22U606 (Pages: 2) Name: …...……..……….

Reg. No: ……………..………

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2025

(CBCSS-UG)

(Regular/Supplementary/Improvement)

CC19U MTS6 E01 / CC20U MTS6 E01 – GRAPH THEORY

(Mathematics – Elective Course)

(2019 Admission onwards)

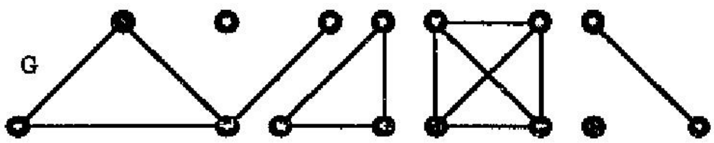
Time: 2 Hours Maximum: 60 Marks

Credit: 2

Section A

Answer ***all*** questions. Each question carries 2 marks.

1. Define the complete graph and give an example.
2. State and prove first theorem of graph theory.
3. Draw the graph $K_5 - \{v\}$ where v is any vertex in K_5.
4. Prove that in any graph G, there is an even number of odd vertices.
5. Define the Connectivity of a graph and find the connectivity of K_n.
6. Let G be a connected graph. Prove that G is a tree if and only if every edge of G is a bridge.
7. Define planar graph and give an example.
8. Find $\omega(G)$ for the graph G given below.



9. State Cayley's theorem on spanning trees.
10. Find number of edges of $k_{m,n}$.
11. Define Hamiltonian graph and give an example.
12. Prove that a connected graph G with n vertices has at least $n - 1$ edges.

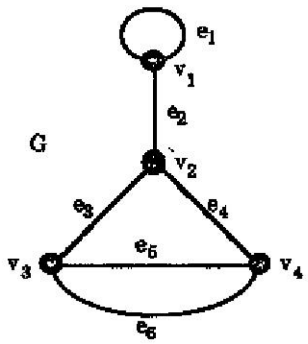
(Ceiling: 20 Marks)

Section B

Answer ***all*** questions. Each question carries 5 marks.

13. Given any two vertices u and v of a graph G, prove that every $u - v$ walk contains a $u - v$ path.

14. Find adjacency matrix $A(G)$ for the graph G.



15. Prove that an edge e of a graph G is a bridge if and only if e is not part of any cycle in G.

16. Let G be a graph with n vertices, where $n \geq 2$. Prove that G has at least two vertices which are not cut vertices.

17. If T is a tree with n vertices, then prove that it has precisely $n - 1$ edges.

18. Prove that the complete bipartite graph $K_{3,3}$ is non-planar.

19. A connected graph G has an Euler trail if and only if it has at most two odd vertices.

(Ceiling: 30 Marks)

Section C

Answer any ***one*** question. The question carries 10 marks.

20. Let G be a nonempty graph with at least two vertices. Prove that G is bipartite if and only if it has no odd cycles.

21. Let G be a graph with n vertices. Then prove that the following statements are equivalent:

    a. G is a tree.

    b. G is an acyclic graph with $n - 1$ edges?

    c. G is a connected graph with $n - 1$ edges?

(1 × 10 = 10 Marks)

****