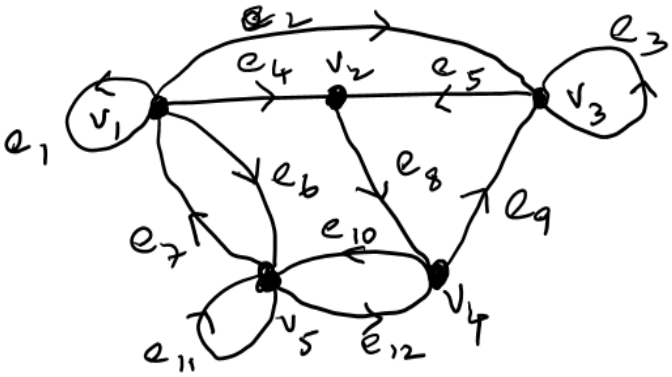
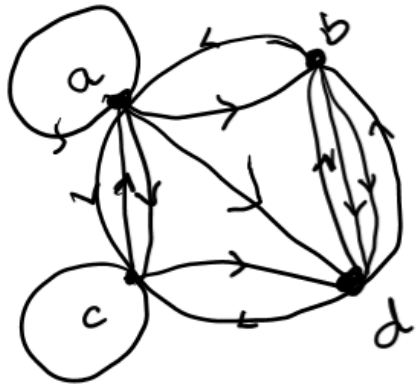
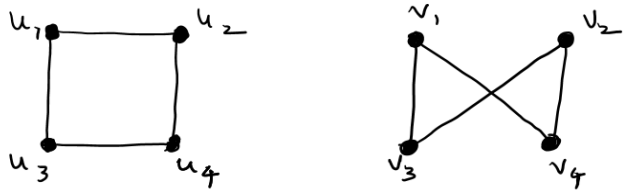
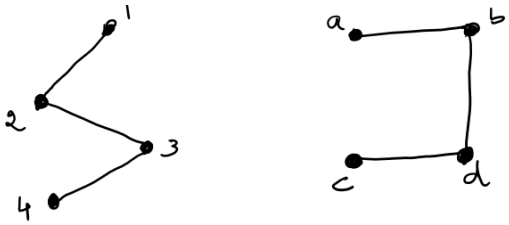
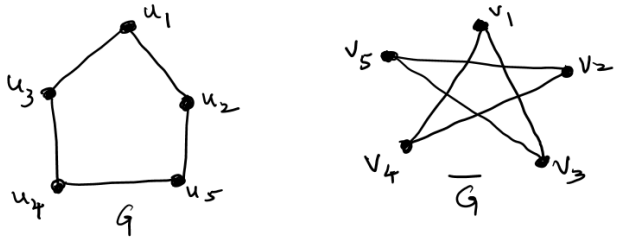
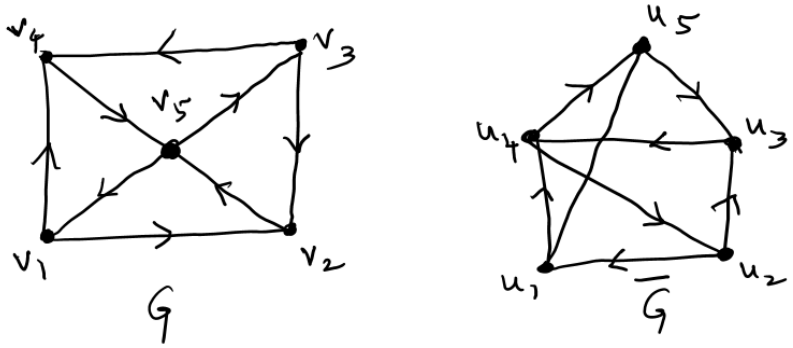
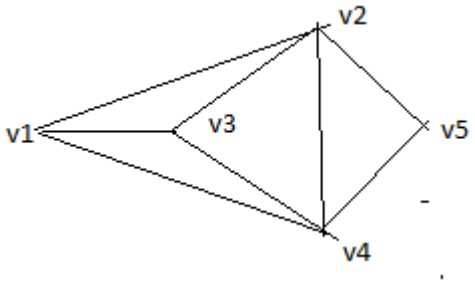
DAYANANDA SAGAR COLLEGE OF ENGINEERING
(An Autonomous Institute Affiliated to VTU, Belagavi)
Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-560078
DEPARTMENT OF MATHEMATICS

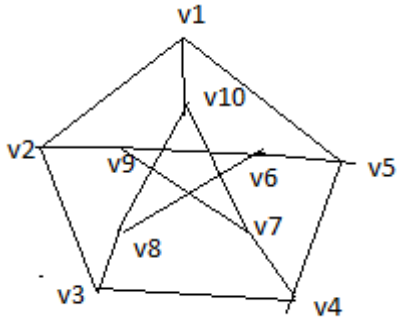
MATHEMATICAL STRUCTURES
COURSE CODE : 21MAT41A
Module-5: Graph Theory and Its Applications
Question Bank

Q.No	Questions
1.	a) Define with an example i) Graph ii) Multi graph iii) Simple Graph b) Define the following terms with a suitable example: i) Directed graph. ii) Undirected graph.
2.	a) Define with an example i) Degree of vertex ii) Isolated vertex b) Define with an example i) Bipartite graph ii) Complete bipartite Graph
3.	a)Define with an Example i) Pseudographs ii) Cycle Graph iii) Wheel Graph b) Verify $\sum_{i=1}^{n} deg^{+}(v_i) = \sum_{i=1}^{n} deg^{-}(v_i) = \lvert E\rvert = e$ in the following graph. 
4.	a) Draw the Graphs i) K_n for $1 \leq n \leq 4$ ii) a) C_3 b) C_4 c) C_5 d) C_6 e) C_8 b) Is C_3 and C_6 bipartite? Explain

5.	a) Draw the complete bipartite graphs $K_{2,3}$, $K_{3,3}$, $K_{3,5}$ and $K_{2,6}$ b) Draw the Graphs of a) W_3 b) W_4 c) W_5 d) W_6 e) W_7
6.	a) Define Complement Graph and if the simple graph G has v vertices and edges, how many edges does $\bar{G}$ have? b) State Handshaking property. Show that every simple graph has two vertices of the same degree
7.	a) Define Adjacency matrix and incidence matrix b) Write the Adjacency Matrix of C_4 and W_4
8.	a) Draw a graph of the given adjacency matrix i) $\begin{bmatrix}0 & 1 & 0\\1 & 0 & 1\\0 & 1 & 0\end{bmatrix}$ ii) $\begin{bmatrix}1 & 1 & 1 & 0\\0 & 0 & 1 & 0\\1 & 0 & 1 & 0\\1 & 1 & 1 & 0\end{bmatrix}$ b) Find the adjacency matrix of the given directed multigraph 
9.	a) Draw Petersen graph. b) Is there a simple graph with 1,1,3,3,3,4,6,7 as the degree of its vertices?

10.	a) Explain a Regular graph with example b) How many vertices does a Regular graph of degree 4 with 10 edges have?
11.	a) Define isomorphism of graphs. Show that the graphs G=(V,E) and H=(W,F) shown in the figures are isomorphic.  b) Show that the two graphs shown in the figure are isomorphic. 
12.	a) Show that the graphs G and $\bar{G}$ shown in the figure are isomorphic.  b) Show that the Digraphs are isomorphic. 

13.	a) Define with an example each (i) Euler Circuit (ii) Euler path (iii) Euler Trail b) Define with an example each (i) A Hamiltonian path (ii) A Hamiltonian Circuit
14.	a) Define with an example : (a) Subgraph of a graph (b) spanning sub graph b) Show that the complement of a bipartite graph need not be a bipartite graph.
15.	Which of the following graphs are Eulerian? i) The complete graph K_5 ii) The complete bipartite graph $K_{2,3}$ iii) The graph of the Octahedron iv) The Petersen graph
16.	Prove that a simple graph with n vertices and k components can have at most (n-k)(n-k+1)/2 edges.
17.	a) i) Give an example of a graph which has a Hamiltonian circuit but not an Euler circuit. ii) Give an example of a graph which has an Euler circuit but not a Hamiltonian circuit. b) Show that K_n has a Hamilton circuit whenever n $\geq$ 3
18.	a) Define Graph coloring of a graph with an example. b)Define chromatic number of a graph with an example.
19.	a) Find the chromatic number of the graph shown below 

	b) Find the chromatic number of the graph shown below 
20.	a) Prove that a graph of order ($n \geq 2$) consisting of a single cycle is 2- chromatic if n is even, and 3-chromatic if n is odd. b) Prove that a graph G is 2-chromatic if and only if it is a non-null bipartite graph.