



VIT

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

SLOT: A2+TA2+TAA2

REG.NO.:

SCHOOL OF ADVANCED SCIENCES CONTINUOUS ASSESSMENT TEST (CAT) -II FALL SEMESTER 2025-2026

Programme Name & Branch : B. Tech
 Course Code : BMAT205L
 Course Name : Discrete Mathematics and Graph Theory
 Faculty Name(s) : Dr. R. Selvakumar, Dr. GSGN Anjaneyulu, Dr. Abhishek Das, Dr. S. Dharani,
 Dr. A. Parthiban, Dr. Juhi Baroi, Dr. Praveen
 Class Number(s) : VL2025260102451, 0865, 0890, 0895, 0894, 4396, 0870
 Date of Examination : 05.10.2025, 9:30am-11am
 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)
- Course Outcomes Statements: CO. 2: Use algebraic structures in applications, CO. 3: Counting techniques in engineering problems, CO. 4: Use lattice and Boolean algebra properties in Digital circuits

Q. No	Question	M	CO	BL
1.	a) Let $(G, *)$ be a group and $(\mathbb{Z} \times \mathbb{Z}, +)$ be a group where '+' is defined as $(a, b) + (c, d) = (a + c, b + d)$, $a, b, c, d \in \mathbb{Z}$. Let $\phi: \mathbb{Z} \times \mathbb{Z} \rightarrow G$ be defined by $\phi(m, n) = h^m * k^n$, where $h, k \in G$ and $h^m = h * h * \dots * h$ (m times). Find the condition (involving h and k), for ϕ to be a homomorphism.	4		
	b) Corresponding to the encoding function $e: B^4 \rightarrow B^7$, assume the parity check matrix is given by $H = \begin{bmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$. Use it to decode the following received words and hence, to find the original message: 1100001, 1110111.	6	2	2
2.	How many positive integers less than or equals to 100 are divisible by none of 2,3,5? Give step by step procedure.	10	3	2
3.	Suppose that a password for a computer system must have at least 8, but no more than 12, characters, where each character in the password is a lowercase English letter, an uppercase English letter, a digit, or one of the six special characters *, >, <, !, + and =. a) How many of these passwords contain at least one of the six special characters? (6 marks) b) If a hacker knows the password contains 8 distinct characters, how many possible passwords must the hacker try? (4 marks)	10	3	3
4.	Solve the recurrence relation $a_n = 4a_{n-1} - n, n \geq 1, a_0 = 1$.	10	3	2
5.	Suppose we have a list of tasks in signal processing. Each task is written as a pair (a, b) , where $a \in \{0,1,2\}$ denotes the extra delay before starting the task, $b \in \{2,3,8\}$ denotes the basic time required to do the task. So, the total time for a task is $(a + b)$. We decide that one task must be done before another if the total time of the first task is a divisor of the total time of the second. So, $(a, b)R(c, d) \Leftrightarrow (a + b) \mid (c + d)$, i.e., $(a + b)$ divides $(c + d)$. For the set $A = \{0, 1, 2\} \times \{2, 3, 8\}$, write down the relation set of R . Then, check whether (A, R) really satisfies the conditions of a poset.	10	4	3
