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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) / S2 (PT) (R,S) Examination June 2023 (2019 Scheme)

Course Code: MAT206

Course Name: GRAPH THEORY

Max. Marks: 100 Duration: 3 Hours

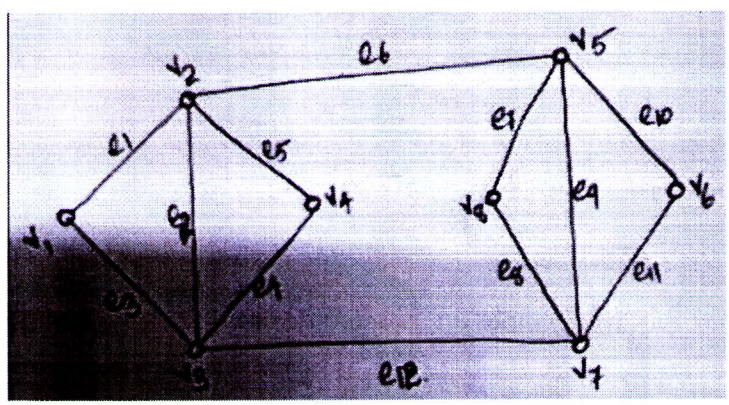
PART A

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

1 Define Walk, Path and Circuit in a graph. 3

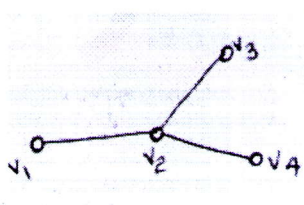
2 Define a connected graph with an example. 3

3 Check whether the following graph is Euler. If so find an Euler tour in it. 3



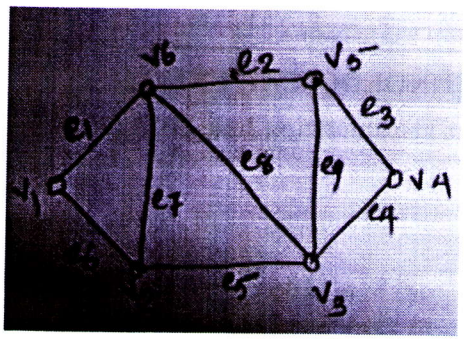
4 Define an equivalence digraph and give an example of an equivalence digraph on 4 vertices. 3

5 Define center of a graph. Find the center of the following graph 3



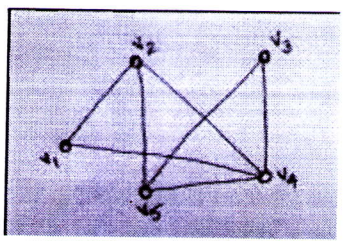
6 Prove that a binary tree on n vertices has $\frac{n+1}{2}$ pendant vertices. 3

7 List out any 5 different cut-sets and hence determine the edge connectivity of the following graph. 3



8 Draw any two non planar graph with proper labelling. 3

9 Find the incidence matrix of the following graph. 3



10 Define chromatic number with an example. 3

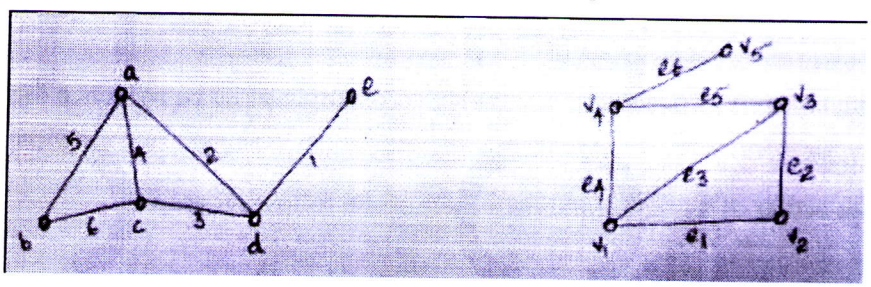
PART B

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

Module -1

11 a) Prove that the number of odd vertices in any graph is always even. 7

b) Check whether the following graphs are isomorphic or not 7



12 a) Prove that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. 8

b) Define a sub graph, vertex disjoint sub graph and edge disjoint sub graph with an example. 6

Module -2

13 a) Prove that a connected graph G is Euler if and only if degree of all the vertices in G are even. 8

b) Distinguish between symmetric and asymmetric digraph with examples. 6

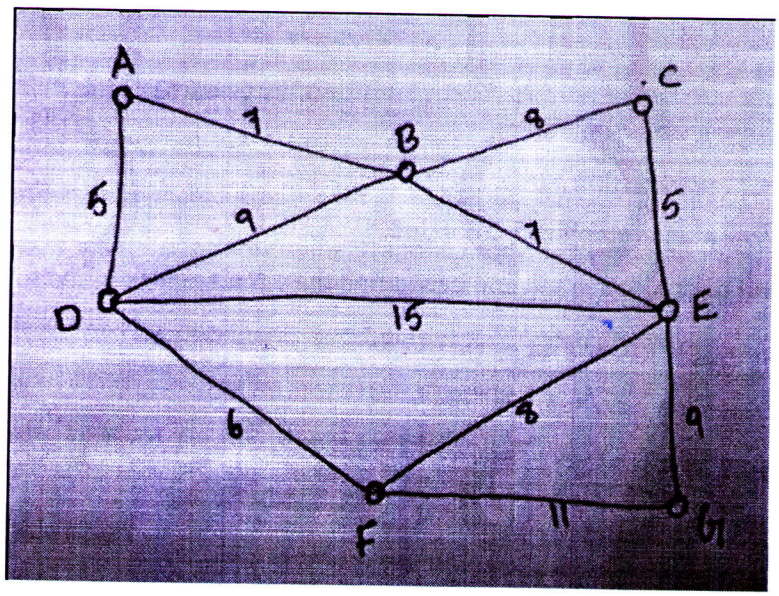
14 a) Explain travelling salesman problem. 7

b) Prove that in a complete graph with n vertices there are $\frac{n-1}{2}$ edge disjoint Hamiltonian circuits, if n is an odd number ≥ 3. 7

Module -3

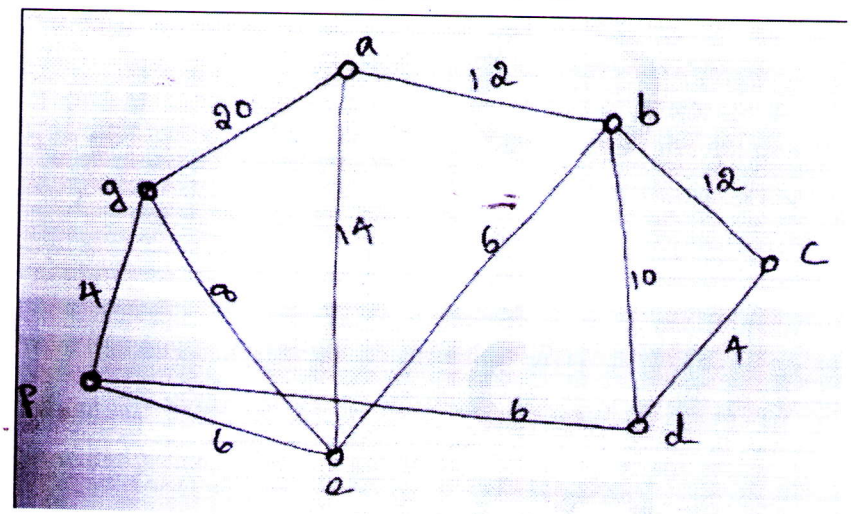
15 a) Prove that a tree with n vertices has n-1 edges. 7

b) Find the minimal spanning tree of the following weighted graph by using Prim's Algorithm 7



16 a) Prove that every connected graph has at least one spanning tree. 6

b) Find the length of the shortest path from the vertex **a** to all other vertices of the given weighted graph G using Dijkstra's Algorithm 8



Module -4

17 a) State and prove Euler theorem on plane graphs. 8

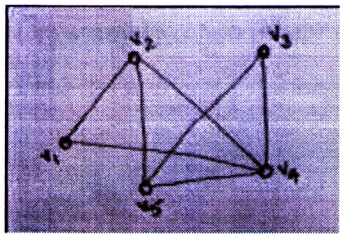
b) Define vertex connectivity and edge connectivity of a graph with an example. 6

18 a) Prove that the maximum vertex connectivity of a connected graph G with n vertices and e edges is $\left\lfloor \frac{2e}{n} \right\rfloor$. 7

b) Prove that every circuit has an even number of edges in common with any cut-set. 7

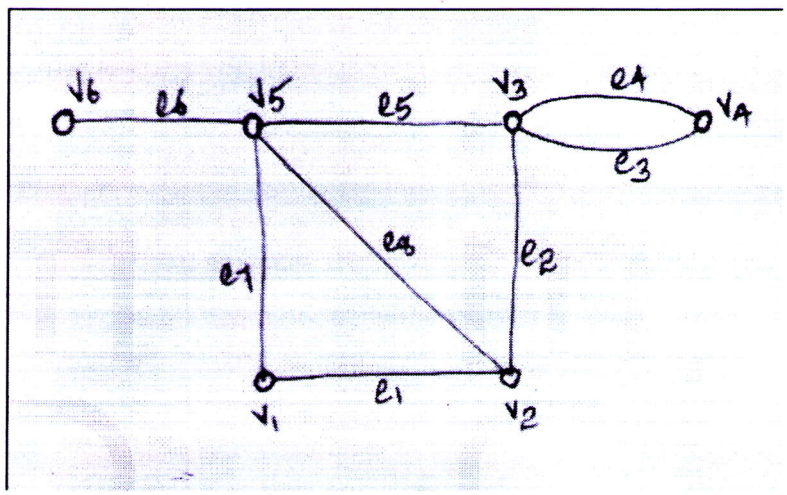
Module -5

19 a) Find the adjacency matrix corresponding to the graph given by 5



b) Prove that every planer graph is 5 colorable. 9

20 a) Define a circuit matrix in a graph and hence find the circuit matrix of the following graph 6



b) Prove that a graph with at least one edge is 2-chromatic if and only if it has no circuits of odd length. 8

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