ABV- Indian Institute of Information Technology & Management, Gwalior

Semester II (2022-23)

Minor

Course Title: Discrete Mathematical Structures

Course Code: BCAS-1202

MM: 40 – 46 **Duration: 120 minutes**

Note:

1. All parts of a question should be answered consecutively. Each answer should start from a new page.
2. The question paper has six questions.
3. Question no. 1: Consider several variables for both quantifiers.
4. Question no. 2: Three different examples must be given for 3 different methods and prove them properly.
5. Question no. 4: Solid Mathematical discussion is needed, and try to discuss all the related concepts for better marks.
6. Question no. 6 b): Two examples must be given.
7. Questions no. 2 and 4 a) are open questions, and the marks will be purely based on the justification and Mathematical explanations.

---

1. a) Define and discuss any two quantifiers using illustrative examples. **(4)**
   b) Discuss the concept of 'Contingency' using real-life examples briefly. **(2)**

2. Discuss any three methods of proof theoretically and explain each method using examples. **(9-12)**

3. Prove or disprove: Let R be the relation from A to B, and let A_1, A_2 be any two non-empty subsets of A. Then a) If $A_1 \subseteq A_2$, then $R(A_1) \subseteq R(A_2)$
   b) $R(A_1 \cup A_2) \supseteq R(A_1) \cup R(A_2)$,
   c) $R(A_1 \cap A_2) \subseteq R(A_1) \cap R(A_2)$ **(4)**

4. a) Discuss two representations for the following relation on a finite set $A = \{1,2,3,4,5\}$, $R = \{(1,2),(2,2),(2,3),(3,4),(4,4),(5,4),(5,1)\}$. **(2)**
   b) How do we find M_{R^n} (for $n \geq 2$) for any relation R on a finite set? State and Prove your claim. **(6)**

   (or)

   a) Discuss the importance of a "Partition of a set" and how it relates to a few important concepts of Relations and graphs. **(6-9)**
   b) Discuss different equivalent conditions for a function to be invertible. **(2)**

5. Fill in the blanks and prove:
   a) The number of odd-degree vertices in a graph is _____ **(1.5)**
   b) A graph G is disconnected with two components iff _____ **(2.5)**

6. a) State and prove the necessary and sufficient condition theorem for an Euler graph. **(5)**
   b) Show the importance of Euler graphs using real-life examples. **(4)**

*****End of Question Paper*****
*****Best of Luck*****