



Register Number:

Date:

ST JOSEPH'S UNIVERSITY, BENGALURU-27  
UG OPEN ELECTIVE - III Semester  
SEMESTER EXAMINATION: OCTOBER 2023  
(Examination conducted in November/December 2023)  
**MTOE 7 : Graphs and their real life applications**

(For current batch students only)

**Duration:** 2 Hours

**Max. Marks:** 60

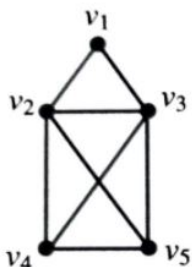
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1. This question paper contains **TWO** printed pages and **THREE** parts.
  2. Calculators are NOT allowed.
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**PART A**

**ANSWER ANY SIX QUESTIONS:**

**6×2=12**

1. Define self loop in a graph with an example.
2. Draw the complete bipartite graph  $K_{3,3}$  and wheel graph  $W_5$ .
3. State the necessary and sufficient condition for a graph to have an Euler circuit.
4. Define planar graphs. Give planar representation of complete graph  $K_4$ .
5. State Four Colour Theorem.
6. Draw any two spanning tree for the graph given below.



7. Define m-ary tree. Give an example.
8. State the n-Queens problem.

**PART B**

**ANSWER ANY THREE QUESTIONS:**

**3×6=18**

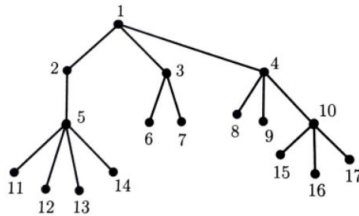
9. Verify the hand-shaking property for Petersen graph.
10. Determine the order of the cubic graph with 9 edges.
11. Show that the cycle graph  $C_6$  is bipartite.
12. Explain the Icosian game puzzle.
13. Explain the Chinese postman problem.

**PART C**

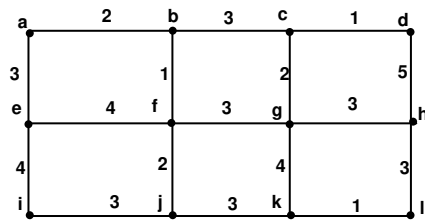
**ANSWER ANY FIVE QUESTIONS:**

**5×6=30**

14. Solve the three men and three utilities problem.
15. Suppose that a connected planar simple graph has 20 vertices, each of degree 3. How many regions does a representation of this planar graph split the plane?
16. Explain the application of trees as models for chemical compounds and the structure of organizations.
17. Find the chromatic number for complete graph  $K_n$ .
18. Define preorder and postorder traversals. For the tree shown below find the preorder traversals and postorder traversals.



19. Explain the steps in Prim's algorithm. Use Prim's algorithm to find a minimum spanning tree in the weighted graph shown below.



20. Explain the backtracking algorithm. How can backtracking be used to decide whether a graph can be colored using  $n$  colors?