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M.A./M.Sc. (Previous) Examination, 2022
MATHEMATICS
Paper Fifth
(Advance Discrete Mathematics)

Time : Three Hours] *[Maximum Marks:100*

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

Unit - I

1. (a) Prepare the truth table for
$(p \Leftrightarrow q) \wedge (q \Leftrightarrow r) \Rightarrow (p \Leftrightarrow r)$

(b) If g is a homomorphism from a commutative semigroup $(S,*)$ onto a semi group $(T,\oplus)$ then show that $(T,\oplus)$ is also commutative semi

group.

(c) Show that for any commutative monoid $(M,*)$ the set of idempotent element of M forms a submonoid.

2. (a) $L = \{1,2,3,4,6,12\},(L,'1'),$
$a \vee b = LCM\ (a,b),\ a \wedge b = hcf\ (a,b)$. Show that $(L,'1')$ is a lattice but it is not complemented lattice ('1' stands for divide)

(b) Show that for Boolean algebra $(B,\pm i')$
$(a+b)(b+c)\cdot(c+a) = a.b + b.c + c.a$
where $a,b,c, \in B$

(c) Write the following function into conjunctive normal form $f(x,y,z) = (x+y+z),(xy+x'z)'$

Unit - III

3. (a) Show that a complete graph with five vertices is not a planar graph.

(b) State and prove Euler's formula for connected planar graph.

(c) Show that a tree with n vertices has (n - 1) edges.

4. (a) Explain the finite state machine and their transition table and transition diagrams.

(b) Minimize finite state machine M, where M is given by the following state table.

State	input		output
	0	1	
$\Rightarrow S_0$	S_3	S_1	1
S_1	S_4	S_1	0
S_2	S_3	S_0	1
S_3	S_2	S_3	0
S_4	S_1	S_0	1

(c) Find a deterministic accepter equivalent to $M = (\{q_0, q_1, q_2\}, \{a, b\}, \delta, \{q_2\})\delta$ is given in table-

State/Σ	a	b
$\rightarrow q_0$	q_0, q_1	q_2
q_1	q_0	q_1
(q_2)	—	q_0, q_1

5. (a) Let $A = \{0,1\}$, show that the following expressions are regular expression over A.

(i) $0^* (0+1)^*$

(ii) $00^* (1+0)^*$

(iii) $(01)^* (01+1^*)$

Also find regular sets corresponding to these regular expression.

(b) Construct the grammar for the language $L = \{a^n b a^m \mid m, n, \geq 1\}$ and for the string $a^4 b\, a^5$ write the derivation.

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(c) Explain regular grammar context free grammar and context sensitive grammar and give examples related to the grammars.