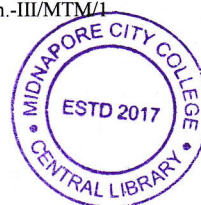


PG CBCS
M.Sc. Semester-III Examination, 2022
MATHEMATICS
PAPER: C-MTM 304
(DISCRETE MATHEMATICS)

**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 $(B, +, \cdot, ')$, 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

S \ Σ	f		g	
	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 Σ , the set set S, the output set O, and initial state of M.
(ii) Draw the state diagram of M.

3. Answer any **TWO** 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 $3+33+333+\dots+33\dots\dots3 = (10^{n+1} - 9n - 10)/27$. 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)