

**MID-SEMESTER EXAMINATION, MARCH-2020**  
**INTRODUCTORY GRAPH THEORY (CSE 1004)**

Programme: B.Tech(CSE & CSIT)  
Full Marks: 30

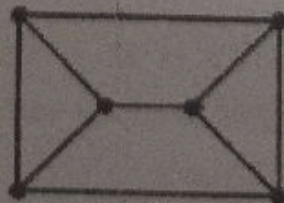
Semester: 2nd  
Time: 2 Hours

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Define the fundamental concepts of graphs and apply them to study graph isomorphisms, Eulerian graphs, graphic sequences and digraphs.	L3, L3, L3, L3, L3, L3 L3, L3, L3	1(a),1(b), 1(c),2(a), 2(b),2(c) 3(a),3(b), 3(c)	2,2, 2,2, 2,2 2,2, 2
Define trees, spanning trees and study its various concepts and apply the Kruskal's algorithm to find the minimum spanning tree and Dijkstra's algorithm to find the shortest path of a connected weighted graphs.	L3, L3, L3, L3, L3, L3	4(a),4(b), 4(c),5(a), 5(b),5(c)	2,2, 2,2, 2,2

\*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

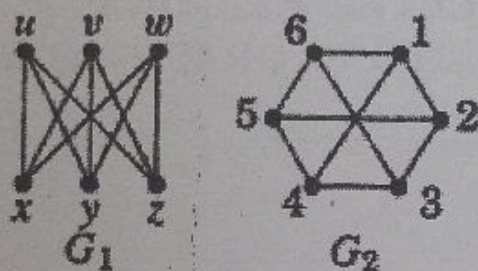
Answer all questions. Each question carries equal mark.

1. (a) Define decomposition of a graph and determine whether the graph given below decomposes into copies of  $P_4$ . 2





- (b) Determine whether the given pair of graphs  $G_1$  and  $G_2$  are isomorphic or not. 2



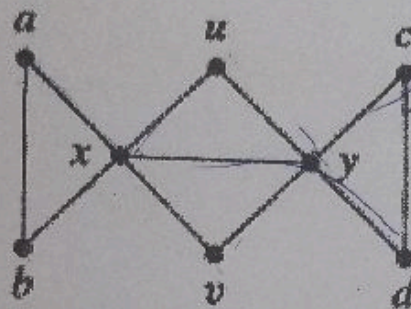
- (c) Prove that the complement of a simple disconnected graph must be connected. 2
2. (a) Prove that every  $u-v$  walk in a simple undirected graph contains a  $u-v$  path. 2
- (b) Define cut-vertex and cut-edge of a graph and determine the cut-vertices and cut-edges of the given graph by suitably naming the vertices. 2



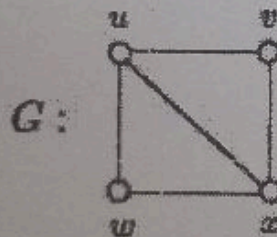
- (c) Prove or disprove: Every Eulerian simple graph with an even number of vertices has an even number of edges. 2
3. (a) Prove that every graph has an even number of vertices of odd degree. 2
- (b) Determine whether the sequence 5, 5, 4, 4, 2, 2, 1, 1 is a graphic sequence or not. 2
- (c) Prove that if there is an  $n$ -vertex tournament with indegree equal to outdegree at every vertex then  $n$  is odd. 2



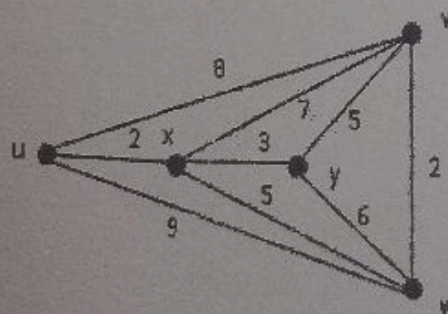
4. (a) Prove that if  $G$  is an  $n$ -vertex connected graph with no cycles then  $G$  has  $n-1$  edges. 2
- (b) Find the eccentricities of each vertex of the given graph and hence find the diameter and radius of the graph. 2



- (c) Let  $T$  be a tree with average degree  $a$ . In terms of  $a$  determine  $n(T)$ . 2
5. (a) Determine the number of spanning trees of the graph  $G$  by contraction of edges or recurrence method. 2



- (b) Define minimum spanning tree and find the minimum spanning tree of the given weighted graph by Kruskal's algorithm. 2



- (c) Prove that if a graph is loopless and has exactly one spanning tree then it is a tree. 2

**\*End of Questions\***