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END SEMESTER EXAMINATION, MAY/JUNE - 2019
MCA THIRD SEMESTER

COURSE CODE: MCA203 **COURSE TITLE: GRAPH THEORY & COMBINATORICS**

[Time allotted: Three hours] **[Max. Marks: 100]**

Note: Attempt all Sections & Questions.

Section (A)

Q.1. Attempt all questions. **(2 x 10 = 20)**

a. Define matching with suitable example.
b. Suppose X is the adjacency matrix of a graph. What does X^K denote?
c. The chromatic polynomial of K_5 is……
d. What are the different properties when a graph G with n vertices is called a tree?
e. What is the edge connectivity of the complete graph of n vertices?
f. Explain eccentricity of a graph.
g. Suppose G is a graph with 1000 vertices and 3000 edges. Is G planar?
h. What is the size of r-regular (p, q)-graph.
i. The number of fundamental cut sets is equal to the number of ……in the graph.
j. Give an example of an Euler graph which is arbitrarily traceable.

Section (B)

Q.2. Attempt any 5 questions. **(7 x 5 = 35)**

a. Define a planar graph. Show that K_5 is not a planar graph.
b. Define the thickness of a graph. Find the thickness of Kuratowski's first and second graph?
c. Find the chromatic polynomial of W_5.
d. If both G and its complement are trees, find the order of G.
e. A family has two children. What is the probability that both the children are boys given that at least one of them is a boy.
f. Prove that the sum of the degrees of the vertices of a graph is equal to twice the number of edges. Does the theorem hold for a multigraph? Justify your answer with example?
g. Find all the spanning trees of the graph given below in Fig.1 using Laplacian Matrix.

Fig. 1

Section (C)

Attempt any 3 questions. **(15 x 3 = 45)**

Q.3. Define the following operations on the graph with suitable examples. **(5*3)**
(i) Ring Sum (ii) Product (iii) Union (iv) Deletion of an edge (v) Intersection

Q.4. Define the following terms with suitable example. **(6*2.5)**
(i) Hamiltonian path (ii) Component of a graph (iii) Euler graph (iv) Spanning subgraph
(v) Edge connectivity (vi) Covering

Q.5. **a.** Define a cut-set vector and circuit vector of a graph. For the graph given below in Fig. 2, find all the cut-set vectors and circuit vectors, circuit subspace (W_τ) and cut-set subspace(W_s) and also find the basis of the two subspaces. **(10)**

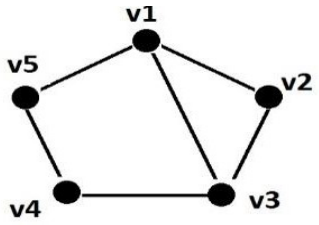
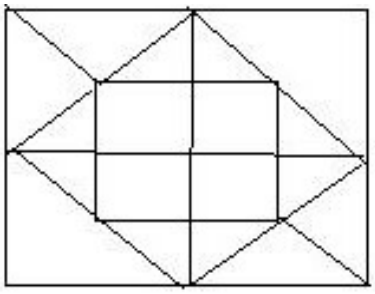


Fig. 2

b. Does there exist a 4-regualar graph on 6 vertices? If so, construct a graph. **(5)**

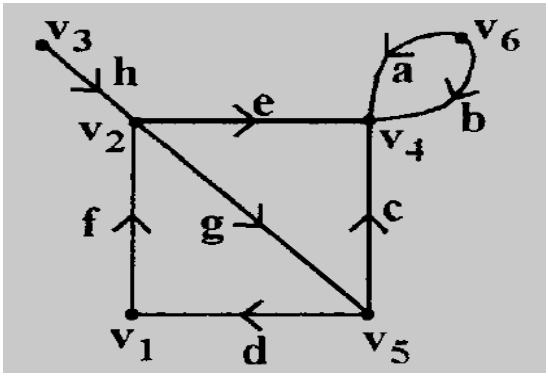
Q.6. **a.** Explain the steps involved in testing for planarity of graphs. **(6)**

b. Find the number of vertices, edges and regions for the following planar graph and verify that Euler's Theorem for connected planar graphs is satisfied. **(9)**



Q.7. **a.** Define a bipartite graph? Show that the complement of a bipartite graph need not to be a bipartite? **(2+6)**

b. Determine the number of skeleton of $K_{3,4}$ and K_6. Write adjacency matrix for the diagraph given below. Use this matrix to decide whether or not the digraph is strongly connected. **(2+3+2)**



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