April 2025
B.A./B.Sc.
Fourth Semester
SKILL ENHANCEMENT COURSE – 2
MATHEMATICS
Course Code: MAS 4.11
(Graph Theory)

Total Mark: 35 *Pass Mark: 14*
Time: 2 hours

Answer five *questions, taking* one *from each unit.*

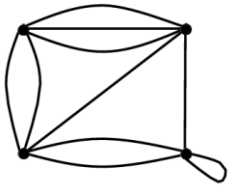
UNIT–I

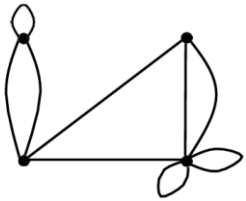
1. (a) Define a simple graph. Show that the maximum degree of any vertex in a simple graph with n vertices is $n-1$. 1+2=3
   (b) Determine the number of edges in a graph with 6 vertices, 2 of degree 4 and 4 of degree 2. Draw two such graphs. 4

2. (a) Using Hakimi-Havel theorem, find x if [8 x 7 6 6 5 4 3 3 1 1 1] is a graphical vector. 4
   (b) Define regular graph. Does there exist a 4 regular graph of 6 vertices? If so, construct one such graph. 3

UNIT–II

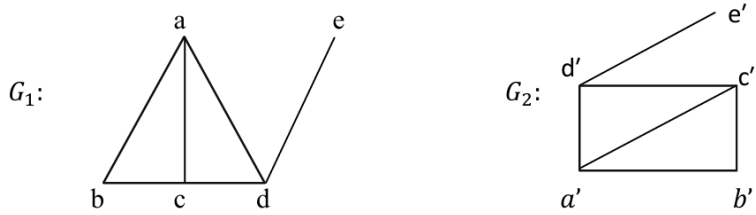
3. (a) Define complement of a simple graph. Draw a self-complementary graph of order 4. 3
   (b) Construct the adjacency and incidence matrix to represent the following graphs: 4

G : 

G': 

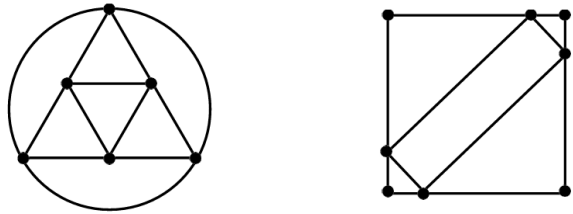
4. (a) Prove that if a connected graph G is decomposed into two subgraphs H_1 and H_2, there must be at least one vertex common to H_1 and H_2. 3

(b) Use adjacency matrix to show that the following graphs are isomorphic. 4



UNIT–III

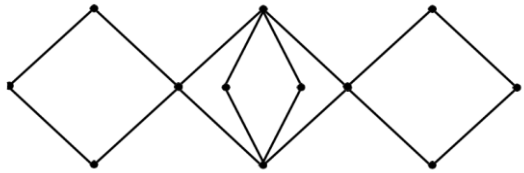
5. (a) Verify whether the following graphs are isomorphic or not. 3



(b) Prove that the maximum number of edges in a simple graph with n vertices and k components $\frac{(n-k)(n-k+1)}{2}$. 4

6. (a) Prove that a connected graph G is Eulerian if and only if the degree of each vertex of G is even. 3

(b) Use Fleury's algorithm to construct an Euler circuit of the graph. 4

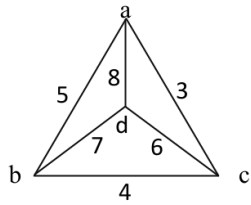


UNIT–IV

7. (a) State and prove Ore's theorem. 5

(b) Define maximal non-Hamiltonian graph. Give one example. 2

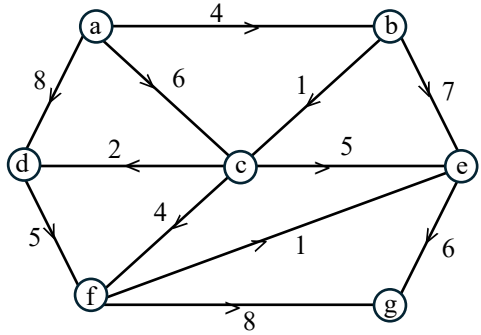
8. (a) Solve the travelling salesman problem for the weighted graph. 4



(b) Draw a graph which contains the following: 3
(i) An Eulerian circuit and a Hamiltonian cycle
(ii) An Eulerian circuit but not a Hamiltonian cycle
(iii) A Hamiltonian cycle but not an Eulerian circuit

UNIT–V

9. Define the shortest path problem. Determine the shortest path between the vertices *a* to *g* using Dijkstra's algorithm. 7



10. Obtain the shortest distance matrix between all the vertices using Floyd-Warshall algrorithm. 7