

SE (ECS) sem IV 'C' scheme Summer 2025 Exam Date: 23/5/25

Time: 3 Hours

Max. Marks: 80

NB:

1. Question No. 1 is compulsory and solve any THREE questions from remaining questions
2. Assume suitable data if necessary
3. Draw clean and neat diagrams

Q.1 Attempt any four

Marks

- a. Show using truth table that the statements $(p \rightarrow q)$ and $(\sim p \vee q)$ are logically equivalent. **5**
 - b. Design a DFA with $\Sigma = \{0, 1\}$ accepts the only input 101. **5**
 - c. Explain mealy and Moore machine, the O/P depends upon and explain with proper diagram. **5**
 - d. Calculate union of two Regular Expression. With proper steps
RE1 = $a(aa)^*$ and RE2 = $(aa)^*$ **5**
 - e. Prove using Mathematical Induction that $1 + 3 + 5 + \dots + (2n - 1) = n^2$ **5**
- Q.2.a. Define with example Euler path, Euler circuit, Hamiltonian path, and Hamiltonian circuit. **10**
- b. Define and give the Example of Injective, Surjective & Bijective function. Check the Injectivity and Surjectivity for the following function. $f: \mathbb{N} \rightarrow \mathbb{N}$ given by $f(x) = x^2$ **10**
- Q.3.a Differentiate between DFA and NFA. **5**
- b. Prove that Statement $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology. **5**
- c. Consider the set $A = \{4, 5, 6, 7\}$. Let R be the relation \leq on A. Draw the directed graph and the Hasse diagram of R. **10**
- Q.4.a. What is Dijkstra's Algorithm? Working Example of Dijkstra's Algorithm **10**
- b. Explain Warshall's algorithm. Consider the set $A = \{1, 4, 7, 8\}$ and $R = \{(1, 4), (4, 7), (7, 4), (1, 8)\}$. Find out the transitive closure of R using Warshall's algorithm **10**
- Q.5. a Explain isomorphism in graph. Is it possible to draw a graph with 5 vertices of degree 1, 1, 2, 2, 4? **10**
- b. Write a short notes on Types of Grammar with examples of each. **10**
- Q.6 Write notes on following
- a) Write a short note on Myhill- Nerode theorem. **5**
 - b) What are Graph Isomorphism Conditions? **5**
 - c) State fundamental theorem of graph theory **5**
 - d) Explain Types of Functions with Example and Diagram. **5**