

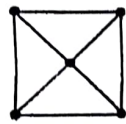


- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

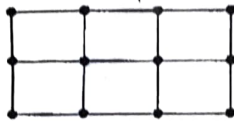
Answer ALL Questions

(10 X 10 = 100 Marks)

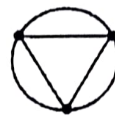
1. Determine the number of positive integers between 1 and 1000 (both inclusive) [10]
that are not divisible by any of 3, 5, 7 and 22.
2. If M_2 is the set of 2×2 non-singular matrices over R , [10]
 $M_2 = \left\{ \begin{bmatrix} a & b \\ b & a \end{bmatrix}; a, b \in R; a^2 + b^2 \neq 0 \right\}$ prove that M_2 is a group under the matrix multiplication. Is it abelian?
3. State and prove Lagrange's theorem. [10]
4. Determine the chromatic number and draw the dual graph for the following [10]
graphs:



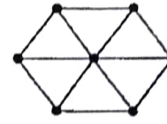
(a)



(b)



(c)



(d)

5. Prove the following without using truth tables: [10]
 - (i) $(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r) \Rightarrow r$
 - (ii) $((p \vee \neg p) \rightarrow q) \rightarrow ((p \vee \neg p) \rightarrow r) \Rightarrow q \rightarrow r$
6. Solve the following implication $p \rightarrow (q \rightarrow s), (\neg r \vee p), q \Rightarrow (r \rightarrow s)$. [10]
7. Simplify the following Boolean expressions using Boolean algebra: [10]
 - (i) $(x + y + xy)(x + z)$
 - (ii) $x[y + z(\overline{xy + xz})]$
 - (iii) $x\bar{y} + z + (\bar{x} + y)\bar{z}$
8. Simplify the Boolean function by Karnaugh map method: [10]
 $f(a, b, c, d) = \sum(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11)$.
- 9.a) Prove that a connected graph G is an Euler graph if and only if all vertices of G [10]
are of even degree.

OR

- 9.b) Prove that every tree on n vertices has exactly $n-1$ edges by induction method. [10]

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

10.a)

Determine the solution of recurrence relation for the Fibonacci sequence
 $0, 1, 1, 2, 3, 5, 8, 13, \dots$

[10]

OR

10.b)

Use mathematical induction to show that

[10]

$$\frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \dots + \frac{1}{\sqrt{n}} > \sqrt{n}, \text{ for } n \geq 2.$$

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