K25U 0162

Reg. No. : ....

Name : ....

VI Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2025
(2019 to 2022 Admissions)
DISCIPLINE SPECIFIC ELECTIVE IN MATHEMATICS
6B14A MAT : Graph Theory

Time : 3 Hours Max. Marks : 48

PART – A

Answer **any 4** questions from this Part. **Each** question carries **1** mark.

1. Define a regular graph.
2. Define a connected graph.
3. When the complete graph K_n become Eulerian ?
4. Define a Hamiltonian graph.
5. Define a Jordan curve. **(4×1=4)**

PART – B

Answer **any 8** questions from this Part. **Each** question carries **2** marks.

6. Show that in any graph G, there is an even number of odd vertices.
7. Define the adjacency matrix of a graph G and illustrate with an example.
8. Find the number of edges in the complete bipartite graph $K_{m, n}$.
9. Draw the complete bipartite graph $K_{2, 3}$. Find the radius and diameter of the complete bipartite graph $K_{2, 3}$.
10. If a connected graph G has 21 vertices, what is the minimum possible number of edges in G ?

P.T.O.

11. Define the vertex connectivity of a graph G. Find the vertex connectivity of the complete bipartite graph $K_{2, 3}$.
12. Explain the travel salesman problem.
13. Give an example of a graph G with 6 vertices, which is both Eulerian and Hamiltonian.
14. Define the closure of a graph. Find the closure of the complete bipartite graph $K_{2, 3}$.
15. Define a planar graph. Draw a non-planar graph on six vertices.
16. Define a critical-planar graph and illustrate the concept with an example. **(8×2=16)**

PART – C

Answer **any 4** questions from this Part. **Each** question carries **4** marks.

17. State and prove the first theorem of graph theory.
18. Draw the Peterson graph and find its radius and diameter.
19. Show that any acyclic graph with n vertices and n – 1 edges must be a tree.
20. Let G be a graph of order $n \geq 2$. Prove that G has at least two vertices which are not cut-vertices.
21. Explain the Konigsberg bridge problem.
22. Prove that a simple graph G is Hamiltonian, if its closure is a complete graph.
23. Prove that the complete bipartite graph $K_{3, 3}$ is non-planar. **(4×4=16)**

PART – D

Answer **any 2** questions from this Part. **Each** question carries **6** marks.

24. Prove that a non-empty graph with at least two vertices is bipartite, if and only if it has no odd cycles.
25. Prove that a graph G is connected if and only if it has a spanning tree.
26. State and prove Dirac's theorem for Hamiltonian graphs.
27. Derive the Euler's formula for the planar graphs. **(2×6=12)**