



# DMI-ST. EUGENE UNIVERSITY

ZAMBIA

DEGREE EXAMINATION – JUNE 2023

Semester: V

055MA51 DISCRETE MATHEMATICS

Time: 3:00 Hours

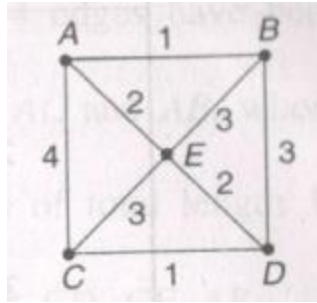
Max. Marks: 100

**Answer any FIVE Questions (5 x 20 = 100 Marks)**

1. a) Construct a truth table for the following compound proposition.  $(p \vee q) \rightarrow (p \wedge q)$ . **(5 Marks)**  
 b) Construct a truth table for the following compound proposition.  $(p \rightarrow q) \rightarrow (q \rightarrow p)$ . **(5 Marks)**  
 c) Construct a truth table for the following compound proposition.  $(q \rightarrow \neg p) \leftrightarrow (p \leftrightarrow q)$ . **(5 Marks)**  
 d) Construct a truth table for the following compound proposition.  
 $(p \leftrightarrow q) \leftrightarrow (p \wedge q) \vee (\neg p \wedge \neg q)$  **(5 Marks)**
2. a)  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$  Use Venn diagram to establish this identity **(10 Marks)**  
 b) If A, B and C are sets, prove, both analytically and graphically, that  $A - (B \cap C) = (A - B) \cup (A - C)$ . **(10 Marks)**
3. a) Given the sequence  $\{6, 18, 54, 162, \dots\}$ , find the next three terms and an expression for the  $n^{\text{th}}$  term? **(10 Marks)**  
 b) Solve the recurrence relation  $F_n = 3F_{n-1} + 10F_{n-2} + 7.5^n$  where  $F_0 = 4$  and  $F_1 = 3$ . **(10 Marks)**
4. a) Describe complete Graph. **(5 Marks)**  
 b) Explain about regular Graph. **(5 Marks)**  
 c) Short note on Bipartite Graph. **(5 Marks)**  
 d) How do you know if a graph is a sub-graph? **(5 Marks)**
5. a) Draw all the spanning trees of the graph G shown in picture below **(10 Marks)**



- b) Use Prim's algorithm to find a minimum spanning tree for weighted graph given in picture.



(10 Marks)

6. a) If  $A = \{2,3,4\}$ ,  $B = \{1,2\}$   $C = \{4,5,6\}$ . Find  $A + B$ ,  $B + C$ ,  $A + C$ ,  $A + B + C$  and  $(A+B)+(B+C)$ .

(10 Marks)

b) If  $P = \{(1,2), (2,3), (3,4)\}$ ,  $Q = \{(1,3), (2,4), (4,2)\}$ . Find

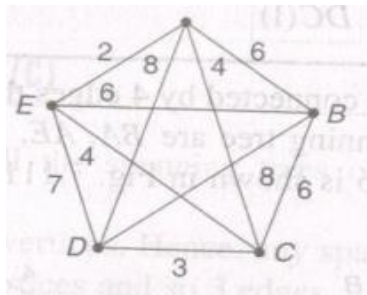
(i)  $P \cup Q$ ,  $P \cap Q$ ,  $\bar{P}$ ,  $\bar{P} \cup Q$

(ii) Domains of  $P$ ,  $P \cup Q$ ,  $P \cap Q$  and

(iii) Ranges  $Q$ ,  $P \cup Q$ ,  $P \cap Q$ .

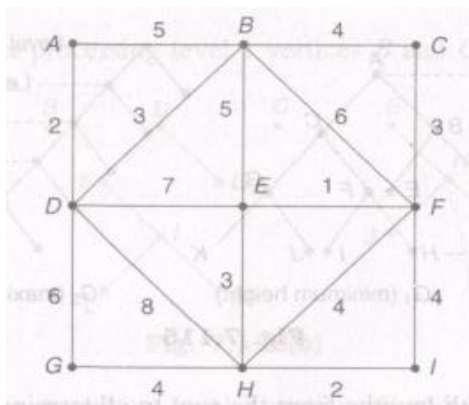
(10 Marks)

7. a) Find the minimum spanning tree for the weighted graph shown in picture by using Kruskal's algorithm.



(10 Marks)

b) Use Kruskal's algorithm to find a minimum spanning tree for weighted graph shown in picture.



(10 Marks)