Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth semester B.Tech degree examinations (S) September 2020

Course Code: CS309

Course Name: GRAPH THEORY AND COMBINATORICS

Max. Marks: 100   Duration: 3 Hours

PART A

*Answer all questions, each carries 3 marks.*   Marks

1	Define pendent vertex, isolated vertex and null graph with an example.	(3)
2	Show that in a simple graph with n vertices ,the maximum number of edges is n(n-1)/2	(3)
3	DefineHamiltonian circuitsand path with examples.Find out the number of edge disjoint Hamiltonian circuits possible in a complete graph with five vertices.	(3)
4	State and prove Dirac's Theorem of Hamiltonicity.	(3)

PART B

Answer any two full questions, each carries 9 marks.

5   a)   Define subgraphs.What are edge disjoint and vertex disjoint subgraphs? Construct   (4)
         two edge disjoint subgraphs of the graph G.
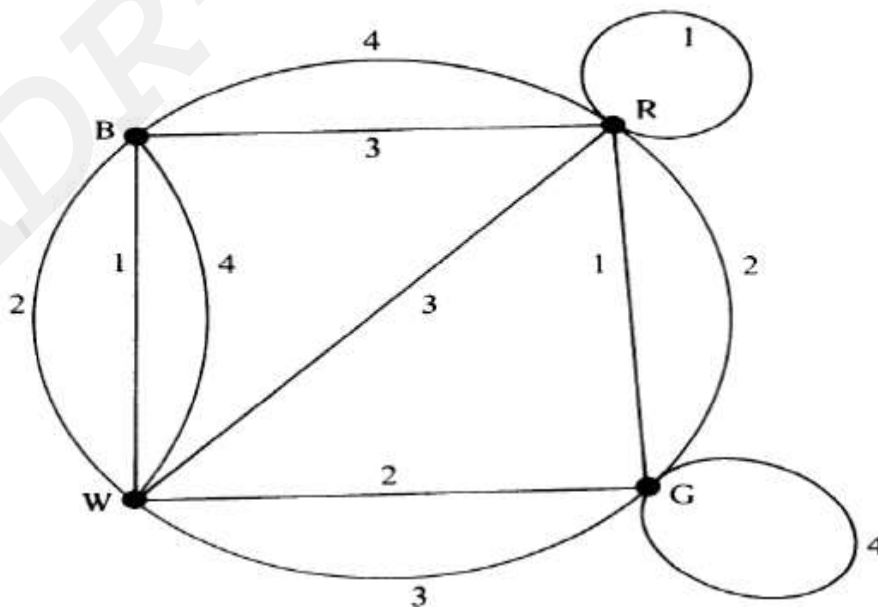
b) Check whether the two graphs are isomorphic or not. Justify your answer. (5)
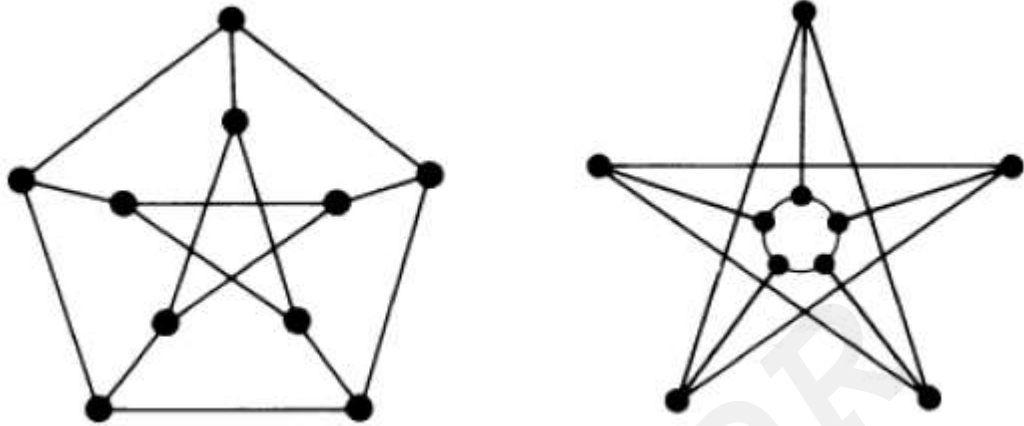

6 a) Prove that in a complete graph with n vertices there are (n-1)/2 edge disjoint (5) Hamiltonian circuits, if n is an odd number >=3

b) Explain arbitrarily traceable graphs with suitable examples. (4)

7 a) Is it possible to have simple graphs with the following degree sequences?if (5) yes,draw the graphs

    a) 2,3,3,3,3,3,4,5

    b) 1,3,3,4,5,6,6

    c) 1,2,3,3,4,5,6

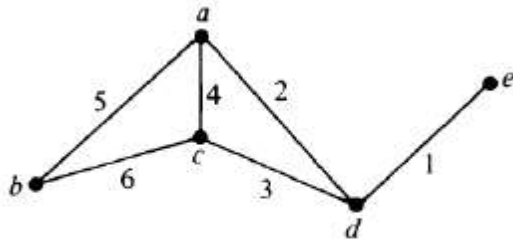b) Explain digraphs and binary relation on digraphs. (4)

PART C
Answer all questions, each carries 3 marks.

8 Prove that in a graph G, if there is exactly one path between every pair of vertices, (3) then G is a tree.

9 Define rooted binary tree. Find the path length of the following tree (3)
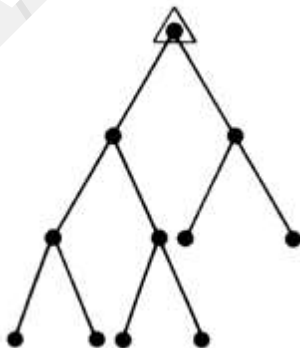
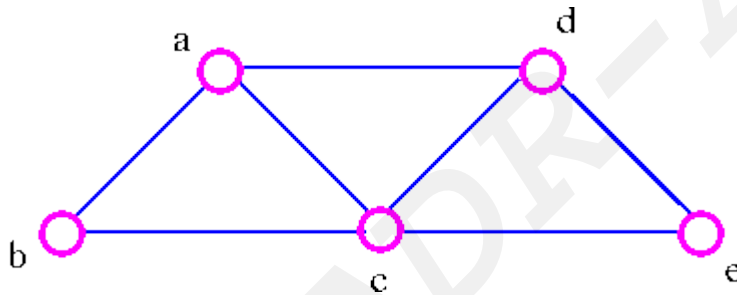10   Sketch all spanning trees of the given graph   (3)

11   Draw the two simplest non planar graphs and also mention their properties.   (3)

PART D
Answer any two full questions, each carries 9 marks.

12 a) Define Spanning tree. Find any two spanning trees T1, T2 of the graph G given   (6)
   below. Also find the branch set, chord set, rank and nullity.

    b) Sketch two different binary trees on 13 vertices, one having maximum height and (3)
        other having minimum height.

13 a) Define Cut set .Find all cutsets of the graph G given below and also find the edge (6)
        connectivity of G.
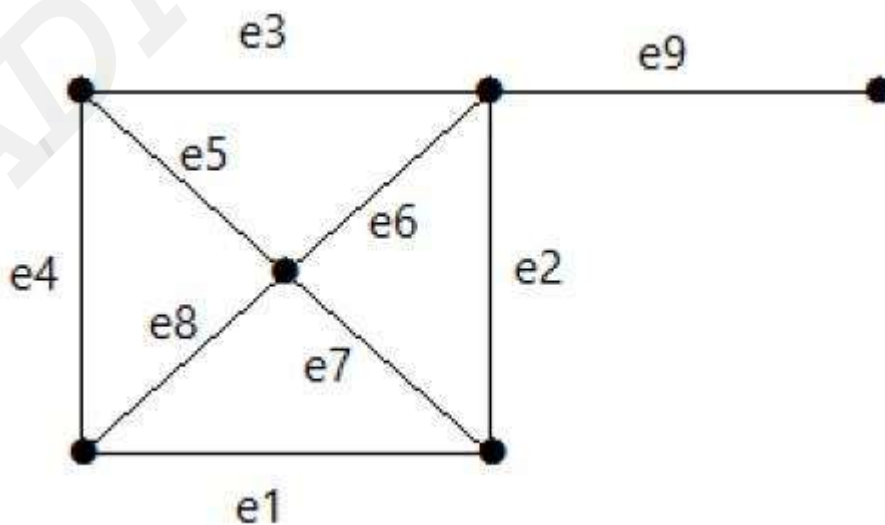
    b) Define vertex connectivity and draw a graph with an articulation point.   (3)

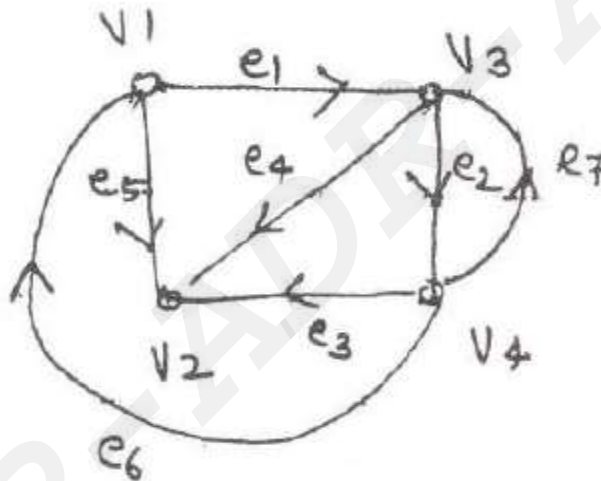14 a) Draw the geometric dual of the graph G given below.   (4)
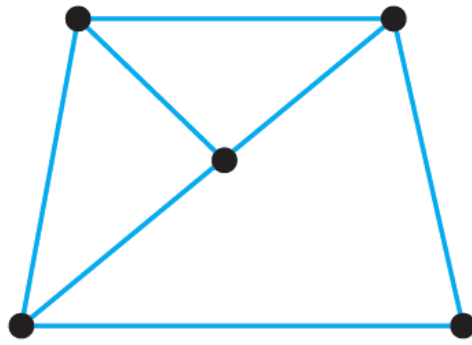
   b) Prove that a connected planar graph with n vertices and e edges has e-n+2 regions.   (5)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Give the incidence matrix of the graph G. Also write the properties of incidence   (6)


   matrix.

   b) Prove that the rank of the incidence matrix of a connected graph G is n-1.   (4)

16 a) Find the Fundamental Circuit matrix of the give graph G with respect to the   (6)
       spanning tree shown in heavy lines. Also find its rank.
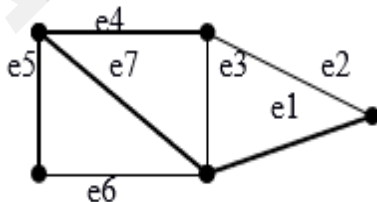
   b) Prove that "If B is a circuit matrix of a connected graph G with e edges and n   (4)
       vertices then rank of B=e-n+1"

17 a) Explain different methods used in computer representation of graphs with an   (5)
       example.

   b) Draw the flow chart to determine connectedness and components of a graph.   (5)

18 a)   Draw a flowchart indicating all the five conditions to find the spanning tree   (10)
/spanning forest. Apply it to find the spanning tree /spanning forest for any
disconnected graph of your choice.

19 a) Write Dijkstra's Shortest path algorithm and apply this algorithm to find the   (10)
shortest path
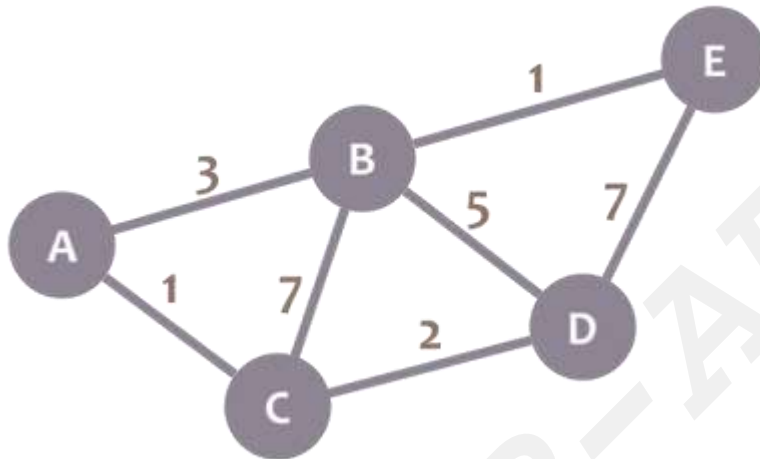
20 a) Discuss an algorithm to find the minimum spanning tree of a graph G with an   (10)
example

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