

**E 6161**



Reg. No.....

Name.....

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, SEPTEMBER 2024**

**Sixth Semester**

Core Course—DISCRETE MATHEMATICS

(For B.Sc. Mathematics Model I and Model II)

[Prior to 2013 Admissions]

Time : Three Hours

Maximum Weight : 25

**Part A**

*Answer all questions.*

*Each bunch of **four** questions carries a weight of 1.*

- I. 1 Define a finite graph.
- 2 Define graph isomorphism.
- 3 Define a complete graph.
- 4 What is a connected graph ?
- II. 5 Define diameter of a graph.
- 6 Give an example of a tree with just one central vertex that is also a centroidal vertex.
- 7 What is an Eulerian graph ?
- 8 Define a Hamiltonian graph.
- III. 9 State travelling salesman problem.
- 10 Define adjacency matrix associated with a graph.
- 11 Define a spanning tree.
- 12 What is decryption.
- IV. 13 Give two examples of Private key Cryptosystem.
- 14 Define a partially ordered set.





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15 Write the dual of  $a \wedge (b \vee a) = a \vee a$ .

16 What is a bounded lattice.

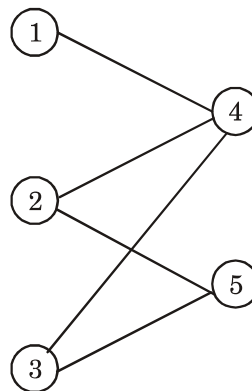
(4 × 1 = 4)

**Part B**

*Answer any **five** questions.  
Each question carries a weight of 1.*

17 Show that every graph has an even number of odd vertices.

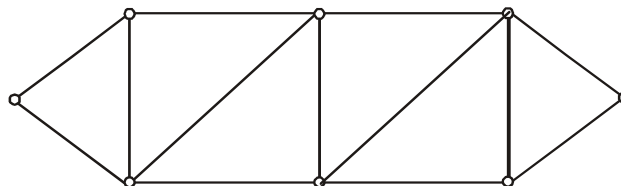
18 Find the adjacency matrix of the graph :



19 Show that if a graph is disconnected, its complement is connected.

20 Is there an Eulerian graph of even order and odd size ? Justify.

21 Determine the closure of the following graph :

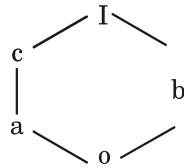


22 What is the secret message produced from the message “MEET YOU IN THE PARK”.





23 Is the following lattice distributive :



Justify your answer :

24 Show that a lattice of length 2 is modular.

(5 × 1 = 5)

**Part C**

*Answer any **four** questions.*

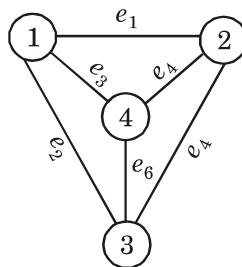
*Each question carries a weight of 2.*

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

26 Draw a complete graph with four vertices.

27 Show that the Petersen graph is not Hamiltonian.

28 Write the incidence matrix of the graph given below :



29 Encrypt the message STOP using the RSA cryptosystem with key (25, 37, 13).

30 Let L be a lattice. Show that  $a \wedge b = a$  if and only if  $a \vee b = b$ .

(4 × 2 = 8)

**Turn over**



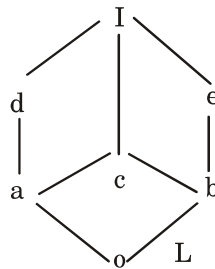


**Part D**

Answer any **two** questions.

Each question carries a weight of 4.

- 31 Show that a graph is bipartite if and only if it contains no odd cycles.
- 32 Show that for a non-trivial connected graph  $G$ , the following statements are equivalent.
  - (a)  $G$  is Eulerian.
  - (b) The degree of each vertex of  $G$  is an even positive integer.
  - (c)  $G$  is an edge-disjoint union of cycles
- 33 Consider the following lattice  $L$ .



- (a) Which non-zero elements are join irreducible
- (b) Which elements are atoms ?
- (c) Which of the following are sub-lattices of  $L$  ?

$$L_1 : \{o, a, b, I\}, L_2 : \{o, a, e, I\}$$

$$L_3 : \{a, c, d, I\}, L_4 : \{o, c, d, I\}$$

- (d) Is  $L$  distributive.
- (e) Find the complements, if they exist for the elements  $a, b, c$ .
- (f) Is  $L$  a complemented lattice.

(2 × 4 = 8)

