

M.Sc. MATHEMATICS
FOURTH SEMESTER
GRAPH THEORY
MSM – 401
[USE OMR FOR OBJECTIVE PART]

**SET
A**

Duration: 3 hrs.

Full Marks: 70

Time: 30 min.

(Objective)

Marks: 20

Choose the correct answer from the following:

1X20=20

- Two graphs are said to be isomorphic if
 - Both have same numbers of vertices
 - Both have the same numbers of edges
 - Both have same numbers of vertices, edges & with same connectivity
 - None of the above
- What is the number of edges present in complete graph K_n having n vertices?
 - $\frac{n(n+1)}{2}$
 - $\frac{n(n-1)}{2}$
 - n^2
 - None of these
- What is the maximum number of edges in a bipartite graph having 12 vertices.
 - 24
 - 38
 - 36
 - 32
- A Graph contains m edges can be decomposed in
 - $2^m - 1$ ways
 - $2^{m-1} - 1$ ways
 - 2^m ways
 - None
- The number of Hamiltonian Circuits in a complete graph of n vertices
 - $\frac{(n-1)!}{2}$
 - $\frac{n!}{2}$
 - $\frac{(n-2)!}{2}$
 - None of these
- What is the determinant of the adjacency matrix of C_4
 - 1
 - 1
 - 0
 - None of these
- Conditions of planarity for n numbers of vertices and e numbers of edges
 - $e < 2n - 6$
 - $e < 2n - 6$
 - $e \leq 3n - 6$
 - $e = 2n - 6$

8. Number of spanning tree of a graph of n vertices is
a. 0
b. 2
c. 2^n
d. None
9. No of cycles in a connected planar graph having 6 vertices, 7 edges is ____
____regions.
a. 1
b. 3
c. 5
d. 7
10. A graph is self-complementary if it is isomorphic to its complement. For all self-complementary graphs on n vertices, n is
a. Amultipleof4
b. Even
c. Odd
d. congruentto $0 \pmod{4}$, or $1 \pmod{4}$
11. A vertex which is not adjacent to every other vertex is called ____ vertex.
a. Isolated
b. Pendant
c. Incident
d. Simple
12. Let n_1 and n_2 be the number of edges of graphs G_1 and G_2 respectively, then the number of edges of $G_1 \cup G_2$ if G_1 and G_2 are connected graphs
a. $n_1 + n_2$
b. $n_1 + n_2 - 1$
c. n_1
d. n_2
13. For a given graph G having v vertices and e edges which is connected and has no cycles, which of the following statements is true?
a. $v = e$
b. $v = e + 1$
c. $v + 1 = e$
d. $v = e - 1$
14. What is the radius of the Petersengraph
a. 2
b. 3
c. 4
d. None of these
15. Total number of trees with 5 vertices
a. 2
b. 3
c. 4
d. 5
16. Which of the following statement is/are TRUE?
P: A cycle is walks with end vertices are same.
Q: A cycle is a path with end vertices is same.
a. P only
b. Q only
c. Both P and Q
d. Neither P and Q
17. A graph is called a ____ if it is a connected a cyclic graph
a. Cyclic graph
b. Regular graph
c. Tree
d. Trivial graph

18. The graph in which, there is a closed trail which includes every edge of the graph is known as?
- Hamiltonian graph
 - Euler graph
 - Directed graph
 - Planar graph
19. The number of elements in the adjacency matrix of a graph having 7 vertices is
- 7
 - 14
 - 36
 - 49
20. G is a simple undirected graph. Some vertices of G are of odd degree. Add a node v to G and make it adjacent to each odd degree vertex of G . The resultant graph is sure to be
- Regular
 - Complete
 - Hamiltonian
 - Euler

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(Descriptive)

Time : 2 hrs. 30 mins.

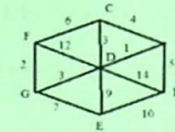
Marks : 50

[Answer question no.1 & any four (4) from the rest]

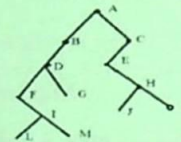
1. With diagrams define of the followings 2×5=10
- General Graph
 - Simple graph
 - Regular graph
 - Complete graph
 - Isomorphic Graph
2. a. If m and M denote the minimum and maximum degrees of the vertices of a graph with n_v vertices and n_E edges, Show that $m \leq \frac{2n_E}{n_v} \leq M$ 5+5=10
- b. If the number of vertices and number of edges of two graphs $G_1(p_1, q_1)$ and $G_2(p_2, q_2)$ then define with example by the rule of $G_1 \cap G_2$, $G_1 \cup G_2$ and $G_1 \oplus G_2$

3. a. If A is the adjacency matrix with $V = \{v_1, v_2, v_3, \dots, v_i\}$, then prove that for any $n \geq 1$ the (i, j) th entry of A^n is the number of $v_i - v_j$ walks of length n in G . 5+5=10
- b. Prove that G with P vertices and $\delta \geq \frac{p-1}{2}$ is connected.

4. a. Find a minimum spanning tree for the weighted graph by using prim algorithm of the following graph 5+5=10



- b. List the order in which the vertices of the tree given below are processed using pre-order, in-order and post-order traversal.



5. a. Find the minimum spanning tree for the weighted graph as given below by using Kruskal algorithm 5+5=10

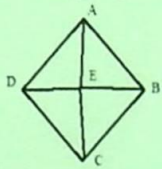


- b. Find the value of the prefix expression
 $+\uparrow 32 \uparrow 23/8 - 42$

6. a. Represent the expression $((a - c) \times d) / (a + (b - d))$ as a binary tree and write prefix and postfix forms of the expression. 5+5=10
 b. Find the value of the postfix expression $72 - 3 + 232 + -13 - * /$.

7. a. If G is a graph with $p \geq 3$ vertices and $\delta \geq \frac{p}{2}$, then prove that G is Hamiltonian. 5+5=10
 b. If G is a connected planer graph having V , E , and F as the sets of vertices, edges and faces respectively, then prove that
 c. $|V| - |E| + |F| = 2$

8. a. Find the chromatic polynomial of the below ABCDE graph 5+5=10



- b. Show that in any group of two or more people, there are always two with exactly the same number of friends inside the group.

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