Q.P Code **D 122904**	Total Pages **3**	Name 603242
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SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2025

MATHEMATICS

MAT2MN104 Graph Theory and Automata

2024 Admission Onwards

Maximum Time :2 Hours	**Maximum Marks :70**

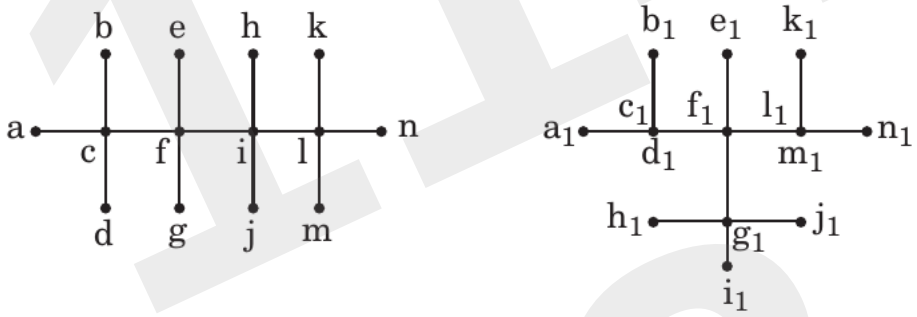
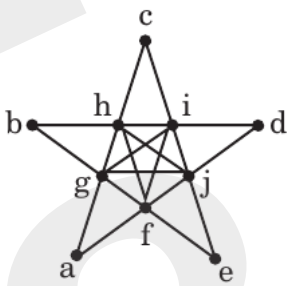
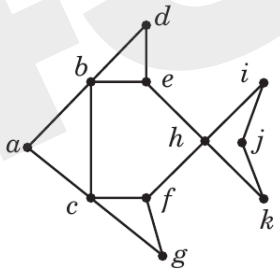
Section A

All Question can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Define adjacency matrix of a graph. Write the adjacency matrix of $K_{3,3}$
2	Is a graph with four vertices a, b, c, and d with deg $(a) = 4$, deg $(b) = 5 =$ deg (d), and deg $(c) = 2$ possible?. If it is possible, draw a graph and if it is not possible, explain the reason.
3	Find the number of edges in the complete bipartite graph $K_{m,n}$.Explain.
4	Write a short note on independent subset of the vertex set
5	Is the complete graph K_6 Eulerian? Defend your answer.
6	Write Euler's formula for a connected planar graph
7	State Kuratowski's theorem
8	Define Alphabet and Language
9	Let $\Sigma = \{a, b, c\}, A = \{a, ab\}, B = \{b, ab\}$, and $C = \{\lambda, bc\}$. Verify that $A(B \bigcup C) = AB \bigcup AC$
10	Write a short note on finite-state automaton

Section B

All Question can be answered. Each Question carries 6 marks (Ceiling : 36 Marks))

11	Characterize the adjacency matrix of the complete graph K_n.
12	Prove or Disprove the following graphs are Isomorphic 
13	Using the complete graph K_5, explain the terms Eulerian path, Eulerian circuit and Eulerian graph
14	Under what conditions will the complete graph K_n and complete bipartite graph $K_{m,n}$ be Hamiltonian? Explain why?
15	Is the following graph planar? Why? 
16	Using Kruskal's algorithm, construct a spanning tree of the the following graph 

17	Identify each language over $\Sigma = \{a, b\}$. (i) $\{a, b\}^*\{b\}$ (ii) $\{a\}\{a, b\}^*$ (iii) $\{a\}\{a, b\}^*\{b\}$
18	Find the language generated by each grammar $G = (N, T, P, \sigma)$ where: $N = \{\sigma, A, B\}, T = \{a, b\}, P = \{\sigma \to aAa, A \to bBb, \sigma \to \lambda, A \to a, B \to a, B \to b\}$

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks))

19	Give an example of a graph that is: (a) Both Eulerian and Hamiltonian. (b) Eulerian, but not Hamiltonian. (c) Hamiltonian, but not Eulerian. (d) Neither Eulerian nor Hamiltonian.
20	Prove that $K_{3,3}$ is nonplanar.