VIT
Vellore Institute of Technology

REG.NO.:

SCHOOL OF ADVANCED SCIENCES
DEPARTMENT OF MATHEMATICS
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: A2 + TA2 + TAA2

Programme Name & Branch	**: BTech (Information Technology/AI and ML/Data Science)**
Course Code and Course Name	**: BMAT205L Discrete Mathematics and Graph Theory**
Faculty Name(s)	**: Dr. Anjaneyulu G.S.G.N., Dr. Pallavi Mishra, Dr. Gayatri S. Panicker**
Class Number(s)	**: VL2024250102592/2591/2590**
Date of Examination	**: 13.10.2024**
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:
  CO2 – Use algebraic structures in applications
  CO3 – Counting techniques in engineering problems
  CO4 – Use lattice and Boolean algebra properties in digital circuits

Q. No	Question	M	CO	BL
1.	Let $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$ be the generator matrix of a (3,6) encoding function. What is the maximum number of errors this encoding function can detect? What is the maximum number of errors it can correct? Decode 110010.	10	2	3
2.	a) Find the number of VTOP passwords, if each password is to be of length 4, and must contain at least one capital letter, at least one small letter, and at least one digit. Note that other symbols or special characters are NOT allowed in a password.	5	3	6
	b) Suppose that 10 distinct numbers are chosen at random from 1 to 99, and let this be called set X. Prove that there exist $Y, Z \subseteq X$, such that both Y and Z are non-empty, disjoint and proper, and $\sum_{y \in Y} y = \sum_{z \in Z} z$.	5		
3.	Let $n \in \mathbb{N}_0$, where $\mathbb{N}_0$ depicts the set of whole numbers. Consider $X_n = \{ x_1 x_2 \cdots x_n : \text{for each } i \leq n, x_i \in \{0, 1, 2, \ldots, 9\}\}$, that is, X_n is the set of n-digit strings with digits from 0 to 9. Let $A_n = \{ x \in X_n : x \text{ has at least one } 0\}$. If $a_n = \lvert A_n \rvert$, find a recurrence relation for a_n. Solve this recurrence relation using the method of generating functions.	10	3	4
4.	Let $A = \mathbb{R}$. Define a binary relation R on A by aRb iff $\exists k \in \mathbb{R}$ such that $ka = b$. Is R a partial order? Justify.	10	4	4
5.	Let B be a Boolean algebra, and let $a, b \in B$. Prove that $a \wedge \neg b = 0 \Leftrightarrow a \wedge b = a$.	10	4	3

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