

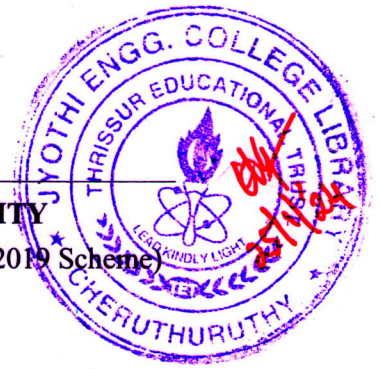
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S2 (PT) (S) Examination January 2024 (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 Show that there is no simple graph corresponding to the following degree sequence 3

2, 2, 3, 4, 5, 5.

- 2 Draw all non-isomorphic simple graphs on 3 vertices. 3

- 3 Draw a connected graph which becomes disconnected when any edge is removed from it. 3

- 4 What is a complement of a graph? Illustrate with a suitable example. 3

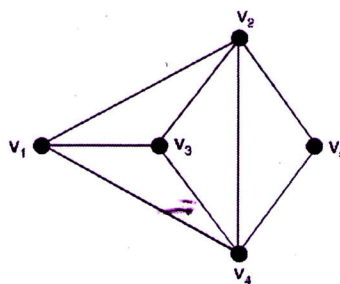
- 5 Prove that there is one and only one path between any pair of vertices in a tree. 3

- 6 Show that the number of vertices in a binary tree is odd. 3

- 7 Define a planar graph. Draw two planar embeddings of K_4 . 3

- 8 What do you mean by a fundamental circuit with respect to a spanning tree in a connected graph G ? Give examples. 3

- 9 Find the chromatic number of the following graph. Justify. 3



- 10 Draw the digraph G corresponding to the adjacency matrix 3

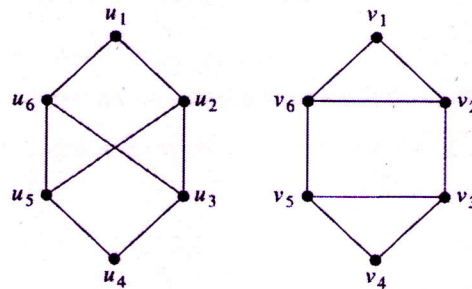
$$\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

PART B

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

Module -1

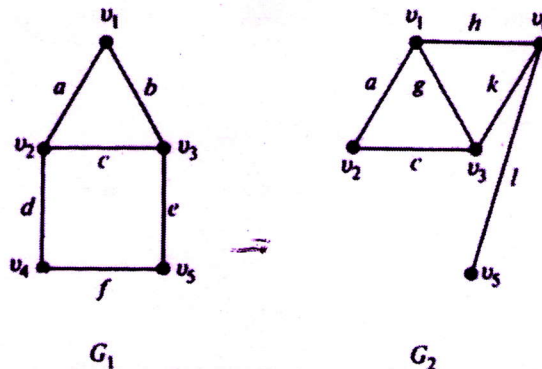
- 11 a) Define and differentiate between a walk, path and circuit with examples. 7
 b) Determine whether the following graphs are isomorphic. Justify. 7



- 12 a) Prove that a graph G will be disconnected if and only if its vertex set V can be partitioned into two non-empty, disjoint subsets V_1 and V_2 such that there exists no edge in G whose one end vertex is in subset V_1 and the other in subset V_2 . 7
 b) Draw the complete graph on n vertices K_n for $n = 1, 2, 3, 4, 5, 6$. 7

Module -2

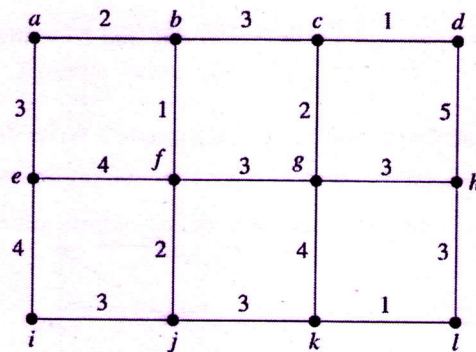
- 13 a) Prove that a connected graph is Euler graph if and only if it can be decomposed into circuits. 7
 b) Find the union, intersection and ring sum of the following graphs. 7



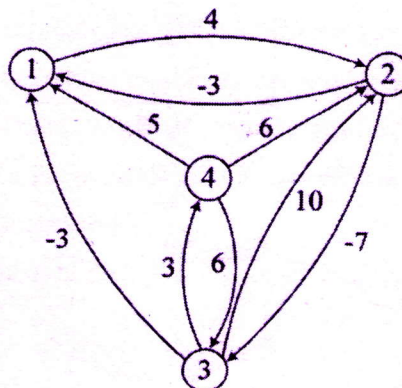
- 14 a) In a complete graph with n vertices there are $\frac{(n-1)}{2}$ edge-disjoint Hamiltonian circuits, if n is odd number ≥ 3 . 7
 b) What is an equivalence graph? Draw the equivalence graph corresponding to the relation "is congruent to modulo 3" in the set of eleven integers from 10 to 20. 7

Module -3

- 15 a) Prove that a tree with n vertices have $n - 1$ edges. 7
- b) Use Kruskal's algorithm to find a minimum spanning tree for the following graph 7



- 16 a) Prove that a connected graph with n vertices and $n - 1$ edges is a tree. 7
- b) Apply Floyd Warshall algorithm to find the shortest distance between all pairs of vertices in the following graph. 7



Module -4

- 17 a) Show that every cut set of a graph G has an even number of edges in common with any circuit. 7
- b) What are self-dual graphs? Show that K_4 is self-dual. 7
- 18 a) Define vertex connectivity and edge connectivity of a graph with examples. 7
- What are separable graphs. Give examples of separable and non-separable graphs.
- b) Draw a graph with vertex connectivity 1 and edge connectivity 3. 7

Module -5

- 19 a) For any graph G , show that the chromatic number $\kappa(G) \leq \Delta(G) + 1$, where $\Delta(G)$ is the maximum degree of a vertex in G . 7
- b) Prove that a covering g of a graph G is minimal if and only if g contains no paths of length three or more. 7
- 20 a) Explain the terms covering, minimal covering and covering number of a graph G with examples. 7
- b) What do you mean by circuit matrix of a graph ? Write down the circuit matrix for the following graph 7

