Reg. No. : | | | | | | | | | | | |

Question Paper Code : 81633

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Third Semester

Computer Science and Engineering

MA 3354 – DISCRETE MATHEMATICS

(Common to : Computer Science and Engineering (Artificial Intelligence and Machine Learning)/Computer Science and Engineering (Cyber Security)/Computer and Communication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the negation of the proposition "Michael's PC runs Linux".

2. Let $P(x)$ denote the statement "$x > 3$." What are the truth values of $P(4)$ and $P(2)$?

3. Show that if n is a positive integer, then $1+2+\cdots+n=\frac{n(n+1)}{2}$.

4. A new company with just two employees, Sanchez and Patel, rents a floor of a building with 12 offices. How many ways are there to assign different offices to these two employees?

5. How many edges are there in a graph with 10 vertices each of degree six?

6. What is meant by strongly connected in a graph.

7. What is meant by homomorphism of two graphs.

8. Let $\langle z_4,+_4\rangle$ and $\langle B,+\rangle$ be an algebraic system and show that $\langle B,+\rangle$ is a homomorphic image of $\langle z_4,+_4\rangle$.

9. Write the properties of Lattices.

10. Give an example of sub-Boolean algebra.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Let p be the statement "Maria learns discrete mathematics" and q the statement "Maria will find a good job." Express the statement $p \to q$ as a statement in English. (8)

(ii) Translate the statement "The sum of two positive integers is always positive" into a logical expression. (8)

Or

(b) (i) Show that the premises "It is not sunny this afternoon and it is colder than yesterday", "We will go swimming only if it is sunny", "If we do not go swimming, then we will take a canoe trip" and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion "We will be home by sunset". (8)

(ii) Show that the premises "If you send me an e-mail message, then I will finish writing the program," "If you do not send me an e-mail message, then I will go to sleep early," and "If I go to sleep early, then I will wake up feeling refreshed" lead to the conclusion "If I do not finish writing the program, then I will wake up feeling refreshed." (8)

12. (a) (i) Prove by induction $1^3 + 2^3 + \cdots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$. (8)

(ii) A man hiked for 10 hours and covered a total distance of 45 km. It is known that he hiked 6 km in the first hour and only 3 km in the last hour. Show that he must have hiked atleast 9 km within a certain period of 2 consecutive hours. (8)

Or

(b) (i) Use the method of generating Function to solve the recurrence relation $a_{n+1} - 8a_n + 16a_{n-1} = 4^n, n \geq 1, a_0 = 1\ a_1 = 8$. (8)

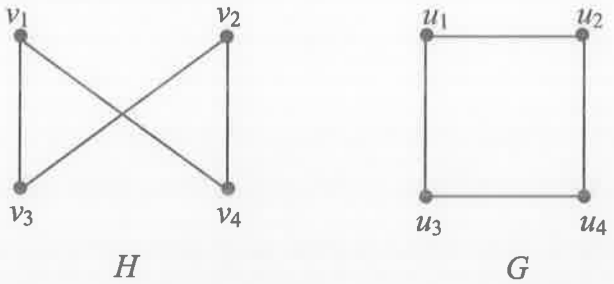
(ii) A total of 1232 students have taken a course in Spanish, 879 have taken a course in French, and 114 have taken a course in Russian. Further, 103 have taken courses in both Spanish and French, 23 have taken course in both Russian and Spanish and 14 have taken courses in both French and Russian. If 2092 students have taken atleast one of Spanish, French and Russian, how many students have taken a course in all three languages. (8)

13. (a) (i) Show that a undirected graph has an even number of vertices of odd degree. (8)

(ii) Show that a simple graph is bipartite if and only if it has no odd cycles. (8)

Or

(b) Show that the graphs $G = (V, E)$ and $H = (W, F)$, displayed in given figure, are isomorphic



Prove that there is a simple path between every pair of distinct vertices of a connected undirected graph.

14. (a) (i) Prove that a non empty set H is a subgroup of G if and only if $a * b^{-1} \in H$. (8)

(ii) Prove that Identity element of a group is unique. (8)

Or

(b) State and prove Lagrange's theorem.

15. (a) (i) Let $\langle L, \leq \rangle$ be a lattice in which * and $\oplus$ denotes the operations of meet and join respectively. For any $a, b \in L$, then show that $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$. (8)

(ii) Let $\langle L, \leq \rangle$ be a lattice For any $a, b, c \in L$ the following holds: $a \leq c \Leftrightarrow a \oplus (b * c) \leq (a \oplus b) = c$. (8)

Or

(b) Find the conjunctive normal form of the following expression using

(i) Truth table (8)

(ii) Algebraic method $f(x, y, z) = (yz + xz')(xy' + z')$. (8)