

M.Sc. 3rd Semester (DDE) Examination,

December-2022

MATHEMATICS

Paper-21MAT23DA1

Discrete Mathematics

Time allowed : 3 hours] [Maximum marks : 80

Note : Attempt five questions in all. Question No. 9 is compulsory.

Unit-I

1. (a) Find homogeneous solution of a recurrence relation $a_r = a_{r-1} + a_{r-2}$ 8
- (b) Find total solution of the difference equation $a_r - 2a_{r-1} = 3 \cdot 2^r$ 8
2. (a) Solve the recurrence relation using generating function method : 8
 $a_n = -a_{n-1} + 6a_{n-2}, n \geq 2$ where $a_0 = -1, a_1 = 8$
- (b) Using generating function method, solve the recurrence relation $a_r = a_{r-1} + 2(r-1)$

Unit-II

3. (a) Find truth tables of the following :
 - (i) $p \wedge (q \vee r)$ and
 - (ii) $(p \wedge q) \vee (p \wedge r)$ 8
- (b) Verify the truth tables that the negations of the conditional and biconditional are as follows :
 - (i) $\sim(p \rightarrow q) \equiv p \wedge \sim q$
 - (ii) $\sim(p \leftrightarrow q) \equiv p \leftrightarrow \sim q \equiv \sim p \leftrightarrow q$ 8
4. (a) Find the atoms and join irreducible elements in D_{24} . 8
- (b) Find the Sub lattices of D_{12} . 8

Unit-III

5. (a) Prove Idempotent, Boundedness and Absorption laws in Boolean Algebra. 8
- (b) Verify Stone's Representation theorem by an example. 8

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6. (a) Find Prime implicants of following expression :

$$E = xyz + x^1z^1 + xyz^1 + x^1y^1z + x^1yz^1 \quad 8$$

- (b) Using truth table show that :

$$(x^1 \wedge y) \vee (x \wedge (y \vee z)) = y \vee (x \wedge z) \quad 8$$

Unit-IV

7. (a) Discuss Binary addition in construction of a finite state machine. 8

- (b) Construct a FSA over $\{a, b\}$ that accepts those strings which have exactly as b. 8

8. (a) Find a language $L(G)$ generated by the grammar G with $N = \{\sigma, A, B\}$, $T = \{a, b\}$
 $P = \{\sigma \rightarrow aB, B \rightarrow b, B \rightarrow bA, A \rightarrow aB\}$; σ is starting symbol. 8

- (b) State and prove Pumping Lemma. 8

Unit-V

9. (a) Define linear recurrence relation of order k .
 (b) Find the generating function for the numeric function $a_n = 2^{n+3}$, $n \geq 0$.

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- (c) State universal bound laws.
 (d) Define Existential statement.
 (e) Is D_{210} a Boolean algebra. Explain.
 (f) Define AND-OR circuit.
 (g) Define Finite State automata.
 (h) Define Moore Machine.

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[P.T.O.]

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