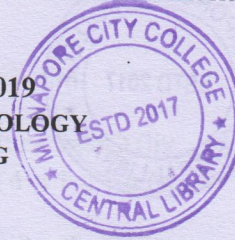


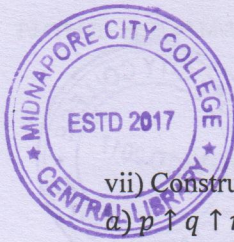
PG (NEW) CBCS  
M.Sc. Semester-III Examination, 2019  
APPLIED MATHEMATICS WITH OCEANOLOGY  
AND COMPUTER PROGRAMMING  
PAPER: C-MTM304  
(DISCRETE MATHEMATICS)



Full Marks: 40

Time: 2 Hours

1. Answer any four questions of the following: 2×4=8
- i) Show that the statement  $(p \wedge q) \Rightarrow q$  is a tautology.
  - ii) Define Hamiltonian & Eulerian graph. 1+1=2
  - iii) Define language and give an example.
  - iv) Prove that the absorption law  $a + (a \cdot b) = a$  in a Boolean algebra.
  - v) Explain spanning tree of a connected graph G.
  - vi) Prove that every distributive lattice is modular.
  - vii) Define chain and antichain and give an example.
  - viii) Define Boolean Algebra.
2. Answer any four questions of the following: 4×4=16
- i) Define connected graph. Show that a graph G is disconnected if its 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 are vertex is in  $V_1$  & the other is in subset  $V_2$ . 1+3=4
  - ii) Define Poset and show that the set  $Z^+$  of all positives integer under divisibility relation forms a poset.
  - iii) Prove by the mathematical induction that  $P(n): 10^n + 3 \cdot 4^{n+2} + 5$  is divisible by 9.
  - iv) Convert the Boolean function  $f(x, y, z) = (x' + y + z')(x' + y + z)(x + y' + z)$  in disjunctive normal form.
  - v) Show that every tree has either one or two centre.
  - vi) Define Hasse Diagram. Let  $A = \{4, 6, 12, 24, 48, 72\}$  along with the relation  $\leq$  such that  $a \leq b$  when 'a divides b'. Draw the Hasse Diagram. 2+2=4
- (Turn over)



(2)

vii) Construct the truth table for following expression

a)  $p \uparrow q \uparrow r$  b)  $p \oplus q \oplus r$ .

2+2=4

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

S	$\Sigma$	f			G		
		A	b	c	a	b	c
$s_0$	$s_0$	$s_0$	$s_1$	$s_2$	0	1	0
$s_1$	$s_1$	$s_1$	$s_1$	$s_0$	1	1	1
$s_2$	$s_2$	$s_1$	$s_1$	$s_0$	1	0	0

- Find the input set  $\Sigma$ , the state set S, the output set O, and initial state of M.
- Draw the state diagram of M.
- Find the output string for the input string aabbcc.

3. Answer any two questions of the following:

2×8=16

- Use generating function to solve the recurrence relation  $a_n = a_{n-1} + a_{n-2}; n \geq 3, a_1 = 1, a_2 = 1$  directly without calculating  $a_0$ .
- State the principle of inclusion-exclusion. Use the principle of inclusion-exclusion, find the number of primes less than 100.
- Define phrase-structure grammar. Describe the classification scheme of phrase-structure grammar introduced by Noam Chomsky.
- a) Prove by the principle of mathematical induction

$$p(n): \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} = \frac{1}{n+1}$$

- Prove that  $(a + a'.b').(a' + a.b) = a'.b' + a.b$       4+4=8

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