2022

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. Find the maximum degree of any vertex in a simple graph with n vertices. 1+2=3

   (b) Verify whether there exist a simple graph corresponding to the following degree sequence . 4

   (i) $[0,2,2,3,4]$

   (ii) $[2,2,3,4,4,5]$

   (iii) $[2,2,4,6]$

   (iv) $[2,2,2,2,4]$

   If any such simple graph exists, draw its corresponding graph.

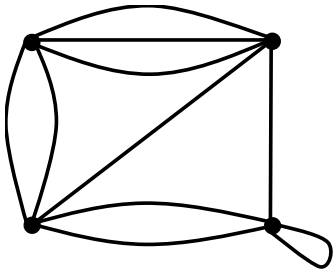
2. (a) State Hakimi-Havel theorem. Show that the sequence $[6,5,5,4,3,3,2,2,2]$ is a graphical vector. Also draw its corresponding graph. 1+2+1=4

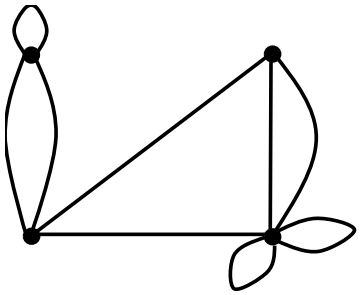
   (b) Define regular graph. Does there exist a 4 regular graph of 6 vertices? If so construct a graph. 1+1+1=3

UNIT – II

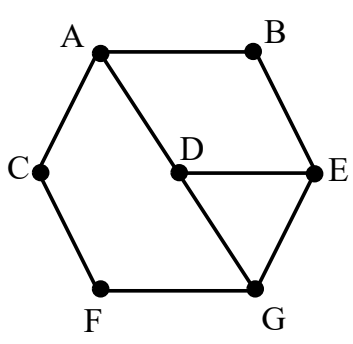
3. (a) Define compliment of a simple graph. Draw two self-complementary graphs of order 5. 1+2=3

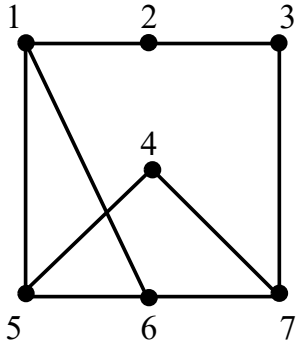
   (b) Construct the adjacency and incidence matrix to represent the following graphs. 2+2=4

G_1 : 

G_2: 

4. (a) Show that the graphs are isomorphic using adjacency matrix. 3

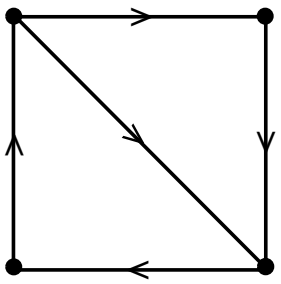




   (b) Draw the graph represented by the incidence matrix

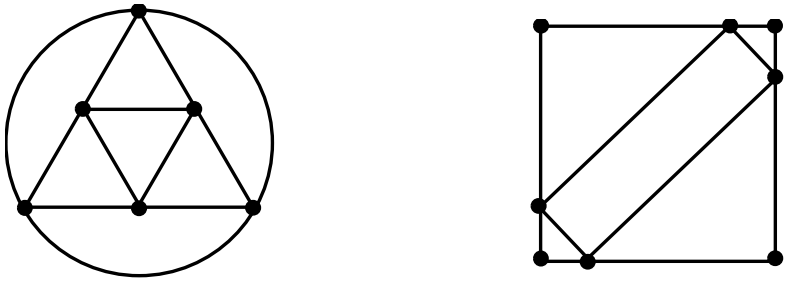
$$\begin{bmatrix} 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix}$$ 2

   (c) Find the incidence matrix to represent the graph. 2



UNIT – III

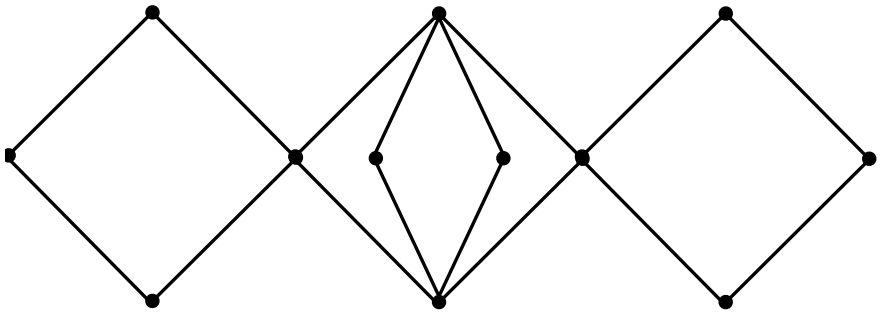
5. (a) Verify whether the following graphs are isomorphic. 3



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

6. (a) In a connected graph G with exactly $2n$ ($n \geq 1$) odd vertices, prove that the set of edges of G can be partitioned into n open trail. 3

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

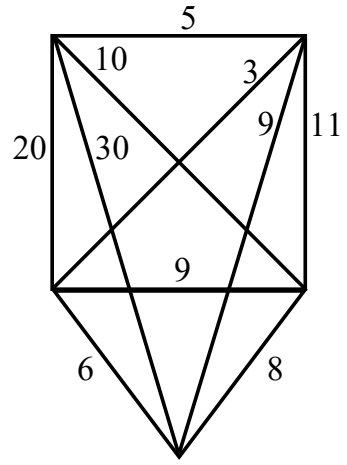


UNIT – IV

7. (a) State and prove Dirac's theorem. 4

(b) Define maximal non-Hamiltonian graph. Give two examples. 1+2=3

8. (a) Solve the travelling salesman problem. 4



(b) Draw a graph which contains the following: 1+1+1=3

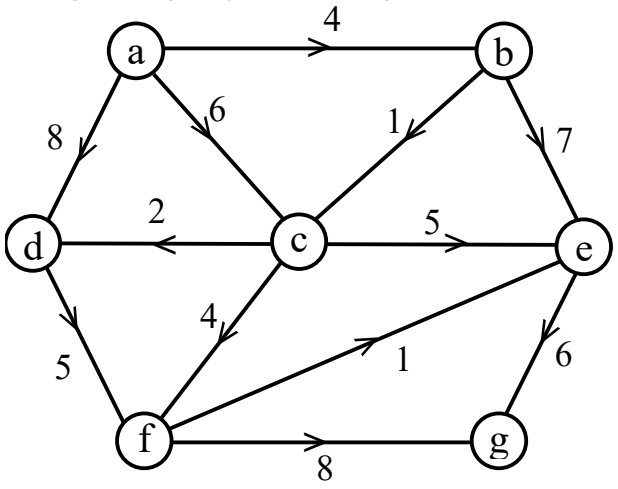
(i) An Eulerian circuit and a Hamiltonian cycle

(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. 1+6=7



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