

2020

BCA

1st Semester Examination

**DISCRETE MATHEMATICS WITH APPLICATION
TO COMPUTER SCIENCE**

PAPER—1103

Full Marks : 100

Time : 3 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group A

Answer any *three* questions. 20×3

1. (a) Construct the truth table for $(\sim p \Rightarrow r) \Rightarrow ((p \Rightarrow q) \Rightarrow (p \Rightarrow r))$.
(b) Prove that the minimum number of edges in a connected graph with n vertices is $n - 1$.

(Turn Over)

2. (a) Examine the set $\{1, 5, 7, 11\}$ is a group under multiplication modulo 12.
- (b) Define a subgroup. If G is a group, then show that $C = \{c \in G: cx = xc \text{ for all } x \in G\}$ is a subgroup of G .
3. (a) Find the number of combinations that can be obtained by the letters of the word VIDYASAGAR taking 4 at a time.
- (b) Define Hasse diagram. Draw a Hasse diagram for the divisibility relation on the set $\{2, 3, 6, 12, 24, 36\}$.
4. (a) Represent the Boolean function $f(x,y,z) = (x + x'y + x'yz') (xy + (xz')) (y + xyz')$ in disjunctive normal form.
- (b) State the principle of Mathematical induction. Using it to show that $(n+1)! = 2^n \forall n \geq 2$.
5. (a) If the relation $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = x^2 + 1$ then find $f^{-1}(-8)$ and $f^{-1}(17)$.
- (b) Define an abelian group. Show that $S = \{1, -1, i, -i\}$ is an abelian group with respect to multiplication, Deduce its proper subgroup.
6. (a) For any set A, B, C show that $A \cup B \cap C = A \cup B \cap (A \cup C)$
- (b) In a class of 32 students, 14 have taken Economics, 7 have taken Economics but not Political Science. Find the number of students who have taken Economics and Political Science and those who have taken Political Science but not Economics.

7. (a) Rewrite the following argument using quantifier, variables and predicate symbols. Prove that the validity of the argument:

All healthy people eat an apple a day

Ram does not eat apple a day

Ram is not a healthy person.

- (b) Define sub lattice of a lattice L. Show that the set $\{\emptyset, \{a\}, \{c\}, \{a,c\}, \{a,b,c\}\}$ is a sublattice of lattice $(P(S), \cup, \cap)$ where $S = \{a, b, c\}$.

Group B

Answer any *one* question.

10×1

8. Draw a Karnaugh map and simplify the Boolean expression
 $F(A, B, C, D) = (7, 13, 14, 15)$
9. Solve the recurrence relation $a_{n+2} - 5a_{n+1} + 6a_n = 2$ with the initial condition $a_0 = 1$ and $a_1 = -1$.
10. Define Eulerian graph. Show that a connected graph contains an Eulerian trail, but not an Eulerian circuit, if and only if it has exactly two vertices of odd degree.

[*Internal Assessment : 30*]
