

RAN-2411001102040001
B.Sc. (I. T.) (Sem. -II) Examination April - 2026
B. Sc. (I.T.) (M.Sc.I.T.) 5 Years Integrated Course : Mathematics - II (MDC - 202)
Time: 2 Hours]
[Total Marks: 50

સૂચના : / Instructions (1) ઉપરોક્ત દર્શાવેલ વિગતો ઉત્તરવહી પર અવશ્ય લખવી. Fill up strictly the above details on your answer book (2) All questions are compulsory. (3) Figures to the right indicate marks of the questions. (4) Follow usual notations.	Seat No.: <table border="1" style="width: 100%; height: 20px; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table> Student's Signature						

- Q.1. (a)** Define self-loop and Pendent vertex with illustration. **04**
- OR**
- (a) Discuss the Konigsberg Bridge Problem.
- (b) **Attempt any two.** **06**
1. Prove that in a simple graph with n vertices the maximum degree of any vertex is $(n-1)$ and the maximum number of edges is $n(n-1)/2$.
 2. Define infinite graph, show that an infinite graph with finite no. of vertices will have at least one pair of vertices joined by an infinite no. of parallel edges.
 3. Justify the statement using example, “sum of degree of vertices in a graph is twice the no. of edges in it.”
- Q.2. (a)** Define fusion and hamiltonian path with illustration. **04**
- OR**
- (a) State the necessary and sufficient conditions for two graphs to be isomorphic with example.
- (b) **Attempt any two.** **06**
1. Prove that, a simple graph with n vertices and k components can have at most $(n-k)(n-k+1)/2$ edges.
 2. Show that, in a complete graph with n vertices there are $(n-1)/2$ edge disjoint Hamiltonian circuits, if n is an odd number ≥ 3 .
 3. Prove that, a given connected graph G is an Euler graph if and only if all vertices of G are of even degree.
- Q.3. (a)** Define eccentricity and rooted tree with illustration. **04**
- OR**
- (a) Prove that, any connected graph with n vertices and $n-1$ edges is a tree.
- (b) **Attempt any two.** **06**
1. What is the minimum possible height of an n - vertex binary tree?
 2. Define minimal spanning tree and weighted graph with an illustration.
 3. Prove that, every tree has either one or two centers.
- Q.4. (a)** Define non-planar graph and prove that $K_{3,3}$ is non-planar. **04**
- OR**
- (a) State and prove Euler's formula,

(b) **Attempt any two.**

06

1. Prove that Kuratowski's first graph is non-planar.
2. Prove that a graph can be embedded in the surface of a sphere if and only if it can be embedded in a plane.
3. In a simple connected planar graph with f regions, n vertices and e edges ($e > 2$). Show that (1) $e \geq \frac{3f}{2}$ — (2) $e \leq 3n - 6$.

Q.5. (a) Discuss the observation about the adjacency matrix.

04

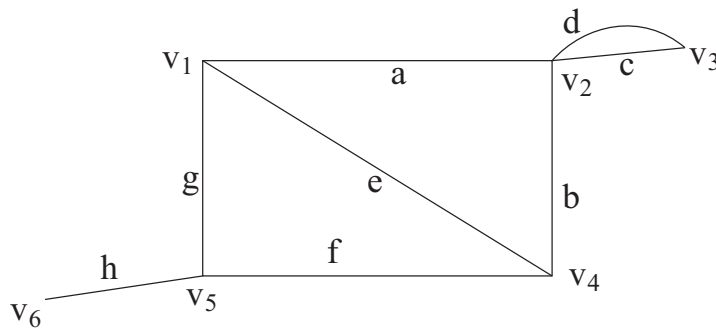
OR

(a) Discuss the observation about the circuit matrix.

(b) **Attempt any two.**

06

1. Make an Incidence matrix of the following graph



2. Discuss the seating arrangement problem.
3. Discuss observations about the path matrix.