

M.Sc. (Maths) Semester - 3 (CBCS) Examination**DEC/JAN. - 2020****Discrete Mathematics (Core)****Time: 1:30 Hours****Marks: 42****Instructions:**

1. Figure to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

- Q.1** (a) Define semigroup, subsemigroup, monoid, submonoid. [4]
- Q.1** (b) Answer any two questions out of three. [10]
- (1) Show that the set of positive integers (excluding zero) with multiplication operation is a monoid.
 - (2) Prove that the inverse of every element is unique in a semigroup with identity e .
 - (3) Show that homomorphic image of an abelian semigroup is abelian.
- Q.2** (a) Let $(L, \leq)$ be a lattice and $a, b \in L$. Prove: [4]
- (i) $a \vee b = b \Leftrightarrow a \leq b$ (ii) $a \wedge b = a \Leftrightarrow a \leq b$
- Q.2** (b) Answer any two questions out of three. [10]
- (1) Show that every lattice holds associative property.
 - (2) Define sublattice and prove or disprove: every subset of a lattice is a sublattice.
 - (3) Show that a complement of every element in Boolean algebra is unique.
- Q.3** (a) Define language. Give two examples of language over a set $A = \{a, b\}$. [4]
- Q.3** (b) Answer any two questions out of three. [10]
- (1) Explain finite state machine with example.
 - (2) Explain Moore machine.
 - (3) Design a finite-state automaton that accepts precisely those strings over $\{a, b\}$ that contains an odd number of a 's.
- Q.4** (a) Explain with example: proposition, primitive, compound proposition and negation of a proposition. [4]
- Q.4** (b) Answer any two questions out of three. [10]
- (1) Explain conjunction and disjunction with example and truth table.
 - (2) State and prove associative laws of logic using truth tables.
 - (3) Explain: conditional statement, negation of conditional statement, biconditional statement.
- Q.5** (a) Write properties of generator matrix and parity-check matrix. [4]
- Q.5** (b) Answer any two questions out of three. [10]
- (1) Write a short note on Hamming matrices.
 - (2) Define: Hamming distance, Error correcting code, t – error correcting code, e – error detecting code.
 - (3) Explain decoding in brief.
