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PG (CBCS)
M.SC. Semester- III Examination, 2023
Mathematics
PAPER: C-MTM 304
(DISCRETE MATHEMATICS)

Full Marks: 50 **Time: 2 Hours**

The figures in the right-hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP-A

1. Answer any **FOUR** of the following questions: 4×2=8

   a) State Hand Shaking Lemma.
   b) Define binary tree.
   c) Define Poset.
   d) Prove $\sim(p \vee q) \equiv \sim p \wedge \sim q$
   e) What do you mean by centre of a graph?
   f) State the principal of Mathematical induction.

GROUP-B

2. Answer any **FOUR** of the following questions: 4×4=16

   a) Prove that a graph G is disconnected if and only if it's vertex set v can be partitioned into two non-empty disjoint subset v_1, v_2 such that there exists no edges in G whose one vertex is in v_1 and other is in v_2.
   b) Prove that $(p \to q) \wedge (p \to r) \equiv p \to (q \wedge r)$.
   c) In the Boolean algebra $(B, +, ., ')$, express the Boolean function $f(x, y, z) = (x + y)(x + z) + y + z'$ in its disjunctive normal form.
   d) Prove that a circuit free graph with n vertices and (n-1) edges is a tree.
   e) Define converse, inverse, contrapositive statement of conditional statement. Then prove that conditional and contrapositive statements are logically equivalent. 2+2
   f) Write down Huntington Postulates.

GROUP-C

3. Answer any **TWO** of the following questions: 2×8=16

   a) State the principle of inclusion-exclusion. In a class of 25 students, 12 students have taken Mathematics, 8 students have taken Mathematics but not Biology. Find the number of students who have taken Mathematics and Biology and those who have taken Biology but not Mathematics. 2+6

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b) Check whether the relation $R = \{(a, b) \in Z \times Z : a - b \leq 0\}$ is partial order relation or not. What is Tautology. Define chain and anti-chain with examples. 4+2+2

c) Prove, by mathematical induction, $10^{n+1} + 10^n + 1$ is divisible by 3 $\forall n \in N$. Draw a full adder using half adder. 6+2

d) Define regular graph. Let G is a r- regular graph where r is odd. Show that G has even number of vertices. Again show that the number of edges of G is multiple of r. 2+(3+3)

[Internal Assessment- 10 Marks]

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