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**

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1. Answer any <u>four</u> 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 $a + (a.b) = a$ 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 <u>four</u> 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 $P(n)$: $10^n + 3.4^{n+2} + 5$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 $\leq$ suchthat $a \leq b$ when 'a divides b'. Draw the Hasse Diagram. 2+2=4

(Turn over)

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 appearingas

		f			G		
S	Σ	A	b	c	a	b	c
s_0		s_0	s_1	s_2	0	1	0
s_1		s_1	s_1	s_0	1	1	1
s_2		s_2	s_1	s_0	1	0	0

a) Find the input set $\sum$, the state set S, the output set O, and initial state of M.

b) Draw the state diagram of M.

c) Find the output string for the input string aabbcc.

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

i) 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.

ii) State the principle of inclusion-exclusion. Use the principle of inclusion-exclusion, find the number of primes less than 100.

iii) Define phrase-structure grammar. Describe the classification scheme of phrase-structure grammar introduced by Noam Chomsky.

iv) a) Prove by the principle of mathematical induction

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

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

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