

S-716

Total Pages : 6

Roll No. -----

MSCIT-09

Discrete Mathematics

(MCA/MSCT)

3RD Semester, Examination 2022(Dec.)

Time: 2 Hours

Max. Marks: 70

Note : This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

Section – A

(Long Answer – type questions)

Note: Section 'A' contains Five (05) long-answer-type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only.

[2 x 19 = 38]

P.T.O.

Q.1. (a) Let R be a relation on a set $X = \{1,2,3,4\}$ is defined as: (10)

$$R = \{(a, b) : a, b \in \mathbb{Z}^+ \text{ and } a \leq b\}.$$

Prove that R is an equivalence relation and find the equivalence class of 1.

(b) Define one-one and onto functions. Find the inverse of the function $f: R \rightarrow R$ defined as

(9)

$$f(x) = 5x - 2 \text{ for all } x \in R$$

Q.2. (a) Define logical equivalence. Without constructing truth table, prove that equivalence

(10)

$$P \rightarrow (Q \rightarrow R) \equiv (P \wedge Q) \rightarrow R$$

(b) What do you mean by logical implication?

Prove that implication. (9)

$$P \rightarrow Q \Rightarrow P \rightarrow (P \wedge Q)$$

Q.3. (a) In how many ways can 3 history, 2 hindi and 4 English books can be arranged in a bookshelf. if (10)

- (i) no restriction is given X
- (ii) all books of same subjects are together
- (iii) Hindi books are together.
- (iv) English books are together.
- (v) Hindi books are together and English books are together.

(b) Define combination. A bag contain 4 different history books and 6 different English books. In how many ways can 3 books be selected so that there is at least 1 book of each subject? (9)

Q.4. (a) If $(G, *)$ be group, then prove that (10)

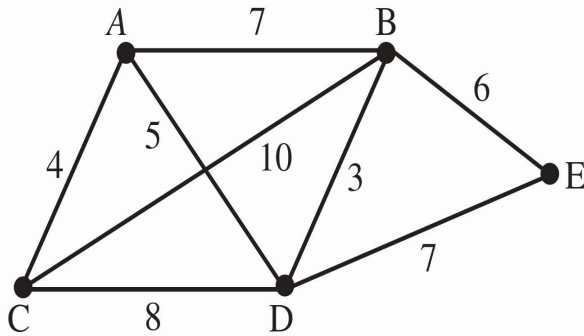
- (i) the identity element is unique
- (ii) the inverse of each element is unique

(b) Define a subgroup. Prove that A non empty subset H of a group G is a subgroup of G If (9)

$$a \in H, b \in H \Rightarrow ab^{-1} \in H$$

P.T.O.

- Q.5. (a) Define spanning tree in a graph. Find the minimal spanning tree using Kruskal's algorithm in the graph given below. (10)



- (b) Define Euler and Hamiltonian graphs with the help of suitable examples. (9)

Section – B

(Short-answer-type questions)

Note: Section 'B' contains Eight (08) short-answer-type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only.

[4 x 8 = 32]

- Q.1. Define complement of a set and difference of two sets.
Also draw their Venn diagrams.
- Q.2. Define a partial order relation.
Let $X = \{2, 3, 4, 6, 8, 12, 24, 36\}$ and
 $R = \{(x, y) : x|y, \forall x, y \in X\}$. Where '|' denotes
the relation 'divides'. Draw the Hasse diagram of $(R, |)$
- Q.3. Define inverse of a function. Let $f: R \rightarrow R$ defined as $f = x^2 + 3$. Check whether the inverse of f exists or not?
If so, then find the inverse also.
- Q.4. Define principal conjunctive normal form (PCNF).
Write PCNF of $P \wedge (P \vee Q)$.
- Q.5. What do you mean by a well-formed formula? Is the
formula $P \vee Q \rightarrow Q \wedge R$ well-formed formula? If not,
explain the reason and then convert it into a well-
formed formula.

P.T.O.

Q.6. Write the predicates for the following sentences:

- (i) All cats are black.
- (ii) Some dogs are not white.

Q.7. Define bounded lattice and complemented lattice with the help of suitable examples.

Q.8. Define the following terms with the help of suitable examples:

- (i) Bipartite graphs
- (ii) Circuit in a graph
