ED-313

M.A./M.Sc 1st Semester
Examination, March-April 2021

MATHEMATICS

Paper - V

Advanced Discrete Mathematics-I

Time : Three Hours] [*Maximum Marks* : 80
[*Minimum Pass Marks* : 16

Note : Answer any **two** parts from each question. All questions carry equal marks.

Unit-I

1. (*a*) Demonstrate that R is a valid inference from the premises $P \to Q$, $Q \to R$ and P.

(*b*) Write short notes on propositional logic and tautologies.

(*c*) Show that

$$\neg(P \wedge Q) \to (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$$

Unit-II

2. (*a*) Define Homomorphism of semi-group and show that, let X be a set of n element, let X^* denote the free semigroup generated by X and let $(S, \oplus)$ be any other semigroup of any n generators then three exist a Homomorphism $g : X^* \to S$.

(*b*) Define the following :

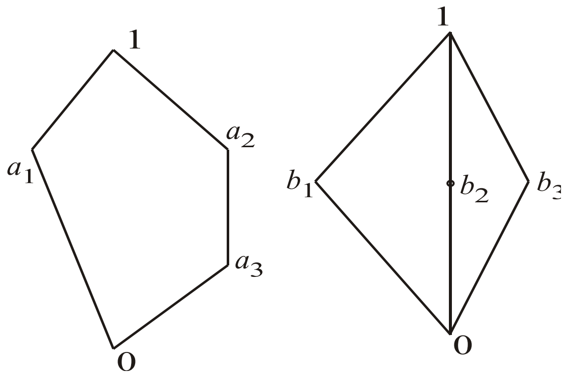
(*i*) Congruence relation and quotient semigroups

(*ii*) Subsemigroup and submonoids

(*c*) Define monoid and show that let $(M, *)$ be a monoid then there exists a subset $T \subseteq M^m$ such that $(M, *)$ is isomorphic to the monoid $(T, 0)$.

Unit-III

3. (*a*) Define distributive lattice and show that the lattices given by the following diagrams in figure are not distributive.



(*b*) Define complemented lattice and show that two bounded lattice L_1 and L_2 are complemented if and only if $L_1 \times L_2$ is complemented.

(*c*) Write short notes on sublattice and switching algebra.

Unit-IV

4. (*a*) Use the Karnaugh map representation to find a minimal sum-of-product of the following function :

$$f = \Sigma\,(10,\ 12,\ 13,\ 14,\ 15)$$

(*b*) Define gates and draw the logical expression with inputs *a*, *b* and output *f* where :

$$f = (a+b+c)\cdot(a+b')\cdot(a'+b')\cdot(b'+c') + a'b'c'$$

(*c*) Define the following :

(*i*) Atoms and Minterms

(*ii*) Sum of product canonical forms

Unit-V

5. (*a*) Define grammar and consider the grammar G with $V = \{S, 0, 1\}$, $T = \{0, 1\}$ and $P = \{S \to 11S,\ S \to 0\}$. Find $L(G)$.

(*b*) Define language and show that the language $L(G) = \{a^n b\, a^n : n \geq 1\}$ is generated by grammar $G = (\{S, c\}, \{a, b\}, S, \phi)$ where ϕ is the set of production $S \to aca,\ c \to aca,\ c \to b$.

(*c*) Write short note on conversion of infix expressions to polish notation and reverse polish notation.

———