विश्वजीवनामृतं ज्ञानम्

ABV- Indian Institute of Information Technology & Management, Gwalior

Discrete Structures (IT201)

Mid-Semester Examination (Session 2024–25)

Maximum Time: 2 Hours **Max Marks: 40**

All the questions are compulsory

Note:

1. All parts of a question should be answered consecutively.
2. Assume suitable data wherever necessary with proper justification.
3. Neat diagrams must be drawn wherever required.

1. (a) Construct the truth table for the logical expression:

$$(p \vee q) \wedge (\neg p \vee r)$$

(b) Use truth tables to determine whether the propositions

$$p(q \vee r) \quad and \quad (pq) \vee (pr)$$

are logically equivalent. [6]

2. (a) Define a function $f : A \to B$. Give an example of one-to-one but not onto function. (b) Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R on A as "aRb if $a - b$ is divisible by 3". Prove that R is an equivalence relation. [7]

3. (a) Prove the set identity:

$$(A \cup B)' \cap C = (A' \cap C) \cap (B' \cap C)$$

(b) In a group of 120 students, 60 study Mathematics, 45 study Physics, and 30 study both. How many study neither subject? [6]

4. (a) Define a group. Show that the set of integers under addition forms a group. (b) Is the set of non-zero integers under multiplication a group? Justify your answer. [6]

5. (a) How many 4-digit numbers can be formed using the digits $1, 2, 3, 4, 5$ without repetition? (b) How many ways are there to arrange the letters of the word "DISCRETE" so that the vowels always come together? [7]

6. (a) Define a simple graph, multigraph, and pseudograph with examples. (b) Draw the graph with vertex set $\{a, b, c, d\}$ and edge set $\{ab, bc, cd, da, ac\}$. Is this graph planar? Explain. [8]