North Gauhati College
Department of Mathematics

SEMESTER III
HOME ASSIGNMENT 2022

MAT-SE-3024
Combinatorics and Graph Theory

January 2022   TOTAL MARKS: 50

INSTRUCTIONS TO CANDIDATES

1. This assignment paper contains **Ten (10)** questions and comprises **Two (2)** printed pages.

2. Each question carry **Five** marks. Answer all questions.

3. Submit the assignment as a single **PDF** file through the online portal of our college website under section "Assignments" and submit a hard copy in the Department of Mathematics.

4. Write your **Name**, **GU Roll No.**, and **Registration Number** in the assignment .

5. Submission **Due Date** is on or before 22nd January, 2022.

PART A

1. Prove that
$$C(2n, 2) = 2C(n, 1) + n^2$$
.

2. How many solutions are there to
$$x_1 + x_2 + x_3 + x_4 + x_5 = 16$$
where each $x_i \geq 27$.

3. Prove that
$$C(n + 1, r) = C(n, r) + C(n, r - 1).$$

4. Find the number of integers between 1 and 250 that are divisible by any of the integers 2, 3 and 7.

PART B

5. Represent the graph $G(V, E)$ where the vertex set V and the edge set E are as follows:
$$V = \{1, 2, 3, 4\}$$
$$E = \{(x, y) : x + y \text{ is odd}\}.$$

6. Show that a complete graph with n vertices consists of $\frac{n(n-1)}{2}$ edges.

7. How many edges and vertices are there in the graph of $K_{2,5}$ and draw K_5, $K_5 + K_1$.

8. Prove that the sum of the degrees of all vertices of a graph is an even integer.

9. How many vertices are there in a graph with 15 edges, if each vertex is of degree 3.

10. Prove that for any graph G with six vertices, G or $\bar{G}$ contains a triangle.

END OF PAPER