A **0200MAT206042503** **Pages: 4**

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) (FT/WP) / (S2 PT) Exam April 2025 (2019 Scheme)

Course Code: MAT206

Course Name: GRAPH THEORY

Max. Marks: 100 Duration: 3 Hours

PART A

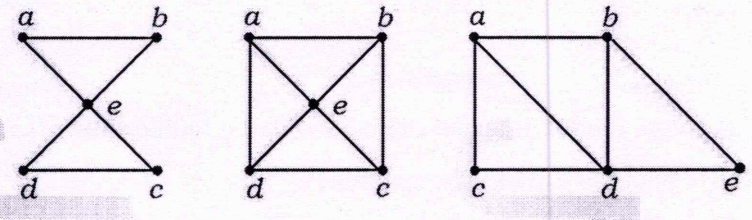
(Answer all questions; each question carries 3 marks) Marks

1 A simple graph G has 44 edges. It has 4 vertices of degree 5, 5 vertices of degree 4, and the remaining vertices have degree 2. Find the total number of vertices. (3)

2 Prove that the number of vertices of odd degree in a graph is always even. (3)

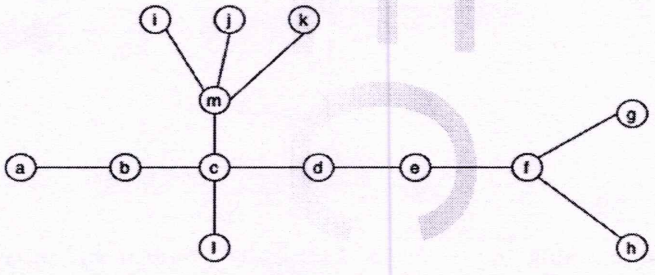
3 Explain weakly connected graphs and strongly connected graphs. Give examples. (3)

4 What is an Euler graph? Which of the following graphs has an Euler circuit? (3)

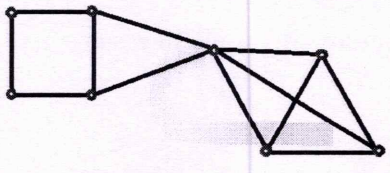


5 Show that the distance between pairs of vertices of a connected graph is a metric. (3)

6 Find the centre and radius of the tree shown below: (3)



7 Find the edge connectivity and vertex connectivity of the graph below. (3)



8 What is Kuratowski's first graph? Is it planar or non-planar? (3)

9 What is a matching in a graph? Give example. (3)

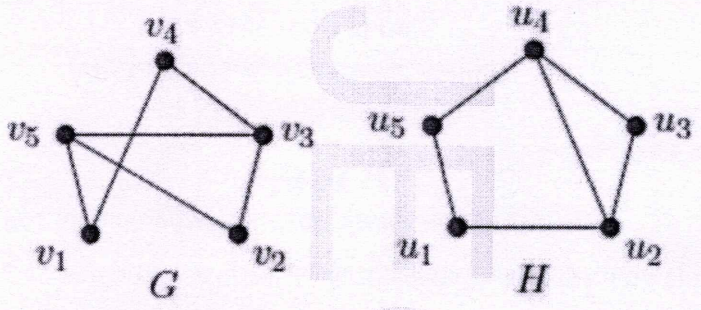
10 What is a κ-chromatic graph? (3)

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Determine whether the following graphs are isomorphic or not? (7)



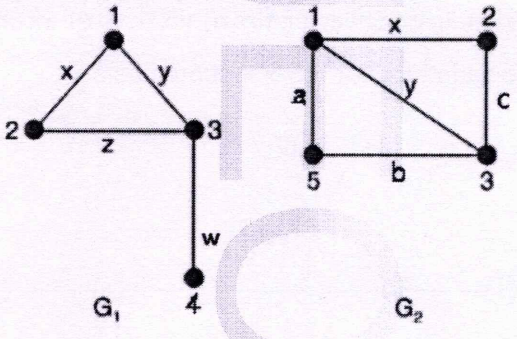
b) Explain walks, paths and circuits with the help of examples. (7)

12 a) Explain the applications of Graph Theory in detail. (8)

b) Prove that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. (6)

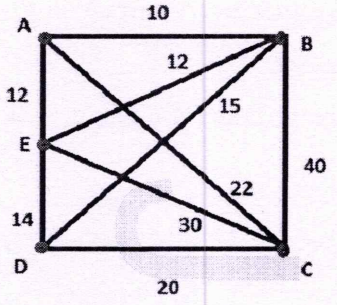
Module -2

13 a) What is mean by union, intersection and ring sum of two graphs? Find i) Union ii) Intersection iii) Ring sum of the following graphs: (9)



b) Prove that a connected graph G is an Euler graph if and only if all vertices of G are of even degree. (5)

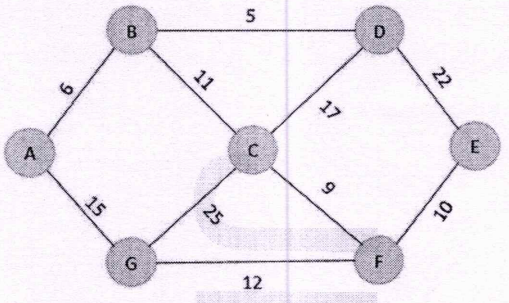
14 a) State travelling salesman problem. Consider a weighted graph given below. Find and draw the minimum cost travelling salesman's tour for it. Also mention the cost. (6)



b) Define Hamiltonian circuit and Hamiltonian path. Give an example for each. Also draw a graph that has a Hamiltonian path but not a Hamiltonian circuit. (8)

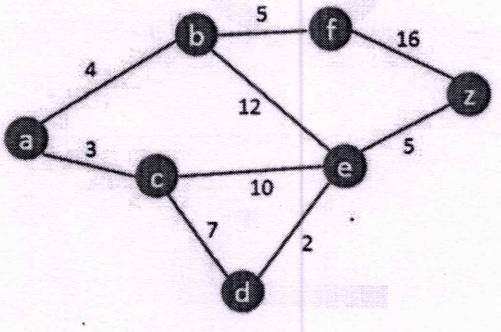
Module -3

15 a) How is Kruskal's algorithm used to find minimum cost spanning tree of a graph. Find a minimum spanning tree in the graph below: (8)



b) Prove that a binary tree with n vertices has $\frac{n+1}{2}$ pendant vertices. (6)

16 a) Give Dijkstra's algorithm to find shortest path between a vertex pair. Use it to find shortest path between a and z (10)

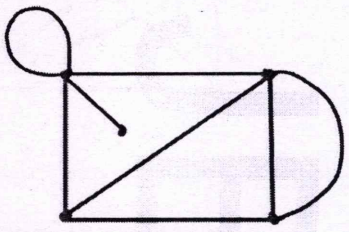


b) Prove that every tree has either one or two centres. (4)

Module -4

17 a) Define cut set. Prove that every circuit in G has an even number of edges in common with any cut set. (8)

b) Find the geometric dual of the following graph (6)



18 a) Prove that a connected planar graph with n vertices and e edges will have (e-n+2) faces. (8)

b) Define Fundamental Circuit and Fundamental cut-set with proper examples. (6)

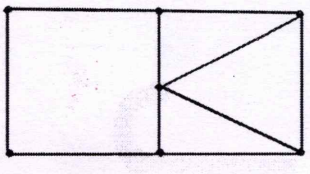
Module -5

19 a) Define Adjacency Matrix X(G) of a graph G. List out at least three properties of the adjacency matrix. Draw the graph represented by the weighted adjacency matrix given below. (7)

	A	B	C	D	E
A	0	2	1	0	0
B	2	0	1	2	0
C	1	1	0	3	0
D	0	2	3	0	2
E	0	0	0	2	0

b) Prove that every tree with two or more vertices is 2-chromatic. (7)

20 a) Find at-least 6 circuits for the given graph and generate the corresponding circuit matrix representation with the circuits obtained. (Note: Assume suitable names for the vertices and edges.) (7)



b) What is a chromatic polynomial of a graph? How to find the chromatic polynomial of a graph. Explain with example. (7)

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