

## Final Assessment Test – November 2025



**VIT**  
Vellore Institute of Technology  
(Approved by the University Grants Commission of India (UGC), Act, 1956)

Course: **BMAT205L - Discrete Mathematics and Graph Theory**Class NBR(s): 0685 / 0866 / 0867 / 0871 / 0873 / 0885 /  
0887 / 0891 / 0896 / 0898 / 0900 / 0902 / 0904 / 0907 /  
0909 / 0911 / 0913 / 0914 / 0921 / 0932 / 2428 / 4388 /

4393

Slot: C1+TC1+TCC1

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. Find the Principle conjunctive normal form (PCNF) and deduce the principle disjunctive normal form (PDNF) of  $P \rightarrow (Q \wedge P) \wedge (\neg P \rightarrow (\neg Q \wedge \neg R))$ . CO1 BL3
2. a) Using the indirect method of proof, prove that  $P \rightarrow R, Q \rightarrow S, P \vee Q \Rightarrow S \vee R$ . [5] CO1 BL2  
b) Show that  $(\exists x)M(x)$  follows logically from the premises  $(x)[H(x) \rightarrow M(x)]$  and  $(\exists x)H(x)$ . [5]
3. Let  $G$  be a reduced residue system Modulo 15, say  $G = \{1, 2, 4, 7, 8, 11, 13, 14\}$ . Then prove that  $G$  is a group under multiplication modulo 15 using the composition table. CO2 BL3  
a) Find the orders and cyclic subgroups generated by 2, 7 and 11.  
b) Is  $G$  Cyclic?
4. Find the code words generated by the parity check matrix  $H = \begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$  when the encoding function is  $e: B^3 \Rightarrow B^6$ . Also find how many errors  $e$  will defect? How many errors  $e$  will correct? CO2 BL2
- 5.a) Consider a set of integers between 1 and 500. Find CO3 BL3  
i) How many of these numbers are divisible by 3 or 5 or 11.  
ii) Also indicate how many are divisible by 3 or by 11 but not by all 3, 5, and 11.  
iii) How many are divisible by 3 or 11 but not by 5?

[OR]

5.b)

Suppose that a valid code word is an  $n$ -digit number in decimal notation containing an even number of 0's. Let  $a_n$  denote the number of valid code words of length  $n$ . The sequence  $\{a_n\}$  satisfies the recurrence relation  $a_n = 8a_{n-1} + 10^{n-1}$  and the initial condition  $a_1 = 9$ . Use generating function to find an explicit formula for  $a_n$ .

CO3 BL3

6.

a) Let  $D_{60} = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}$  and the divisibility ( $/$ ) be a relation on a poset on  $D_{60}$ . (i) Draw the Hasse diagram for  $D_{60}$ . Find the greatest lower bound and the least upper bound of 10 and 20.

[5] CO4 BL1

b)  $S_{42}$  is the set of all divisors of 42. Prove that  $(S_{42}, D)$  is a complemented lattice. Where  $D$  is the relation divisor of 42.

[5]

7.

a) In any Boolean algebra, prove that  $(a + b')(b + c')(c + a') = (a' + b)(b' + c)(c' + a)$

[5] CO4 BL2

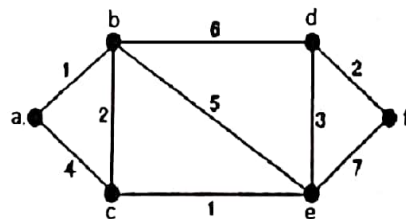
b) Obtain the sum of products and product of sums canonical forms in three variables of the Boolean expression  $x_1 \oplus (x_2 * x_3')$

[5]

8.

Explain Dijkstra's algorithm. Using Dijkstra's algorithm on the graph given below and find the shortest path from a to f.

CO5 BL2



9.a)

Prove that a tree with  $n$  vertices has  $(n - 1)$  edges.

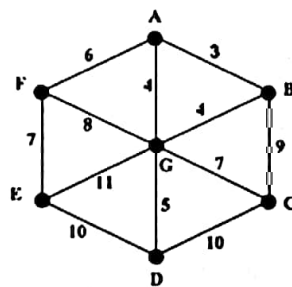
CO5 BL3

[OR]

9.b)

Explain the Prim's algorithm. Find the minimum spanning tree of the following graph by using Prim's algorithm.

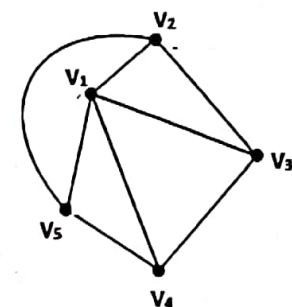
CO5 BL3



10.

Find the chromatic polynomial of the following graph

CO5 BL3



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