

(UG VI Semester Examination)
MATHEMATICS

Course Title: GRAPH THEORY

Course Code: UMTTS-606

Date of Examination: 24-06-2021

Instruction for Students Appearing for Online Examination of 6th Semester (Pvt.), Session 2020-21:-

- The candidate needs to attempt any four questions out of the eight questions.
- All questions carry equal marks.
- The candidate shall have to write the answers on A4 size white Plane sheets only.
- The candidate shall have to put his/her Name and Signature on the top right hand corner of each page.

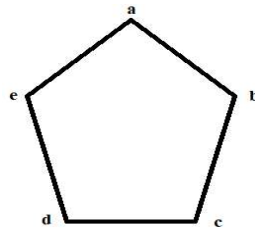
Time: 3 hours

M. Marks: 80

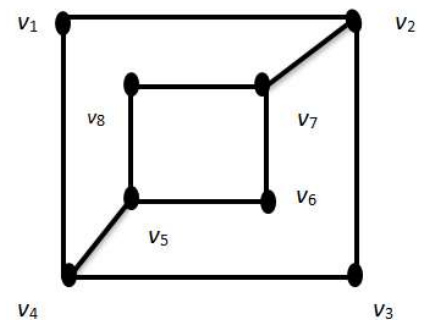
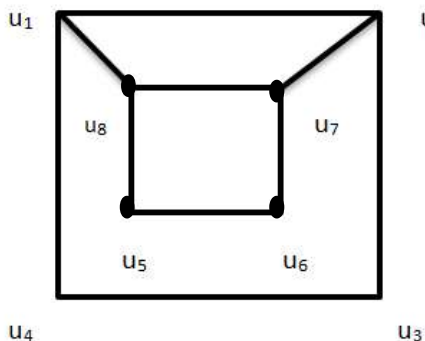
- 1(a). Define graph, Indegree of a vertex, outdegree of a vertex and degree of a vertex.
 (b). What is vertex deleted sub-graph and edge deleted sub-graph? Give suitable examples.
2. What is Adjacency matrix and Incidence matrix of a graph

For a graph

- Write the adjacency list
- Find the adjacency matrix
- Find the incidence matrix
- Draw compliment graph



3. State and prove the First theorem on Graph Theory.
4. What is Hamiltonian circuit and Euler circuit. Give an example of a connected graph that has
- Neither an Euler circuit nor a Hamiltonian circuit.
 - An Euler circuit but not a Hamiltonian circuit.
 - A Hamiltonian circuit but no Euler circuit.
 - Both an Hamiltonian circuit and Euler circuit.
5. Show that the following graphs are not isomorphic.



- 6 (a) Find n , if a complete graph having n vertices has 15 edges.
 (b) Draw two 3-regular graph with eight vertices.
 (c) Find k , if a k -regular graph with 7 vertices has 14 edges. Also draw the k -regular graph.

7 (a). What is Bipartite Graph. Prove that every subgraph H of a bipartite graph G is itself bipartite.

(b) What is complete graph and complement of a graph? Let G be a complete graph of n vertices. Find the complement of G .

8 (a) Draw the directed graph G whose incidence matrix is

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & -1 & 1 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 & 0 & -1 \\ 1 & 0 & 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}_{5 \times 6}$$

(b) Prove that a complete graph K_n , where $n \geq 3$ has $(n-1)!$ Hamiltonian circuit.

(c) Find the number of loops and multiple edges in a general graph G from its adjacency matrix

$$\begin{bmatrix} 1 & 1 & 2 & 0 \\ 1 & 2 & 1 & 3 \\ 2 & 1 & 0 & 1 \\ 0 & 3 & 1 & 0 \end{bmatrix}_{4 \times 4}$$

Also draw the graph .
