



# THE AMERICAN COLLEGE, MADURAI

(An Autonomous Institution Affiliated to Madurai Kamaraj University)  
Re-accredited (2<sup>nd</sup> Cycle) by NAAC with Grade "A", CGPA – 3.46 on a 4-point scale

## Backlog Arrear Examination, March 2021

### DISCRETE MATHEMATICS

MAS 1434 / 1556 / COS

TIME: 2 Hour

TOTAL: 75 Marks

#### PART A

Answer any FIVE Questions:

5 × 15 = 75

1. Construct the truth table for  $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R)$ . Also check whether it is a tautology or contradiction.
2. (A). Obtain PDNF of  $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$ .  
(B). Obtain PCNF of  $(\neg P \rightarrow R) \wedge (Q \not\Rightarrow P)$ .
3. (A). Let a relation R be defined on the set of all real numbers by if  $x, y$  are positive integers,  $xRy \Leftrightarrow x \equiv y \pmod{m}$ . Show that the relation R is an equivalence relation.  
(B). If  $A = \{c, d\}$ ,  $B = \{1, 2\}$ ,  $C = \{2, 3\}$ , then find  $A \times (B \cup C)$ ,  $(A \times B) \cup (A \times C)$ ,  $A \times (B \cap C)$ ,  $(A \times B) \cap (A \times C)$ .
4. In a survey of 100 students, it was found that 40 studied Mathematics, 64 studied Physics, 35 studied Chemistry, 1 studied all the three subjects, 25 studied Mathematics and Physics, 3 studied Mathematics and Chemistry and 20 studied Physics and Chemistry. Find the number of students who studied chemistry only and the number who studied none of these subjects.
5. Let G be the set of all matrices of the form  $\begin{pmatrix} x & x \\ x & x \end{pmatrix}$  where  $x \in R^*$ . Then prove that G is an abelian group under matrix multiplication.
6. Explain the types of grammars with an example.
7. A) Let  $M = (\{q_0, q_1, q_2, q_3\}, \{a, b\}, \delta, q_0, \{q_1\})$  be a finite automaton where  $\delta$  is given by  $\delta(q_0, a) = q_1$ ,  $\delta(q_0, b) = q_2$ ,  $\delta(q_1, a) = q_3$ ,  $\delta(q_1, b) = q_0$ ,  $\delta(q_2, a) = q_2$ ,  $\delta(q_2, b) = q_2$ ,  $\delta(q_3, a) = q_2$ ,  $\delta(q_3, b) = q_2$ .  
(i) Represent M by its state table and state diagram.  
(ii) Which of the following strings are accepted by **ababa, aabba, aaab**.  
B) Draw the state diagram representing the NFA M is given by  $M = (\{q_0, q_1, q_2, q_3\}, \{a, b\}, \delta, q_0, \{q_3\})$  where  $\delta$  is

$\delta$	a	b
$q_0$	$q_0, q_1$	$q_0, q_2$
$q_1$	$q_3$	-
$q_2$	-	$q_3$
$q_3$	$q_3$	$q_3$

Also find  $\hat{\delta}(q_0, baab)$  for the given NFA