

**Total No. of Pages : 02**

**Total No. of Questions : 09**

**MCA (2014 Batch) (Sem.-2)**  
**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**  
**Subject Code : MCA-201**  
**M.Code : 26052**

**Time : 3 Hrs.**

**Max. Marks : 100**

**INSTRUCTIONS TO CANDIDATES :**

1. **SECTIONS-A, B, C & D contains TWO questions each carrying TWENTY marks each and students has to attempt any ONE question from each SECTION.**
2. **SECTION-E is COMPULSORY consisting of TEN questions carrying TWENTY marks in all.**

## SECTION-A

1.
  - a) Define a Hamiltonian circuit in a graph. Give an example of a graph which has a Hamiltonian circuit and an example of a graph which does not have a Hamiltonian circuit.
  - b) State and prove five-color problem.
2. A connected multigraph has an Euler circuit. Prove that each of its vertices has even degree.

## SECTION-B

3. In a survey of 25 students, it was found that 15 had taken Mathematics, 12 had taken Physics and 11 had taken Chemistry, 5 had taken Mathematics and Chemistry, 9 had taken Mathematics and Physics, 4 had taken Physics and Chemistry and 3 had taken all the three subjects. Find the number of students studying (a) only Physics; (b) Physics and Chemistry but not Mathematics; (c) Atleast one of the three subjects.
4. a) Partition the set  $A = \{1, 2, 3, \dots, 10\}$  using the minsets generated by  $B_1 = \{1, 7, 8\}$ ,  $B_2 = \{1, 6, 9, 10\}$ ,  $B_3 = \{1, 9, 10\}$ . Also represent the minsets thus generated through a Venn diagram.  
b) Define a Relation. Discuss the properties of relations.

## SECTION-C

5. Prove by the principle of mathematical induction that for all  $n \in \mathbb{N}$ :

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{1}{6}n(n+1)(2n+1)$$

6. Show that  $(\forall x) (P(x) \vee Q(x)) \Rightarrow (\forall x) P(x) \vee (\exists x) Q(x)$ .

**SECTION-D**

7. a) Find the inverse of the matrix :

$$\begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

- b) Discuss matrix addition, scalar multiplication and multiplication of matrices by taking suitable example.
8. Solve the following system using Gauss-Jordan elimination :

$$3x_1 + x_2 + 7x_3 + 2x_4 = 13$$

$$2x_1 - 4x_2 + 14x_3 - x_4 = -10$$

$$5x_1 + 11x_2 - 7x_3 + 8x_4 = 59$$

$$2x_1 + 5x_2 - 4x_3 - 3x_4 = 39$$

**SECTION-E**

9. Write briefly :

- What is a bipartite graph and a complete bipartite graph?
- Differentiate between directed and undirected graph.
- What is chromatic number?
- What is a universal set? Give an example.
- State the DeMorgan's laws.
- What are the different types of quantifiers? What is the purpose of each?
- Define Proposition.
- What is the difference between Equivalence and Implication?
- What is transpose of a matrix? Give an example.
- What is an Identity matrix? Give an example.

**NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.**