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B.TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

GRAPH THEORY

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Attempt all questions: **10 x 2 = 20**

(a) Calculate the number of edges in the graph G with 16 vertices, each of degree 2.

(b) Draw a bipartite graph representing three houses and three utilities say water, gas and electricity.

(c) Differentiate between rooted and binary trees.

(d) Define thickness and crossing number of a graph.

(e) Explain the radius and diameter of a graph with examples.

(f) What do you mean by matching in a graph?

(g) Define chromatic number of a graph with example.

(h) Draw a graph which is Hamiltonian but not Eulerian.

(i) Define fundamental circuits and cut sets.

(j) What do you mean by orthogonal vectors.

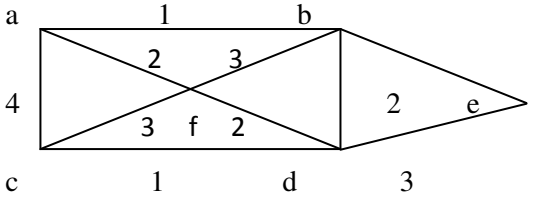
SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) Define edge connectivity and vertex connectivity of a graph. Construct a graph G with edge connectivity 4, vertex connectivity 3 and degree of each vertex of G $\geq$ 3.

(b) Define incidence matrix, fundamental circuit matrix and fundamental cut set matrix. Also establish the relation among them.

(c) What do you mean by minimum spanning tree of a weighted graph? Using the Prim's algorithm find the minimum spanning tree of the following graph.



State the Kuratowaski's theorem on planarity of graphs and explain how it characterizes which graphs are planar.

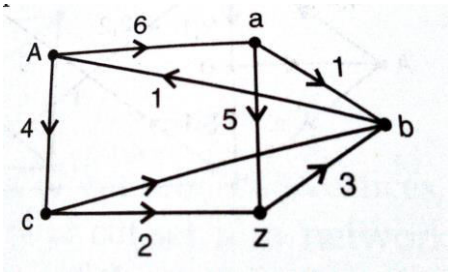
(d) Prove that a simple graph with n vertices and k components can have at most (n-k) (n-k+1)/2 edges.

(e) Discuss (i) Konigsberg Bridge Problem
(ii) Travelling Salesman Problem.

(f) Define chromatic polynomial of a graph. Find the chromatic polynomial of the following graph.

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(g) Verify Max-flow Min-cut theorem for the following transport network –



SECTION – C

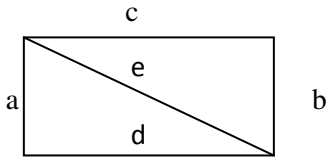
Attempt any two of the following questions: **2 x 15 = 30**

3. (a) Prove that the number of edges in a complete bipartite $K_{m,n}$ is mn.

(b) Prove that the number of pendant vertices in a binary tree T with n vertices is (n+1)/2.

(c) Find the thickness and crossing number of Peterson's graph.

4. (a) Find the circuit subspace V_C and cut-sets subspace V_S for the graph



(b) Define incidence matrix of a graph with example. Prove that the rank of an incidence matrix of a graph with n vertices in (n-1).

(c) Define the term distance and eccentricity in a tree. Show that the distance between two spanning trees is a metric.

5. (a) Explain the operations on the graphs union, intersection and ring sum.

(b) Define fundamental cut sets of a graph. Find all the fundamental cut sets of K_5.

(c) Explain how the covering number of a graph G with n vertices is related to the diameter of G.

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