	K23U 3603
Reg. No.:	11230 3003
Name :	•

III Semester B.Sc. Honours in Mathematics Degree (CBCSS - OBE -Regular/Supplementary/Improvement) Examination, November 2023 (2021 and 2022 Admissions) 3B11 BMH : GRAPH THEORY

Time: 3 Hours

Max. Marks: 60

SECTION - A

Answer any 4 questions out of 5 questions. Each question carries 1 mark. (4x1=4) 1. Define simple graph.

- 2. Define forest.
- Is K₄ an Euler graph? Justify your answer.
- 4. Find the number of edges in complete bipartite graph $K_{m,n}$. Define k-critical graph.

Answer any 6 questions out of 9 questions. Each question carries 2 marks. (6x2=12) 6. State First theorem of Graph theory.

SECTION - B

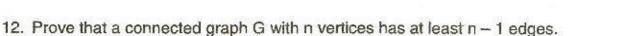
- 7. Draw Petersen graph and is that regular ? Justify your answer.
- Define vertex connectivity of a graph and find the vertex connectivity of K₄.
- 9. Define unicyclic graphs and give an example.
- 10. Differentiate between Hamiltonian path and Hamiltonian cycle.
- 11. Define matching and give an example.

P.T.O.

a bridge,

prove that $e \le 3n - 6$.

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- Is K₅ planar ? Justify your answer.
- 14. Let G be a graph with $\chi(G) = k$. Then prove that G has atleast k vertices such that $d(v) \ge k - 1$.
- SECTION C

Answer any 8 questions out of 12 questions. Each question carries 4 marks. (8×4=32)

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15. Prove that it is impossible to have a group of nine people at a party such that each one knows exactly five of the others in the group.

- Define adjacency matrix, Write the adjacency matrix of K₃. 17. Define graph isomorphism and give an example.
- If T is a tree with n vertices then prove that it has precisely n − 1 edges.
- 19. Prove that a simple graph G is Hamiltonian if and only if its closure c(G) is Hamiltonian.
- 20. Let v be a vertex of the connected graph G. Then prove that v is a cut vertex of G if and only if there are two vertices u and w of G, both different from v such that v is on every u-w path in G.

21. Let G be a connected graph, then prove that G is a tree iff every edge of G is

22. Let G be a k-regular bipartite graph with k > 0. Then prove that G has a perfect matching.

23. State The Chinese Postman Problem and The Travelling Salesman Problem.

24. Let G be a simple 3-connected graph with at least five vertices. Then prove that G has a contractible edge.

25. Let G be a simple planar graph with n vertices and e edges, where 3 ≤ n. Then

26. Let G be a graph with n vertices and q edges and let w(G) denote the number

of connected components of G. Then prove that $q \ge n - w(G)$.

graph with n vertices then either n is 4t or 4t + 1 for some integer t. Prove that "A graph G is connected iff it has a spanning tree".

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 $(2 \times 6 = 12)$

29. If G is a simple graph with n vertices, where $n \ge 3$, and the degree $d(v) \ge \frac{n}{2}$ for

SECTION - D

Define self-complementary graph and prove that if G is a self-complementary

Answer any 2 questions out of 4 questions. Each question carries 6 marks.

every vertex v of G. Then prove that G is Hamiltonian.

State and prove Euler's formula.