

Reg. No. :

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Question Paper Code : 11639

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026

Third Semester

Computer Science and Engineering

MA3354 – 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. Symbolize the expression “All the world loves a lover”.
2. Construct the truth table for $(P \rightarrow Q) \wedge (Q \rightarrow P)$.
3. How many five different letter words can be formed out of the word “LOGARITHMS”?
4. State the Pigeonhole principle.

5. Draw a graph with the adjacency matrix
$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}.$$

6. What is the condition for a graph to be Eulerian?
7. What do you call a homomorphism of a semi group into itself?
8. If $(G, *)$ is a group of order 11, find all subgroups of G .
9. Draw the Hasse diagram of $D_{20} = \{1, 2, 4, 5, 10, 20\}$.
10. In a Boolean algebra, prove the complement of any element is unique.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Using algebra of equivalence, show that
 $((Q \wedge A) \rightarrow C) \wedge (A \rightarrow (P \vee C)) \Leftrightarrow (A \wedge (P \rightarrow Q)) \rightarrow C.$ (8)

- (ii) Prove that $\sqrt{2}$ is irrational by giving a proof by contradiction. (8)

Or

- (b) (i) “If there was a ball game, then traveling was difficult. If they arrived on time, then traveling was not difficult. They arrived on time. Therefore, there was no ball game”. Show that these statements constitute a valid argument. (8)

- (ii) Show that $(x) (P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x).$ (8)

12. (a) (i) Use mathematical induction to show that $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$, whenever n is a positive integer. (8)

- (ii) A factory makes custom sports cars at an increasing rate. In the first month only one car is made, in the second month two cars are made, and so on, with n cars made in the n^{th} month. Set up recurrence relation for the number of cars produced in the first n months by this factory and also how many cars are produced in the first year? (8)

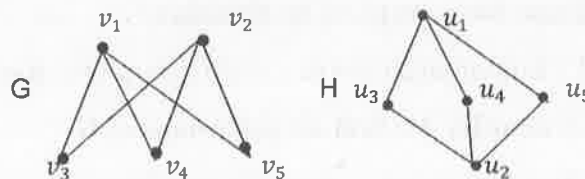
Or

- (b) (i) Find the generating function of Fibonacci sequence. (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 courses in both Spanish and Russian, 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) Prove that a simple graph with n vertices and k components cannot have more than $\frac{(n-k)(n-k+1)}{2}$ edges. (8)

- (ii) Whether the following graphs G and H are isomorphic or not? — Justify your answer. (8)



Or

- (b) (i) In a simple digraph, prove $G = (V, E)$, every node of the digraph lies in exactly one strong component. (8)
- (ii) Prove that a given connected graph G is an Euler graph if and only if all the vertices of G are of even degree. (8)
14. (a) (i) Prove that a group G is abelian if and only if $(a * b)^2 = a^2 * b^2$. (8)
- (ii) Let $f : (G, *) \rightarrow (H, \Delta)$ be group homomorphism. Then show that $\text{Ker } f$ is a normal subgroup. (8)
- Or
- (b) (i) State and prove Lagrange's Theorem. (8)
- (ii) Prove that every cyclic group is an abelian group. (8)
15. (a) (i) Let $(L, \leq)$ be a lattice in which $*$ and $\oplus$ denote the operations of meet and join respectively. For any $a, b \in L$, prove that $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$. (8)
- (ii) Show that a lattice is distributive if and only if $(a * b) \oplus (b * c) \oplus (c * a) = (a \oplus b) * (b \oplus c) * (c \oplus a)$. (8)
- Or
- (b) (i) Show that a lattice homomorphism on a Boolean algebra which preserves 0 and 1 is a Boolean homomorphism. (8)
- (ii) Prove that every chain is a distributive lattice. (8)

