I Semester M.C.A. (Two Years Course) Examination, May/June 2025
(CBCS) (2020 – 21 and Onwards)
COMPUTER SCIENCE
1MCA2 : Discrete Mathematics
Equivalent to Discrete Mathematics and its Application (2013 and Below)

Time : 3 Hours

Max. Marks : 70

Instructions : 1) Answer **any 5** from Section – **A**.
2) Answer **any 4** from Section – **B**.

SECTION – A

Answer **any five** questions. **Each** question carries **six** marks. (5×6=30)

1. a) Prove that "Null set is a subset of every set". 3

   b) If A, B and C are three sets, then prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$. 3

2. Show that the compound propositions $[p \rightarrow (\sim q \vee r)] \leftrightarrow \sim [p \rightarrow (q \rightarrow r)]$ is contradiction or not. 6

3. a) Let $f : R \rightarrow R$ is defined by $f(x) = 7x + 5$. Prove that f is one-one and onto function. 3

   b) Let $A = \{1, 2, 3, 4, 6\}$ and R be the relation on A defined by aRb if and only if "a is a multiple of b". 3
      i) Write down R as a set of ordered pair.
      ii) Represent R as a matrix form.
      iii) Draw the digraph of R.

4. Obtain an explicit form for the following sequence a_n defined recursively by $a_n = 2a_{n-1} + 1$ for $n \geq 2$ with $a_1 = 3$. 6

5. a) Show that the open interval (0, 1) is uncountable. 3

   b) Find converse, inverse and contrapositive of the following implication :
      "If it rains then the match will be cancelled." 3

6. Define the following with example.
   Graph, Connected graph, Undirected Graph. 6

P.T.O.

7. What is the expected value of the sum of the numbers that appear when a pair of dice is rolled ? **6**
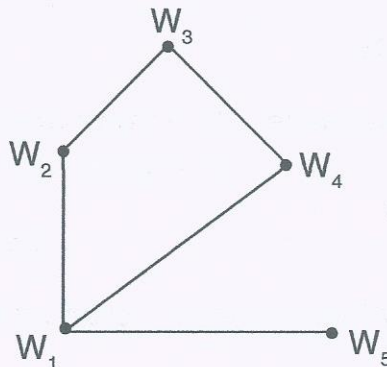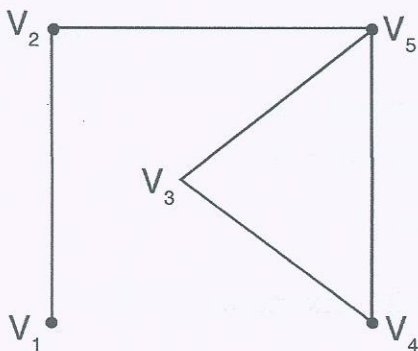
8. a) Define Bipartite graph with example. **3**

   b) Check whether the graphs G_1 and G_2 are Isomorphism. **3**

SECTION – B

Answer **any four** of the following. **Each** question carries **10** marks. **(4×10=40)**

9. a) In a survey of 200 students, it was found that 120 students study Mathematics, 90 students study Physics and 70 students study Chemistry, 40 Students study Mathematics and Physics, 30 students study Physics and Chemistry, 50 students study Chemistry and Mathematics and 20 students study none of the subjects. Find the number of students who study all the three subjects. **5**

   b) Define :

   1) Modus Tollens

   2) Syllogism

   3) Modus Ponem. **5**

10. a) By Mathematical Induction, prove that $1^3 + 2^3 + 3^3 + ... n^3 = \dfrac{n^2(n+1)^2}{4}$; where n is a positive integer. **5**

    b) The matrix of a relation on the set $A = \{1, 2, 3\}$ is given by $M_n = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$.

    Show that R is an equivalence relation. **5**

11. a) State and prove Baye's Theorem. 5

b) The probability distribution of a Discrete Random Variable is given below. 5

x	−2	−1	0	1	2	3
P(x)	0.1	K	0.2	2K	0.3	K

12. a) Prove that for any propositions p, q, r, the compound proposition $(p \to q) \wedge (q \to r) \to (p \to r)$ is a tautology. 5

b) Explain the Basic Logical Connectives. 5

13. a) State and prove Hand Shaking Lemma. 5

b) Three coins are tossed in succession. Find out the probabilities of occurances 5

1) Two consecutive heads

2) Two tails.

14. By using Kruskal's and Prim's Algorithm, find the minimum spanning tree. 10

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