**20U605** (Pages: 2) Name: …………..……….

Reg. No……….……….

**SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023**

(CBCSS-UG)

(Regular/Supplementary/Improvement)

**CC19U MTS6 E01 / CC20U MTS6 E01 - GRAPH THEORY**

(Mathematics - Elective Course)

(2019, 2020 Admissions)

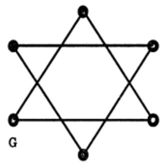
Time: 2 Hours Maximum: 60 Marks

Credit: 3

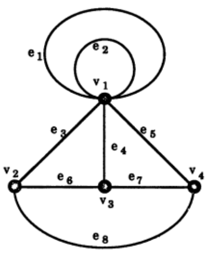
**Section A**

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

1. Define graph isomorphism.
2. Sketch a self-complementary graph with 4 vertices.
3. What is meant by component of a graph? How many components are there for the graph given below?




4. Find the eccentricity of Peterson graph.
5. A(G) = $\begin{bmatrix} 0 & 1 & 2 & 3 \\ 1 & 0 & 3 & 2 \\ 2 & 3 & 0 & 1 \\ 3 & 2 & 1 & 0 \end{bmatrix}$. Sketch the graph
6. Let G be an acyclic graph with 10 vertices and 3 components. Find number of edges of G.
7. Draw underlying simple graph of the given graph




8. Define a spanning tree. Give an example.
9. Find $\kappa(G)$ of star graphs with $n$ vertices
10. Distinguish between Euler trail and Euler tour.
11. Prove that a graph is Hamiltonian if and only if its underlying simple graph is Hamiltonian.

12. Let G be a 4 – regular graph with 10 faces. Find number of vertices of G.

**(Ceiling: 20 Marks)**

## Section B

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

13. State and prove first theorem of graph theory.
14. Prove that a non- empty bipartite graph $G$ with at least two vertices has no odd cycle.
15. Draw all trees with six vertices.
16. Prove that a connected graph $G$ with $n$ vertices has at least $n-1$ edges.
17. Let $G$ be a connected graph with at least 3 vertices. Prove that if $G$ has a bridge then $G$ has a cut vertex.
18. Let $G$ be a Hamiltonian graph then show that $G$ does not have a cut vertex.
19. Prove that $K_5$ is non planar.

**(Ceiling: 30 Marks)**

## Section C

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

20. (a) Let $u, v$ be distinct vertices of a tree $T$. Then prove that there is precisely one path from $u$ to $v$

    (b) let $G$ be a graph without any loops. If for every pair of distinct vertices $u$ and $v$ of $G$, there is precisely one path from $u$ to $v$ then prove that $G$ is a tree

21. (a) Prove that a simple graph is Hamiltonian if and only if closure of that graph is Hamiltonian

    (b) Let $G$ be a simple graph on n vertices with $n \geq 3$ then prove that if $c(G)$ is complete then $G$ is Hamiltonian.

**(1 × 10 = 10 Marks)**

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