Total pages: 2

PG CBCS M.SC. Semester-III Examination, 2021 DEPARTMENT OF MATHEMATICS PAPER: C-MTM-304

(DISCRETE MATHEMATICS)

Full Marks: 50

Time: 2 Hours

Answer any <u>FOUR</u> questions from the following: $10 \times 4=40$

1. a) Define regular graph. Prove that the sum of the degrees of all vertices of a graph is an even integer.

b) Prove that the complement law a + a' = 1 and $a \cdot a' = 0$ in a Boolean algebra.

c) State and prove De-Morgan's law in a Boolean algebra. 4+2+4

- State the principle of inclusion-exclusion. Use the principle of inclusion-exclusion, find the number of primes less than 100.
 10
- 3. a) Explain binary tree. Find the number of pendant vertices in a binary tree with *n* vertices.

b) Define poset and show that the set Z^+ of all positive integers under divisibility relation forms a poset. 5+5

4. a) A function f is defined by f(x, y, z) = yz + y'z'. Find its conjunctive normal form (CNF) and disjunctive normal form (DNF).
b) Define centre of a graph. Show that every tree has either one or two centre.

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5. a) Show that if a graph (connected or disconnected) has exactly two vertices of odd degree, there must be a path joining these two vertices.

b) Prove that by mathematical induction $n < 2^n$, for all natural number n.

- c) What is proposition?
- 6. a) Prove that a tree T with n vertices has n-1 edges.

b) Write down the differences between conjunctive normal form and disjunctive normal form.

c) Prove $\sim (p \land q) \lor q$ is a tautology. 5+3+2

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4 + 4 + 2

7. a) Prove that the power set of a set X together with union, intersection and complement form a Boolean algebra.

b) Define generating function and find a closed form for the generating function of the sequence $0, 1, 2, 3, \dots$ 6+4

- 8. a) Convert 257 into corresponding binary number.
 - b) Write a short note on Full Adder.
 - c) Draw a Full Adder using Half Adder.
 - d) Define connected graph.

2+4+2+2

[Internal Assessment- 10 Marks]