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PG CBCS

M.SC. Semester-III Examination, 2022

MATHEMATICS

PAPER: C-MTM 304

(DISCRETE MATHEMATICS)

Full Marks: 40 **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.

1. Answer any FOUR questions from the following: **4×2=08**

a) State Hand Shaking Lemma.

b) Define bipartite graph and give an example.

c) Define Poset.

d) Define chain and anti-chain with an example.

e) What do you know by eccentricity of a graph?

f) Find the language for the regular expression given below:

$(a + b) * (a + bb)$.

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

a) Show that the set $\mathbb{N}$ of all natural numbers under divisibility relation forms a poset.

b) In the Boolean algebra $(B, +, ., ')$, express the Boolean function $f(x, y, z) = (x + y)(x + z) + y + z'$ in its disjunctive normal form.

c) Prove that a connected graph with n vertices and (n-1) edges is a tree.

d) Define Planar graph and prove that the graph $K_{3,3}$ (Kuratowski's second graph) is non-planar.

e) Write down Huntington Postulates.

f) Define finite-state machine (FSM). Let M be the FSM with state table appearing as

	f		g	
S \ Σ	a	b	a	b
s_0	s_1	s_0	1	0
s_1	s_3	s_0	1	1
s_2	s_1	s_2	0	1
s_3	s_2	s_1	0	0

[P. T. O]

(i) Find the input set $\sum$, the set set S, the output set O, and initial state of M.
(ii) Draw the state diagram of M.

3. Answer any <u>TWO</u> questions from the following: **2×8=16**

a) State the principle of inclusion-exclusion. Use the principle of inclusion-exclusion, find the total number of integers between 1 and 1000 which are neither perfect squares nor perfect cubes. 2+6

b) Prove by mathematical induction 3+33+333+.....+33.....3= $(10^{n+1} - 9n - 10)/27$. Draw a full adder using half adder. 6+2

c) Define phrase-structure grammar. Describe the classification scheme of phrase-structure grammar introduced by Noam Chomsky. 2+6

d) i) Determine the generating function of the following sequences:

$$f_r = \frac{r(r+1)}{2}, (r > 0).$$

ii) 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)

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