REV-00
MCA/18/24 2016/12

# MASTER OF COMPUTER APPLICATION

## Third Semester

## GRAPH THEORY

## (MCA - 305)

**Duration: 3Hrs.** **Full Marks: 70**

Part-A (Objective) =20
Part-B (Descriptive) =50

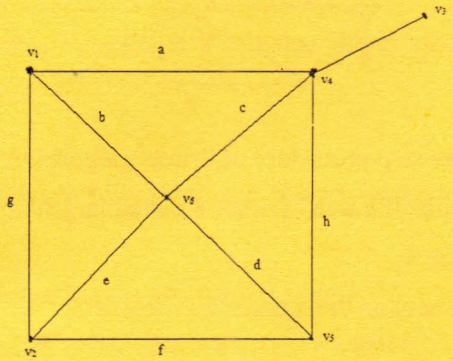
## (PART-B: Descriptive)

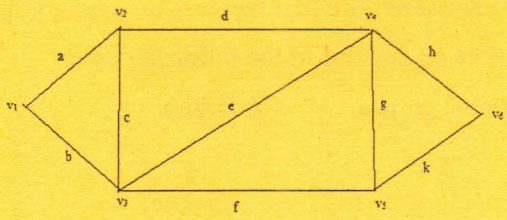
**Duration: 2 hrs. 40 mins.** **Marks: 50**

**Answer any *four* from *Question no.* 2 to 8**
***Question no.* 1 is compulsory.**

1. (i) Prove that "The sum of the degrees of all vertices of a graph is an even integer".
   (ii) Does there exists a simple graph corresponding to the following degrees: 0, 2, 2, 3, and 4.
   (iii) Find the edge and vertex connectivity of the following graphs:

(4+2+4=10)



2. (i) Prove that "If a connected graph $G$ is Eulerian, then every vertex of $G$ has even degree."

(ii) Does there exists a 5-regular graph with 11 points? If not explain why.

(iii) Give example of a graph such that it has an Eulerian path but not Hamiltonian.

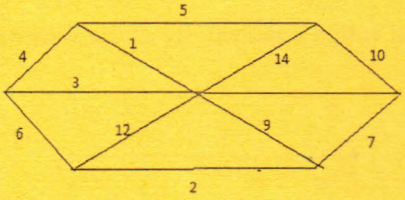
(5+3+2=10)

3. (i) Prove that "A connected graph with n vertices and (n-1) edges is a tree".

(ii) A tree T with 50 end points has an equal number of points of degree 2, 3, 4 and 5 and no point of degree greater than 5. What is the order of T?

(iii) Use Prim's algorithm to find a minimum spanning tree for the weighted graph given below:

(4+3+3=10)




4. (i) Give the step by step procedure of Prime's algorithm.

(ii) Give an example of a tree of order 8 containing six points of degree 1 and 2 points of degree 4.

(iii) Write a short note on "Fundamental cut sets".

(6+1+3=10)

5. (i) State and prove Kuratowski's first theorem for planer graph.

(ii) Write a short note on any one of the following topic:

(a) Homeomorphic graphs (b) Region

(6+4=10)

6. (i) Write step by step procedure to detect the planarity of a graph.

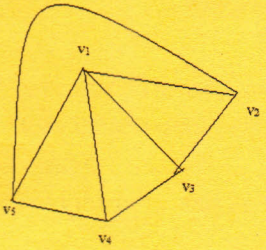
(ii) Draw the graph represented by the following adjacent matrix:

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

(iii) What is four-color conjecture?

(6+3+1=10)

7. (i) Find the chromatic polynomial of the following graph




(ii) Define chromatic number for a graph. Prove that "Every tree with two or more vertices is 2-chromatic."

(5+5=10)

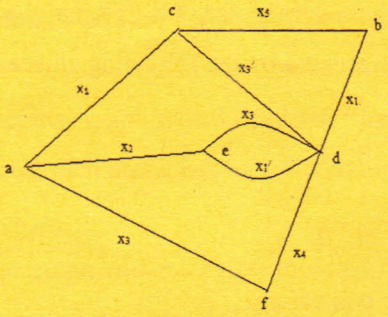
8. (i) What is the relation between "digraphs" and "binary relation"? Explain briefly with one example.

(ii) What is an isolated vertex in case of directed graph?

(iii) Find the switching function between the vertices a and *b* of the following graph:

(4+1+5=10)

PTO


c
x5
b
x3'
x1
x1
x3
x2
e
a
x1'
d
x3
x4
f

*****

# MASTER OF COMPUTER APPLICATION
## Third Semester
## GRAPH THEORY
## (MCA - 305)

**Duration: 20 minutes** **Marks – 20**

### (PART A - Objective Type)

**I. Choose the correct answer:** **1×20=20**

1. Draw the graph $K_{4,6}$.

2. If $v$ is an isolated vertex of graph $G$, then the degree of it is
   (a) Zero (b) Two (c) One (d) Four

3. In a $K$-regular graph $G$ which is true
   (a) deg$v$=$k$, $\forall v \in G$ (c)deg$v \neq$ k, for some $\forall v \in G$
   (b) deg$v$=$k$, for some $\forall v \in G$ (d)deg$v \neq$ k, $\forall v \in G$

4. A tree $T$ is
   (a) Connected and cyclic (c) Connected but not cyclic
   (b) Acyclic but not connected (d) None of the above

5. Construct a connected graph of order 6 and side 6.

6. A graph $G$ is connected graph if and only if$G$ has only
   (a) One component (c) Three component
   (b) Two component (d) Zero component

7. Every non trivial tree has at least .....end points.
   (a) One (b) Three (c) Two (d) Zero

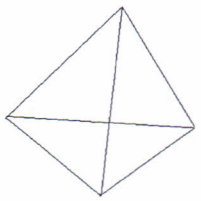
8. The degree of leaf is
   (a) 1 (b) 2 (c) 3 (d) 0

9. In a binary tree root of the tree has a degree
   (a) 1 (b) 2 (c) 4 (d) None

10. An edge in a spanning tree $T$ is called
   (a) a branch of $T$. (c) a chord of $T$.
   (b) a side (d) all of the above

11. A graph that cannot be drawn on a plane without a crossover between its edges is called a ***planer/non planer*** graph. (Pick the correct one)

12. Draw the planer graph of tetrahedron.



13. Kuratowski's second graph is
   (a) Planer (b) Non Planer (c) Complete (d) None

14. $\chi(K_p) = ?$
   (a) $p$-1 (b) $p$ (c) p+1 (d) $\frac{p-1}{2}$

15. $\chi(K_{m,n}) = ?$
   (a) $mn$ (b) $\frac{m}{n}$ (c) 2 (d)1

16. A graph with $n$ vertices and using $n$ different colors can be properly colored in
   (a) $n$! ways (b) $\frac{n}{2}$ ways (c) $\frac{n!}{2}$ ways (d) 2 ways

17. An $n$ vertex graph is a tree if and only if its chromatic polynomial is
   (a) $P_n(\lambda) = \lambda(\lambda-1)^{n-1}$ (c) $P_n(\lambda) = \lambda(\lambda-1).....(\lambda-n+1)$
   (b) $P_n(\lambda) = \lambda(\lambda-1)$ (d) None
   where $\lambda$ is the maximum number of colors to be used.

18. A vertex $v$ in a digraph is called pendent vertex if
   (a) $d^+(v)+d^-(v)=1$ (c) $d^+(v)+d^-(v)=\frac{1}{2}$
   (b) $d^+(v)-d^-(v)=1$ (d) $d^+(v)+d^-(v)=0$
   where $d^+(v)$ is out-degree of $v$ and $d^-(v)$ is in-degree of $v$.

19. The digraph of reflexive relation will have a ……..at every vertex.
    (a) Self-loop (c) Cycle
    (b) Parallel edges (d) None

20. In contact network, a binary a variable $x_i$ assigned to a value …….when the contact is closed.
    (a) 0 (b) 1 (c) -1 (d) 2

*****