GUJARAT TECHNOLOGICAL UNIVERSITY
B.VOC- SEMESTER–II EXAMINATION – SUMMER 2025

Subject Code:21120204   **Date:28-05-2025**
Subject Name: Basic Mathematics
**Time:10:30 AM TO 12:30 PM**   **Total Marks:50**
Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		Marks

Q.1 **(a)** If $A = \{w, x, y\}$, $B = \{x, y, z\}$ and $C = \{y\}$, then verify that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$. — **05**

(b) In the graph given below, write the degree of each vertex. Is it a simple graph? If not, write the type of the graph. — **05**
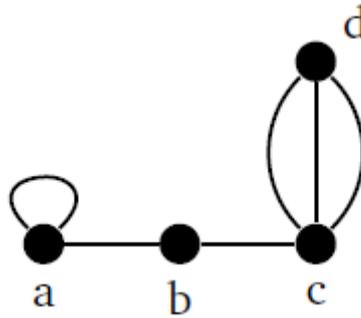
Q.2 **(a)** If α and β are the roots of $x^2 - 2x + 4 = 0$, find $\alpha \cdot \beta$. — **05**

(b) Find the complex conjugate and modulus of $\dfrac{(2+i)(1-2i)}{3-i}$. — **05**

OR

(b) Consider the following five relations on the set A={1,2,3,4}: — **05**

$R_1 = \{(1,1), (1,2), (2,3), (1,3), (4,4)\}$

$R_2 = \{(1,1), (1,2), (2,1), (2,2), (3,3), (4,4)\}$

$R_3 = \{(1,3), (2,1)\}$,

$R_4 = \phi,$ the empty relation

$R_5 = A \times A,$ the universal relation

(i) Which of the relations are reflexive? Why?
(i) Which of the relations are not symmetric? Why?
(i) Which of the relations are not transitive? Why?

Q.3 **(a)** (i) For what value of k the vectors u and v are orthogonal? — **05**
$u = (2,\ 1,\ 3)$ and $v = (1,\ 7,\ k)$.

(ii) If $u = (-1,\ 2,\ 3)$ and $v = (2,\ 0,\ 4)$, find $u + v$ and $u - v$.

(b) Expand $\begin{vmatrix} 1 & 1 & 1 \\ bc & ac & ab \\ \dfrac{1}{a} & \dfrac{1}{b} & \dfrac{1}{c} \end{vmatrix}$.   **05**

OR

Q.3 (a) If $f: R \rightarrow R$, $f(x) = x^2 + 2$ and $g: R \rightarrow R$, $g(x) = 3x$, can fog and gof be defined? If yes, find $fog(x)$ and $gof(x)$.   **05**

(b) If possible find $A+4B$ and $B+C-2D$, where $A = \begin{bmatrix} 1 & -1 & 1 \\ -3 & 2 & -1 \\ -2 & 1 & 0 \end{bmatrix}$,   **05**

$B = \begin{bmatrix} 1 & 2 \\ 4 & 5 \\ 6 & 7 \\ 8 & 9 \end{bmatrix}$, $C = \begin{bmatrix} 0 & 1 \\ 2 & 0 \\ 3 & -1 \\ 4 & 6 \end{bmatrix}$ and $D = \begin{bmatrix} 5 & -4 \\ -3 & 2 \\ 5 & -3 \\ -1 & 0 \end{bmatrix}$.

Q.4 (a) Find standard deviation of the following data   **05**

x	10	11	12	13	14	15	16
f	2	7	11	15	10	4	1

(b) If A and B are two events such that $P(A) = \dfrac{2}{3}$, $P(B) = \dfrac{1}{2}$,   **05**

$P(A \cap B) = \dfrac{1}{3}$ and $P(\bar{A} \cap B) = \dfrac{1}{6}$ find (i) $P(A \cup B)$ (ii) $P(\bar{A})$

(iii) $P(\bar{B})$ (iv) $P(\bar{A} \cup B)$ (v) $P(\bar{A} \cap \bar{B})$

OR

Q.4 (a) Find the mean deviation about mean from the following data: **05**

Product output	145	155	165	175	185	195
Workers	4	6	10	18	9	3

(b) A class consists of 6 girls and 10 boys. If a committee of three is chosen at random from the class, find the probability that (i) three boys are selected, and (ii) exactly two girls are selected.   **05**

Q.5 (a) State De Morgan's theorem for Boolean algebra. Also, write the complement of the following Boolean functions.   **05**
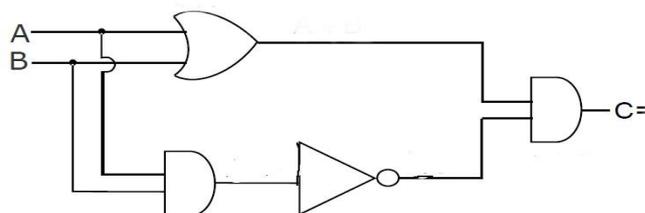(i) $F = \bar{x} \cdot y \cdot \bar{z} + \bar{x} \cdot \bar{y} \cdot z$ (ii) $F = (x+y) \cdot (\bar{x}+z) \cdot (y+z)$

(b) Express the Boolean function $F = x + yz$ as a sum of minterms.   **05**

OR

Q.5 (a) Prove that $x + x \cdot y = x$ using the truth table.   **05**

(b) Find the Boolean expression of the given logic circuit.   **05**

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