



VIT

Vellore Institute of Technology
(Chartered by the Government of India under section 3 of the U.T. Act, 1954)

Final Assessment Test – November 2025

Course: UMAT101L - Discrete Mathematics

Class NBR(s): 5537 / 5539 / 6087 / 6088

Time: Three Hours

Slot: F1+TF1

Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Apply the principles of counting, permutations, and combinations for realistic problems.
CO2	Learn the concepts of statements calculus, inference theory and predicate calculus on logic.
CO3	Use the lattice and Boolean algebra techniques in execution of digital circuits.
CO4	Use algebraic structures in computer science applications.
CO5	Solve science and engineering problems using graph theoretical techniques.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions

(10 X 10 = 100 Marks)

- How many different bit strings of length seven either start with a 1 bit or end with two bits 00? CO1 BL2
 - How many different licence plates can be made if each plate contains a sequence of three upper case English letters followed by three digits.
- How many cards must be selected from a standard deck of 52 cards to guarantee that at least three cards of the same suit are selected. CO1 BL3
 - How many must be selected from a standard deck of 52 cards to guarantee that at least three hearts are selected?
- Construct the truth table for $((P \vee \neg Q) \wedge (Q \rightarrow R)) \vee (\neg P \wedge R)$. CO2 BL3
 - With using a truth table, check if $(P \rightarrow Q) \vee (Q \rightarrow P)$ is tautology or not?
- Construct PCNF. Hence deduce PDNF of the statement formula
 $(P \vee Q) \wedge (P \vee \neg Q) \wedge (\neg P \vee R)$. CO2 BL2
- Show that $(\forall x) (H(x) \rightarrow M(x)) \wedge H(S) \Rightarrow M(S)$. CO2 BL2
 - Consider the statement "Some books in the library are missing"
 - Write this statement in symbolic (Predicate logic) form.
 - Write the negation of the statement and justify that the negation is correct by simplifying it symbolic form.
- Show that the conclusion $P \rightarrow R$ follows logically from the premises
 $\neg P \vee Q, \neg Q \vee R, P \vee S$ CO2 BL2
 - Verify the validity of the argument
 - Lions are dangerous animals
 - There are lions
 - Therefore, there are dangerous animals

- (i) Let S be any non-empty set, then show that $(P(S), \subseteq)$ is a lattice.
- (ii) Let n be a positive integer and S_n denote the set of all positive divisors of n . Define a relation ' $\leq$ ' on S_n as follows: for $a, b \in S_n$, $a \leq b$ if a divides b . For $n = 30$, show that $(S_{30}, \leq)$ forms a lattice.

CO3 BL2

OR

- 7.b) (i) Let $A = \{1, 2, 3\}$. Consider the set $\rho(A)$, the power set of A . Determine whether the poset $(\rho(A), \subseteq)$ is a lattice.
- (ii) Verify Boolean algebra identities by using standard laws
- (a) $(x + y')(x + z) = x + y'z$
- (b) $x(y + z(x' + y)) = xy + xz$.

CO3 BL2

- 8.a) Show that the set of all 2×2 matrices $G = \left\{ \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} \mid a, b \in \mathbb{R}, a \neq 0, b \neq 0 \right\}$ forms an abelian group under usual matrix multiplication.

CO4 BL2

OR

- 8.b) In a group G of order 30, what are the possible orders of its subgroups? Give an example.
9. Given a graph G with vertices $V = \{a, b, c, d, e\}$ and edges $E = \{(a, b), (b, c), (c, d), (d, e), (a, e), (b, e)\}$
- (i) Determine if G has a Euler path or Euler circuit.
- (ii) Determine if G has a Hamiltonian path or Hamiltonian circuit. Explain with logical reasons.

CO4 BL2

CO5 BL2

10. Find the Minimum Spanning Tree (MST) of the following graph using Prim's Algorithm and Kruskal's Algorithm:

CO5 BL2

$G = (V, E)$ Vertices $V = \{a, b, c, d, e\}$

Edges	$\{a, b\}$	$\{a, c\}$	$\{b, c\}$	$\{b, d\}$	$\{c, d\}$	$\{c, e\}$	$\{d, e\}$
Weight	4	2	5	10	3	4	11

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