

U.G. 4th Semester Examination - 2024

MATHEMATICS

[PROGRAMME]

Skill Enhancement Course (SEC)

Course Code : MATH-G-SEC-T-2(A&B)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate marks.

The symbols and notations have their usual meanings.

Answer all the questions from Selected Option.

OPTION-A

MATH-G-SEC-T-2A

(Graph Theory)

1. Answer any five questions: $2 \times 5 = 10$

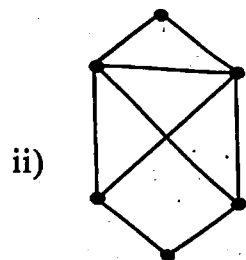
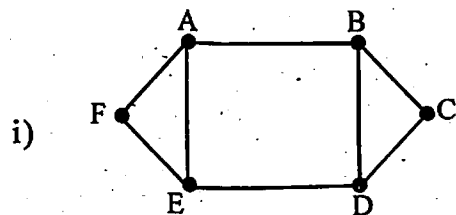
- a) What is the number of edges present in a complete graph K_5 , having 5 vertices?
- b) The sum of the out degrees of all vertices of a di-graph is 20. Find the number of edges of the graph.

[Turn Over]

c) Does there exist a simple graph with five vertices having degrees 2, 2, 4, 4, 4? Justify your answer.

d) Find the maximum number of edges in a bipartite graph of 12 vertices.

e) Draw the complement of the following graph:



f) G be a graph of 35 edges. If all vertices have degree at least 3, what is the maximum number of vertices G can have.

g) Draw a graph G that has the incidence matrix I .

$$I = \begin{array}{c|ccccc} & a & b & c & d & e \\ \hline u & 1 & 2 & 1 & 0 & 0 \\ v & 0 & 0 & 1 & 1 & 1 \\ w & 0 & 0 & 0 & 0 & 0 \\ x & 1 & 0 & 0 & 1 & 1 \end{array}$$

h) Let T be a tree with 10 vertices. Find the sum of the degrees of all the vertices in T .

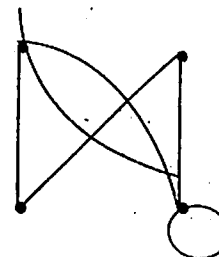
2. Answer any two questions: $5 \times 2 = 10$

a) Prove that minimum number of edges in a connected graph with n vertices is $(n - 1)$.

b) Show that a graph is connected if and only if it has a spanning tree.

c) Prove that the number of vertices of a self-complementary graph must be of the form $4p$ or $4p+1$, where p is a non-negative integer.

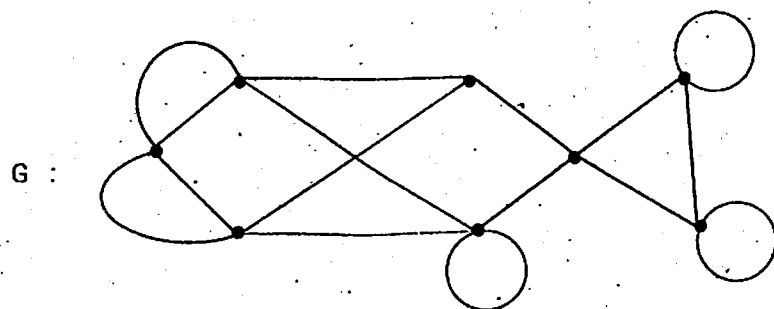
d) Determine the adjacency matrix of the following graph:



3. Answer any two questions: $10 \times 2 = 20$

a) In the following graph G, find:

- i) A walk of length 8
- ii) A trail of length 7
- iii) A circuit of length 7
- iv) A cycle of length 6
- v) A trail containing all the edges of G

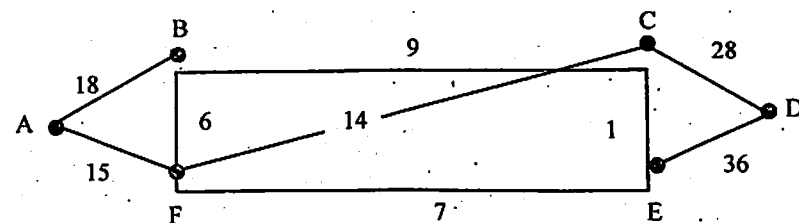


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b) i) Let G be a simple connected graph with n (≥ 3) vertices and m edges. If $m \geq \frac{1}{2}(n-1)(n-2)+2$, show that G is Hamiltonian.

ii) Show that number of pendant vertices in a binary tree is $\frac{1}{2}(n+1)$, where n is the number of vertices in the tree. $5+5$

c) i) Applying Dijkstra's Algorithm find the shortest path from the vertex A to D in the following simple graph:



ii) Let G be a graph having no cycles, n vertices and k connected components. Then prove that G has $(n - k)$ edges. $5+5$

OPTION-B

MATH-G-SEC-T-2B

[Operating System (Linux)]

1. Answer any **five** questions: $2 \times 5 = 10$

- a) Define Operating System.
- b) What is kernel in LINUX operating system?
- c) What are the different types of commonly used shells on a typical LINUX system?
- d) List some methods of virtualization available on LINUX.
- e) What are the components of the LINUX file structure.
- f) What is the difference between 'grep' and 'egrep' commands?
- g) Explain role of spool directory while printing file in LINUX.
- h) Explain the three types of files used in LINUX OS.

2. Answer any **two** questions: $5 \times 2 = 10$

- a) Explain FIFO page replacement algorithm with an example.

b) Explain the architecture of LINUX operating system.

c) What are wildcards? Explain.

d) Discuss File attributes in LINUX.

3. Answer any **two** questions: $10 \times 2 = 20$

a) Define deadlock. Explain different methods of handling deadlocks in detail. $2+8$

b) Explain the backing up and restoring process in LINUX OS. $5+5$

c) What are the different types of LINUX shell? Write a note on shell configuration and initialization. $3+7$

d) Write a shell script to sort a given five digits number in ascending order using an array. 10