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B.A./B.Sc. (Sixth Semester) Examination, 2024-25

MATHEMATICS

(Combinatorics and Graph Theory)

(Vocational Course)

Time : Two Hours] **[Maximum Marks : 70**

Note : (i) Attempt any *five* questions from Section A and any *three* questions from Section B.

(ii) Answer each question of Section A within 50 words.

(iii) Limit your answers within the given answer book. Additional answer book (B-Answer book) should not be provided or used.

(Section–A)

Note : Attempt any *five* questions. Each question carries 5 marks.

1. Determine the number of 10-permutations of the multiset $S = \{3.a, 4.b, 5.c\}$.

2. Show that if $(n + 1)$ integers are chosen from the set $\{1, 2, ..., 2n\}$ then there are always two which differ by 1.

3. Define Bipartite multigraphs.

4. Describe Eulerian graph.

5. Let G be a tree of order $n \geq 2$ then show that G has at least two pendent vertices.

6. Define and describe Networks.

7. Define Digraphs.

(Section–B)

Note : Attempt any *three* questions. Each question carries 15 marks.

1. State and prove Pigeonhole (strong form) principle.

2. Find the number of integers between 0 to 99.999 (inclusive) have among their digits each of 2, 5 and 8.

3. Use the formula $D_n = nD_{n-1} + (-1)^n$, $(n = 2, 3, 4, ...)$ prove that for $n \geq 2$:

$$D_n = n!\left(1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \ldots + (-1)^n \frac{1}{n!}\right).$$

4. A connected graph of order $n \geq 1$ is a tree iff it has exactly $(n-1)$ edges, prove it.

5. Prove that every connected graph has a spanning tree.

6. Describe the following :

   (a) Pigeonhole principle (Simple form).

   (b) Combinators with Repetition.