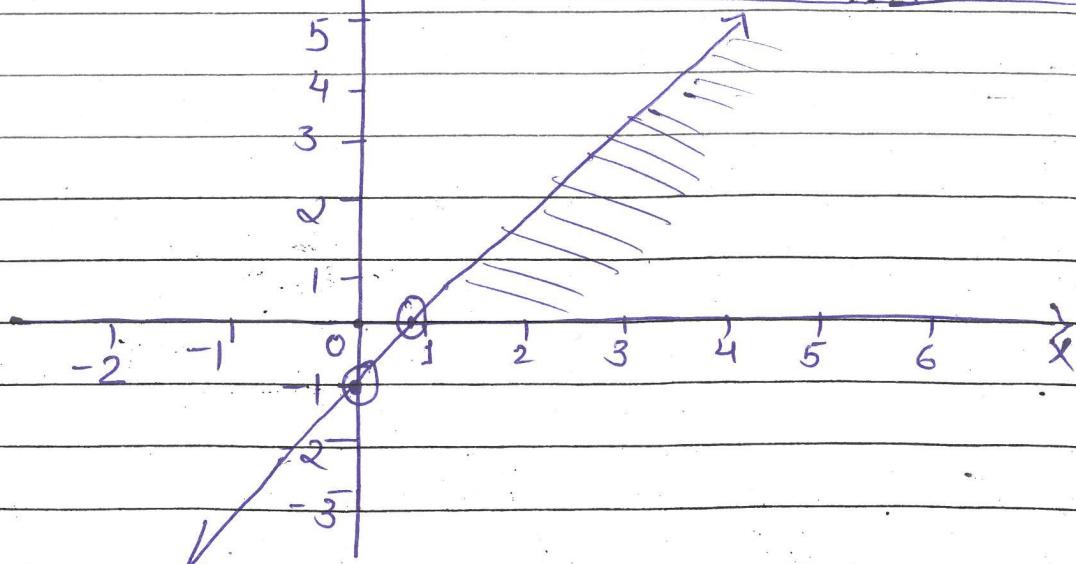
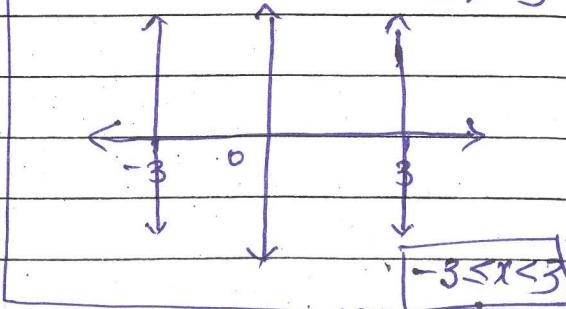
x	0	y_2
y	-1	0

y

(b) $|x| \leq 3$

$$\begin{array}{ll} x < 3 & -x < 3 \\ (x \geq 0) & (x < 0) \\ x > -3 & \end{array}$$

2.5



2.5

(Q4)

Marks

(i) The equation of line passing through two points (x_1, y_1) & (x_2, y_2) is given by -

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

∴ The equation of line passing through $E(3, -2)$ & $(-4, 9)$

$$\frac{y - (-2)}{x - 3} = \frac{9 - (-2)}{-4 - 3}$$

$$\frac{y + 2}{x - 3} = \frac{11}{-7}$$

$$-7(y + 2) = 11(x - 3)$$

$$-7y - 14 = 11x - 33$$

$$33 - 14 = 11x + 7y$$

$$11x + 7y = 19$$

$$11x + 7y = +19$$

Any

$$11x + 7y = 19$$

Any

(Q4(ii))

We know that angle b/w two lines are

$$\tan \theta = \left| \frac{m_2 - m_1}{1 + m_1 m_2} \right|$$

Marks

$$\text{Putting } \theta = \frac{\pi}{4} = \frac{180}{4} = 45^\circ$$

1

$$\text{Let } n_1 = \sqrt{2}$$

$$n_2 = ?$$

$$\tan \theta = \left| \frac{n_2 - n_1}{1 + n_1 n_2} \right|$$

$$\tan 45 = \left| \frac{n_2 - \sqrt{2}}{1 + \sqrt{2}n_2} \right|$$

$$1 = \left| \frac{\sqrt{2}n_2 - 1}{\sqrt{2}(1 + n_2)} \right|$$

$$\frac{\sqrt{2}n_2 - 1}{\sqrt{2} + n_2} = 1 \quad \& \quad \frac{\sqrt{2}n_2 - 1}{\sqrt{2} + n_2} = -1$$

$$\sqrt{2}n_2 - 1 = \sqrt{2} + n_2$$

$$\sqrt{2}n_2 - 1 = -(\sqrt{2} + n_2)$$

$$\sqrt{2}n_2 - n_2 = \sqrt{2} + 1$$

$$\sqrt{2}n_2 - 1 = -\sqrt{2} - n_2$$

$$\boxed{n_2 = 3}$$

$$\sqrt{2}n_2 + n_2 = -\sqrt{2} + 1$$

$$3n_2 = -1$$

$$\boxed{n_2 = -\frac{1}{3}}$$

Therefore $n_2 = 3$ or $n_2 = -\frac{1}{3}$ Any

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Q4 (iii)

Marks

Let $P(x_1, y_1)$ be any pt. on the parabola
whose focus is $(-1, -2)$ & the
directrix $x - 2y + 3 = 0$

$$f(-1, -2)$$

Acc. to definitⁿ of Parabola.

$$\sqrt{(x_1 + 1)^2 + (y_1 + 2)^2} = \left| \frac{x_1 - 2y_1 + 3}{\sqrt{1^2 + (-2)^2}} \right|$$

$$x_1^2 + 1 + 2x_1 + y_1^2 + 4 + y_1 = x_1^2 + 4y_1^2 + 9 - 4x_1y_1$$

$$\frac{-12y_1 + 6x_1}{5}$$

$$x_1^2 + y_1^2 + 2x_1 + 4y_1 + 5 = x_1^2 + 4y_1^2 - 4x_1y_1 - 12y_1 + 6x_1 + 9$$

$$\frac{5}{5}$$

$$5x_1^2 + 5y_1^2 + 2x_1 + 10x_1 + 20y_1 + 25 = x_1^2 + 4y_1^2 - 4x_1y_1 - 12y_1 + 6x_1 + 9$$

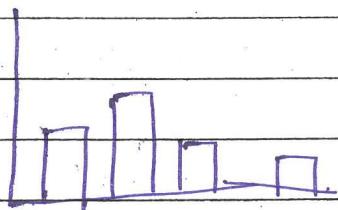
$$4x_1^2 + y_1^2 + 4x_1 + 32y_1 + 4x_1y_1 + 16 = 0 \text{ Ans}$$

Q5(i)

Marks

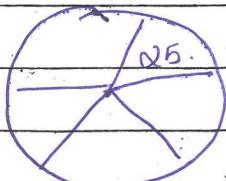
Bar graph :-

A bar graph is a graphical representation of information. It uses bars that extend to different heights to depict value. Bar graphs can be created with vertical bars, horizontal bars, grouped bars or stacked bars (bars containing multiple types of information).



Pie diagram :-

A pie chart is a type of graph that represents the data in the circular graph. The slices of pie show the relative size of the data & it is a type of pictorial representation of data.



(ii) Mode.

Marks

Class	Frequency	Marks
0-10	2	
10-20	17	
20-30	7	
30-40	18	
40-50	6	
50-60	18	
60-70	4	

Grouping Table.

Marks	I	II	III, IV	V	VI	
0-10	2	19				
10-20	17		24	26		
20-30	7	25			42	
30-40	18		24			
40-50	6	24		42	28	
50-60	18			22		
60-70	4					

Analysis Table

Column	0-10	10-20	20-30	30-40	40-50	50-60	60-70
I				✓		✓	
II			✓	✓			
III		✓	✓	✓	✓		
IV				✓	✓	✓	
V		✓	✓	✓			
VI			✓	✓			

(6)

Modal class 30 - 40

Marks

$$M_o = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$\textcircled{a} f_1 = 30, f_0 = 18, f_2 = 7, f_1 = 6$$

$$M = \frac{30 + 18 - 7}{2 \times 18 - 7 - 6} \times 10$$

$$= \frac{30 + 11}{23} \times 10$$

$$\approx 30 \Rightarrow 30 + 4.78$$

$$\Rightarrow \boxed{34.78}$$

(iii)

x	$dx = (x - 50)$	dx^2	y	$dy = (y - 76)$	dy^2	$dxdy$	
50	-7	49	90	14	196	-98	
52	-5	25	86	10	100	-50	
54	-3	9	83	7	49	-21	
56	-1	1	81	5	25	-5	2
58	1	1	76	0	0	0	
60	3	9	70	-6	36	-18	
62	5	25	67	-9	81	-45	
64	7	49	65	-11	121	-77	
456	0	168	618	10	608	-314	

Marks

(Q5) Mean of x Series = $\bar{x} = \frac{\sum x}{n} = \frac{456}{8} = 57$

— II — y — II = $\bar{y} = \frac{618}{8} = 77.25$

$$r_{xy} = \frac{n \sum dx dy - \sum dx \sum dy}{\sqrt{n \sum dx^2 - (\sum dx)^2} \sqrt{n \sum dy^2 - (\sum dy)^2}}$$

$$= \frac{8(-314)}{\sqrt{8(168)-0^2}} - \frac{(10)(10)}{\sqrt{8(608)-(10)^2}}$$

$$r_{xy} = \frac{-2512 - 0}{\sqrt{1344-0} \sqrt{4864-100}} = \frac{-2512}{\sqrt{1344} \sqrt{4764}}$$

$$r_{xy} = \frac{-2512}{36.66 \times 69.02} = \boxed{-0.99}$$

(Q6) (i)

Total number of balls = 14

No. of favourable outcome (red + green) 1
 $= 5 + 3 = 8$

$$P = \frac{\text{No. of favourable outcome}}{\text{Total no. of outcome}} \quad 2$$

$$P = \frac{8}{14} = \frac{4}{7} \quad \underline{\text{Ans}} \quad 2$$

$$(ii) \text{ Mean } (\mu) = 4$$

$$n \cdot p = 4$$

- (1)

$$\text{Variance } (\sigma^2) = \frac{4}{3}$$

Marks

1

$$n \cdot p(1-p) = \frac{4}{3} - (2)$$

Substitute $n \cdot p = 4$ in eqn (2)

$$n \cdot p(1-p) = \frac{4}{3}$$

1

$$4(1-p) = \frac{4}{3}$$

$$1-p = \frac{4}{3} \times \frac{1}{4}$$

1

$$1-p = \frac{1}{3}$$

$$p = \frac{2}{3}$$

1

$$P = \frac{2}{3}$$

$$n = 6$$

$$P = {}^n C_R (p)^R (q)^{n-R}$$

$$P(X=2) = {}^6 C_2 \left(\frac{2}{3}\right)^2 \cdot \left(\frac{1}{3}\right)^4$$

$$= \left[\frac{20}{243} \right]$$

1

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Q6 (iii)

Marks

$$n = 200$$

$R = 5$ (number of Successes i.e. defective fuses) |

$p = 0.02$ (probability of fuse being defective) |

$(1-p) = 0.98$ (probability of a fuse not being defective) |

$$P(X=5) = nCr (p)^R (q)^{n-R}$$

$$= 200C_5 (0.02)^5 (0.98)^{195}$$

$$= 0.158 \text{ Ans} \\ \text{or. } (15.8)\% \text{ Ans}$$