BH/D/TZ

Reg. No: 24BELN124

VIT®

Vellore Institute of Technology

Final Assessment Test – April 2026

Course: **BMAT205L - Discrete Mathematics and Graph Theory**

Class NBR(s): **1702** Slot: **C2+TC2+TCC2**

Time: **Three Hours** 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	Learn proof techniques and concepts of inference theory,
CO2	Use algebraic structures in applications.
CO3	Counting techniques in engineering problems.
CO4	Use lattice and Boolean algebra properties in Digital circuits.
CO5	Solve Science and Engineering problems using Graph theory.

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

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Obtain the principal disjunctive and principal conjunctive normal forms of the following statement: $(P \to (Q \wedge R)) \wedge (\neg P \to (\neg Q \wedge \neg R))$. **[10]** CO1 BL1

2. If A works hard, then either B or C will enjoy themselves. **[10]** CO1 BL3
   If B enjoys himself, then A will not work hard.
   If D enjoys himself, then C will not enjoy himself.
   Therefore, if A works hard, then D will not enjoy himself.
   Show that the above statements constitute a valid argument.

3. State and prove Lagrange's theorem in groups. **[10]** CO2 BL2

4. Find all the code words generated by the encoding function $e: B^3 \longrightarrow B^6$ with respect to the following parity check matrix. **[10]** CO2 BL1

$$H = \begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

5. Find the solution to the recurrence relation $S_n = 7S_{n-1} - 10\,S_{n-2}$ with the initial conditions $S_0 = 2$ and $S_1 = 5$. **[10]** CO3 BL2

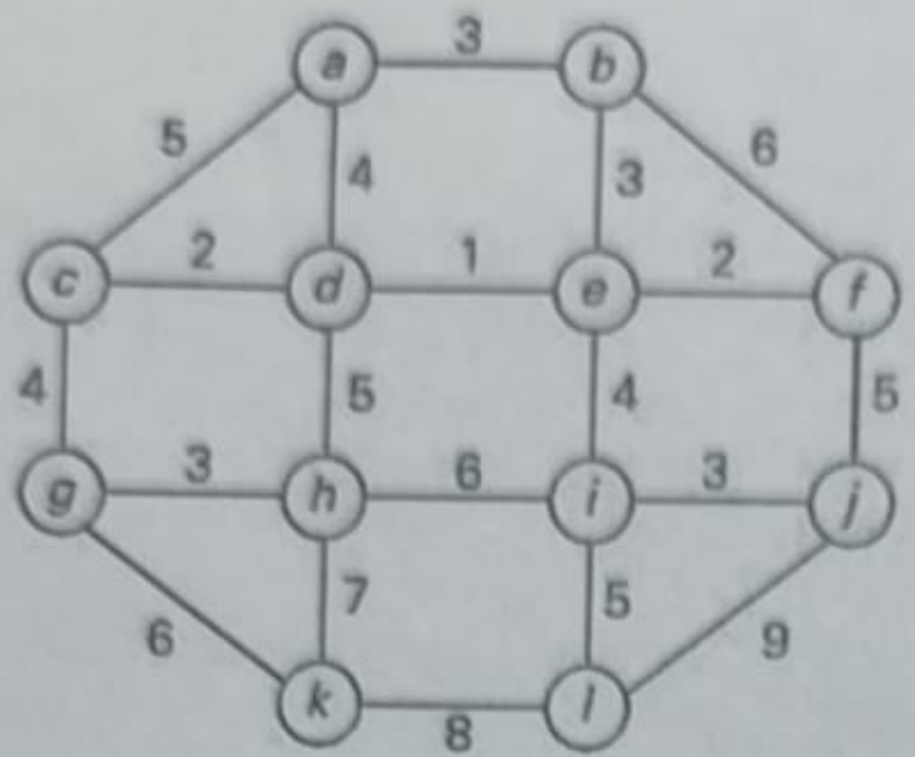
6. Let $\langle L, \leq, *, \oplus \rangle$ be a lattice in which $*$ and $\oplus$ denote the operations of meet and join respectively. For any $a, b \in L$, prove that $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$. **[10]** CO4 BL3

7. Expand the Boolean expression $(x_1 \oplus x_2)$ into an equivalent sum-of-products and product-of-sums canonical forms in terms of three variables namely x_1, x_2 and x_3. **[10]** CO4 BL3

8.a) Show that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. **[10]** CO5 BL2

[OR]

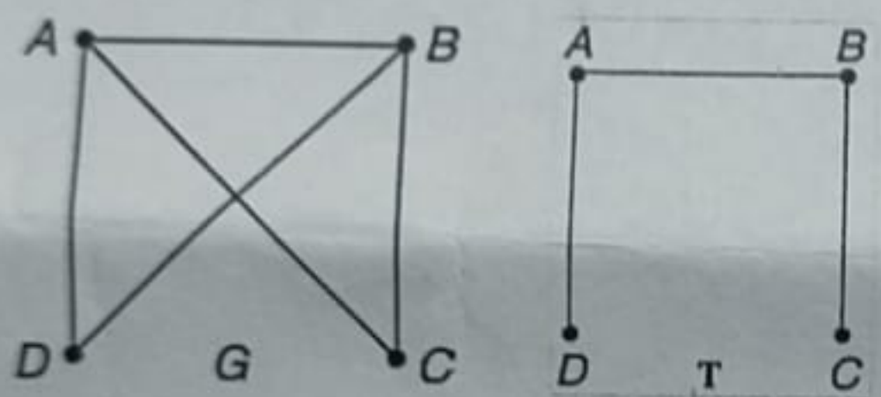
8.b) Apply the Dijkstra's algorithm to find the shortest path between the vertices a and l in the following weighted connected graph and hence compute the total weight of the obtained shortest path between the above mentioned vertices. **[10]** CO5 BL2



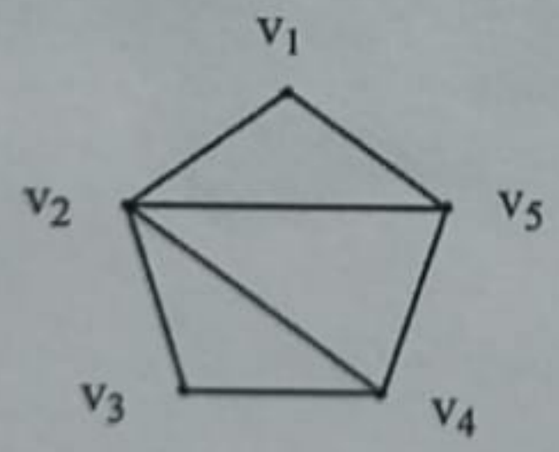
9.a) Show that a graph G is a tree, if and only if, there is a unique path between every pair of vertices in a graph G. **[10]** CO5 BL2

[OR]

9.b) Find all the possible fundamental circuits for the given graph G with respect to the given spanning tree T. Also find at least 5 possible spanning trees for the given graph G. **[10]** CO5 BL2



10. Find the chromatic number and the chromatic polynomial of the following graph by using the method of adding an edge and fusing 2 vertices. **[10]** CO5 BL3



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