MCA–09/M. Sc. IT–09

Discrete Mathematics

Master of Computer Applications/Master of Science in Information Technology

(MCA/M. Sc. IT–11/12/16/17)

Third Semester, Examination, 2017

Time : 3 Hours **Max. Marks : 80**

Note : This paper is of **eighty (80)** marks containing **three (03)** Sections A, B and C. Attempt the questions contained in these Sections according to the detailed instructions given therein.

Section–A

(Long Answer Type Questions)

Note : Section 'A' contains four (04) long answer type questions of nineteen (19) marks each. Learners are required to answer *two* (02) questions only.

1. (a) What is incidence matrix ? 5

   (b) What is the producture for counting ? 5

   (c) Prove that the number of vertices of degree in a graph is always even. 9

2. (a) Define and Construct the truth table of the following logical operators : 12

   (i) Disjunction

   (ii) Conjunction

   (iii) Conditional

   (iv) Bi-conditional

(b) Check whether the compound proposition $(P \rightarrow Q) \wedge (\sim Q) \rightarrow (\sim P)$ is a tautology ? 7

3. (a) Write the predicates for the following sentences : 12

(i) All students are wise.

(ii) Some students know French.

(iii) All players are not healthy.

(iv) Some cats are not black.

(b) Show that the set $\{1, -1, i, -i\}$ is a group with respect to multiplication. 7

4. (a) Define the following terms with the help of suitable examples : 12

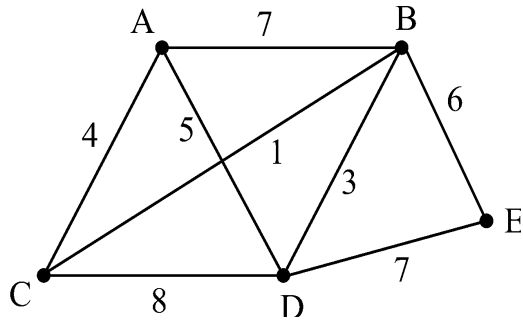
(i) Simple Graph

(ii) Multi Graph

(iii) Path

(iv) Circuit

(b) Find the minimal spanning tree using Kruskal's algorithm in the graph shown below. 7



Section–B

(Short Answer Type Questions)

Note : Section 'B' contains eight (08) short answer type questions of eight (8) marks each. Learners are required to answer *four* (04) questions only.

1. Draw the Venn diagram of the following sets :
   (i) $A \cup B \cap C$
   (ii) $A \cap B \cap C$
   (iii) $A - B$
   (iv) $(A \cup B)'$
2. (i) Define partial order relation with the help of suitable example.
   (ii) Define the rule of Inference. Explain the different rules of inference.
3. Let X = {1, 2, 3, 4} and R is a relation on X defined as $xRy \Leftrightarrow x > y$ for all $x, y \in X$:
   (i) Find the elements of R.
   (ii) Draw the graph of R.
   (iii) Give the relation matrix of R.
   (iv) Check whether R is transitive.
4. (i) Define equivalence of propositions.
   (ii) Define Pigeonhole principle.
5. Define Euler path and Hamiltonian path in a graph.
6. Prove that :
   (i) $(A \cup B)' = A' \cap B'$
   (ii) $(A \cap B)' = A' \cup B'$

7. Define a tree. Prove that there are $n - 1$ edges in tree with n vertices.
8. Define permutation and combination with the help of suitable examples.

Section–C

(Objective Type Questions)

Note : Section 'C' contains ten (10) objective type questions of one (01) mark each. All the questions of this Section are compulsory.

1. Let X = {1, 2, 3}. Which of the following is true ?
   (a) $\{2\} \in X$
   (b) $1 \in X$
   (c) $\phi \in X$
   (d) None of these

2. A = {1, 2, 3} and B = {2, 3, 4}, then $A \cap B$ =
   (a) {1, 2, 3}
   (b) {2}
   (c) {2, 3}
   (d) {2, 3, 4}

3. Let X = a, b, c . Which of the following is a transitive relation ?
   (a) $(a, b), (b, c), (a, a)$
   (b) $(b, c), (c, b), (c, a)$
   (c) $(a, b), (a, a), (b, a)$
   (d) $(a, a), (c, a), (c, c), (a, c)$

4. A relation R on X is said to be 'symmetric' if $\forall x, y \in X$:

   (a) $xRy \Rightarrow yRx$

   (b) $xRy \Rightarrow yRx$ and $x = y$

   (c) $xRy \Rightarrow yRx$ and $x \neq y$

   (d) $xRy \Rightarrow yRx$ and $x \leq y$

5. Let X = {a, b, c} and Y = {1, 2, 3}. Which of the following relation from X to Y is not a function ?

   (a) $(a,1),(b,2),(c,3)$

   (b) $(a,1),(b,1),(c,2)$

   (c) $(a,2),(a,3),(c,1)$

   (d) $(a,1),(b,2),(c,2)$

6. The proposition $P \rightarrow Q$ is equivalent to :

   (a) $P \vee \sim Q$

   (b) $\sim P \vee Q$

   (c) $\sim P \wedge Q$

   (d) $P \wedge \sim Q$

7. Which of the following is a tautology ?

   (a) $\sim P \vee Q$

   (b) $P \vee \sim Q$

   (c) $\sim P \vee \sim Q$

   (d) $P \vee \sim P$

8. How many different words (meaning or meaningless) can be formed by arranging the letters of the word 'MODE' ?

   (a) 12

   (b) 16

   (c) 24

   (d) 36

9. The value $^{5}P_{2}$:

   (a) 60

   (b) 20

   (c) 10

   (d) None of these

10. A relation R on X is called partial order relation if it is :

    (a) Reflexive, Symmetric and Transitive

    (b) Reflexive, Antisymmetric Transitive

    (c) Reflexive, Asymmetric and Transitive

    (d) Reflexive and Transitive