

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.: XXXX

SCHOOL OF ADVANCED SCIENCES
CAT – II– MODEL QP
WINTER SEMESTER 2025-2026

SLOT: XXXX

Programme Name & Branch : B. Tech & XXX
Course Code and Course Name : BAMAT205 & Discrete Mathematics and Linear Algebra
Faculty Name(s) : Common Slot QP
Class Number(s) : Common Slot QP
Date of Examination : XX-XX-XX
Exam Duration : 90 minutes **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes:
 - [1] Apply proof techniques in solving logical problems.
 - [2] Solve engineering problems involving counting principles.

Q.No	Question	M	CO	BL
1	Let $G = (\mathbb{Z}_{10}, +)$ be the group under addition modulo 10. a. Determine all subgroups of G . b. Identify which of these subgroups are cyclic. c. Explain how Lagrange's theorem applies to this group.	10	3	1
2	For a $(6, 3)$ code, the generator matrix G is given below: $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 \end{bmatrix}.$ (i) Construct the parity check matrix H . (ii) Find all codewords generated by G . (iii) Find the minimum Hamming distance of the code. (iv) Determine the error if the received codeword is 100011.	10	3	3
3	For the poset $(A,)$ where $A = \{2, 3, 4, 6, 8, 12, 24\}$ and the relation is divisibility, find: (a) the maximal and minimal elements (b) the greatest and least elements (c) the upper bounds and LUB of $\{3, 4\}$ (d) the lower bounds and GLB of $\{6, 12\}$	10	3	2

4	<p>(A) Verify whether the set</p> $H = \left\{ \begin{bmatrix} 2a & b \\ 3a + b & 3b \end{bmatrix} \mid a, b \in \mathbb{R} \right\}$ <p>forms a subspace of the vector space $M_{2 \times 2}(\mathbb{R})$.</p> <p>(B) Let</p> $W = \{(x, y, z) \in \mathbb{R}^3 \mid x + y + z = 0\}.$ <p>Verify whether W is a subspace of \mathbb{R}^3.</p>	5 + 5	4	2
5	<p>Let</p> $v_1 = (1, 2, 1), \quad v_2 = (2, 3, 1), \quad v_3 = (3, 5, 2)$ <p>be vectors in \mathbb{R}^3.</p> <p>(a) Determine whether the vectors v_1, v_2, v_3 are linearly independent.</p> <p>(b) If they are linearly dependent, express one of the vectors as a linear combination of the other two.</p>	10	4	3
