

Roll No.

Total No. of Pages : 03

Total No. of Questions : 09

MCA (2015 Batch) (Sem.-2)

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Subject Code : MCA-201

Paper ID : [72876]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

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

SECTION-A

1. What is meant by the term “path”? Explain Eulerian path and Hamiltonian path with examples. 10
2. a) Consider a relation R is defined on $\mathbb{N}$ as 5

$$\forall c, d \in \mathbb{N} \quad (c, d) \in R \text{ iff } c + d \text{ is even.}$$

Is R an equivalence relation? Justify. If yes, how many equivalence classes does R have?

- b) Prove $(p \wedge q) \rightarrow p \vee q$ is a tautology but $(p \vee q) \rightarrow (p \wedge q)$ is not. 5

SECTION-B

3. a) Let A be a set and given the following definition :
 diagonal of $A \times A = \{(a,a) \mid a \in A\}$.
 Suppose $A \subseteq B$. State true or false with proper justification :
 i) $(A \times B) \cap (B \times A) = B \times B$
 ii) (the diagonal of $A \times A$) $\cap$ (the diagonal of $B \times B$) = the diagonal of $B \times B$
 b) Prove that inverse of non-singular symmetric matrix is symmetric.
4. Prove by mathematical induction that for all positive odd n integers.

$$\sum_{0 \leq k \leq n} (-2)^k = \frac{1}{3}(1-2^{n+1})$$

SECTION-C

5. Solve the following system by using the Gauss-Jordan elimination method. 10

$$x + 2y - 3z = 2$$

$$6x + 3y - 9z = 6$$

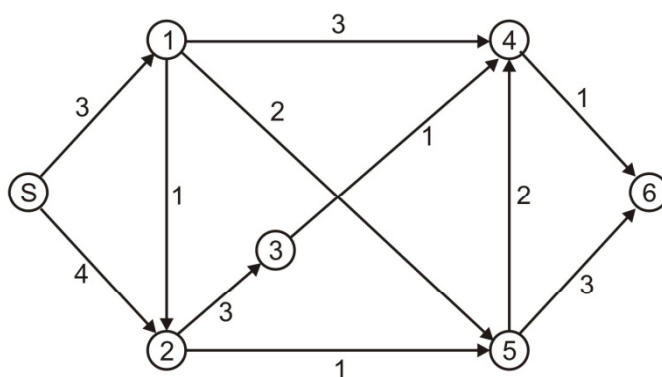
$$7x + 14y - 21z = 13$$

6. Let $S(x)$ be the predicate “ x is a student”, $B(x)$ the predicate “ x is a book”, and $H(x, y)$ the predicate “ x has y ”, where the universe of discourse is the set of all objects. Use quantifiers to express each of the following statements. 10

- i) Every student has a book.
- ii) Some student does not have any book.
- iii) Some student has all the books.
- iv) Not every student has a book.
- v) There is a book which every student has.

SECTION - D

7. a) Show that the premises “A student in this class has not read the book,” and “Everyone in this class passed the first exam” imply the conclusion “Someone who passed the first exam has not read the book”. 5
- b) List and explain the properties of matrices. 5
8. Compute the shortest-paths tree from s using Dijkstra’s algorithm. Draw each iteration. 10



SECTION-E

9. **Write briefly :**

- a) Determine whether function $f(x) = 2x + 3$ is a bisection from $\mathbf{R}$ to $\mathbf{R}$ or not.
- b) Give the tautology that is the basis for the rule of inference called *modus ponens*.
- c) What do you mean by transpose of a matrix?
- d) Is ϕ different from $\{\phi\}$? Why?
- e) Give example of Bipartite Graph.
- f) Compute the rank of matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & 8 \end{bmatrix}$
- g) Draw truth table of $\sim (p \wedge q) \equiv (\sim p) \vee (\sim q)$.
- h) What is significance of universal and existential quantifiers?
- i) Define chromatic number of a graph with example.
- j) Give an example of antisymmetric relation.