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1310N703

Candidate's Seat No : _____

B.Sc. Sem.-6 (Rep) Examination

CC-310

Mathematics

October-2025

Time : 2-30 Hours] [Max. Marks : 70

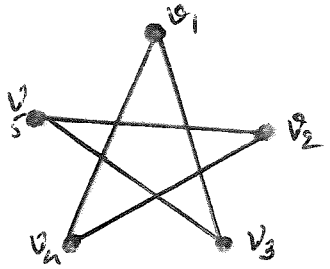
Instructions:

(a) Notations and terminologies are standard.
(b) All the questions are compulsory.
(c) Each question carries equal marks.

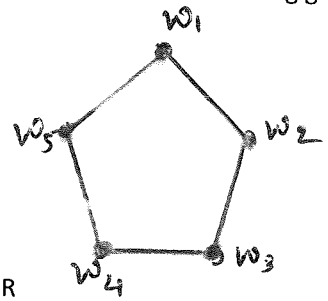
$Q-1$

(a) State the First Theorem of Graph Theory and prove that in any graph G, there is an even number of odd vertices. 7

(b) Define Isomorphism of a graph and check whether the following graphs are isomorphic or not. 7



OR



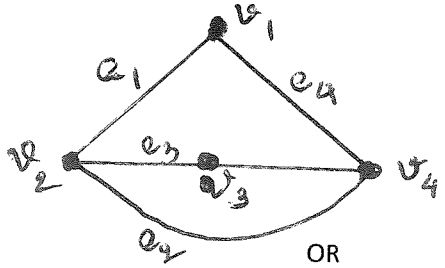
(a) Define the following terms. 7
(i) Subgraph
(ii) Proper Subgraph
(iii) Spanning Subgraph
(vi) Edge deleted subgraph

(b) If G be a k-regular graph, where k is an odd number, then prove that the number of edges in G is a multiple of k. 7

$Q-2$

(a) Prove that if G is a nonempty graph with at least two vertices, then G is bipartite if and only if it has no odd cycles. 7

(b) Find Adjacency and incidence matrix of the given graph. 7



OR

(a) If T is a tree, then prove that it has precisely $n-1$ edges. 7

(b) If G is a graph with n vertices, q edges and $w(G)$, which is the number of connected components of G, then prove that $q \geq n - w(G)$. 7

P.T.O.

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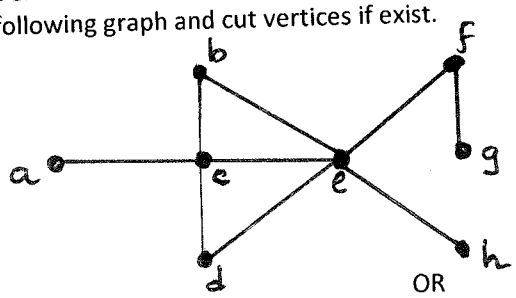
$Q-3$

(a) If G is a graph with n vertices, where $n \geq 2$. Then prove that G has at least two vertices, which are not cut vertices. 7

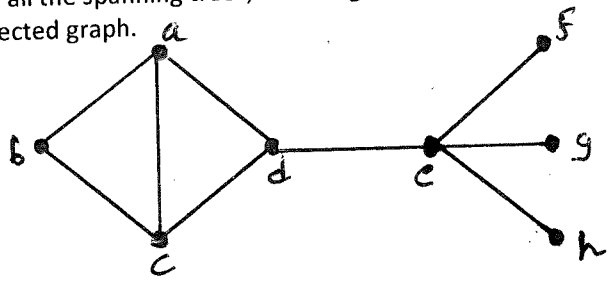
(b) Define cut vertex and connectivity of a graph. Find connectivity $k(G)$ of the following graph and cut vertices if exist. 7



OR

(a) Prove that a graph G is connected if and only if it has a spanning tree. 7

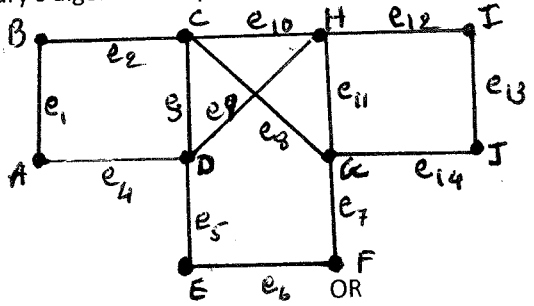
(b) Draw all the spanning trees, including isomorphic ones, of the following connected graph. 7



$Q-4$

(a) If G be a graph in which the degree of every vertex is at least two, then prove that G contains a cycle. 7

(b) Use Fleury's algorithm to produce an Euler tour for the following graph. 7



OR

(a) Prove that a connected graph G is Euler if and only if the degree of every vertex is even 7

(b) If G is a simple graph with n vertices, where $n \geq 3$ and the degree $d(v) \geq \frac{n}{2}$ for every vertex v of G, then prove that G is Hamiltonian. 7

$Q-5$ Attempt Any Seven. in short : 14

(i) Define bipartite and complete bipartite graph.

(ii) Give an example of a self-complement graph and justify your answer.

(iii) Draw a graph with 4 vertices, which is 2-regular.

(iv) Define Tree and Forest.

(v) Find radius and diameter of complete graph K_5.

(vi) Draw a graph, whose adjacency matrix is $A = \begin{bmatrix} 2 & 3 & 1 \\ 3 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

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(*vii*) State Cayley's theorem.
(*viii*) Find the connectivity of K_5 and K_1.
(*ix*) State Whitney's theorem.
(*x*) Check whether complete graph K_4 is Euler or not.
(*xi*) Define Hamiltonian graph.
(*xii*) Define closure of graph G.