R22 Regulation *Subject code: 4E5EA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech V Semester Supplementary Examinations, May 2025

FORMAL LANGUAGES AND AUTOMATA THEORY

(CSE)

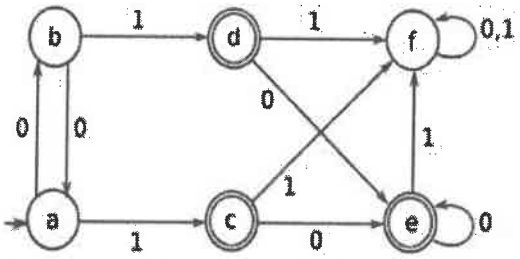
Maximum Marks: 60 Date:23.06.2025 AN Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	Write about the applications of Finite Automata?	1M	1	L1
b)	Write a procedure for conversion of NFA to DFA?	1M	1	L1
c)	Construct a regular grammar for the regular expression a*b(a+b)*	1M	2	L2
d)	List closure properties of regular languages.	1M	2	L2
e)	For the CFG remove the ε production S → aSa/ bSb/ε	1M	3	L1
f)	Define a pushdown automaton (PDA).	1M	3	L1
g)	What are the closure properties of context-free languages?	1M	4	L1
h)	Describe the basic structure of a Turing Machine.	1M	4	L2
i)	Compare recursive and recursive enumerable languages.	1M	5	L1
j)	Define NP-complete problem.	1M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	a) Minimize the following finite automata. 	5M	1	L5
	b) Briefly discuss about Finite Automata with Epsilon-Transitions.	5M	1	L3
	OR			
3	Design DFA for the following over {a, b} i) All strings containing not more than three a's. ii) All strings that has at least two occurrences of b between any two occurrences of a.	5M 5M	1	L4
4	a) Define Regular Expression? Explain about the properties of Regular Expressions.	5M	2	L2

	b) Apply pumping lemma for the language L={a^n /n is prime} and prove that it is not regular?	5M	2	L2
	OR			
5	Design a FA for the following languages i) (0*1*)* ii) (0+1)* 111* iii) (0* 11* + 101)	10M	2	L2
6	a) Explain about Ambiguity in Grammars and Languages with example.	5M	3	L2
	b) Construct PDA from the following CFG S → aAA A → aS|bS|a	5M	3	L5
	OR			
7	a) Derive left and right most derivations for the input string a=b*c+d/e for the given Grammar. E → E+E|E-E|E*E E → E/E E → (E)|id	5M	3	L3
	b) Differentiate PDA and non-deterministic PDA.	5M	3	L2
8	a) Define Chomsky Normal Form (CNF). Convert the following grammar to CNF S → 0S0|1S1|∈	5M	4	L2
	b) Design a Turing machine to recognize all strings consisting of odd numbers of 1's.	5M	4	L3
	OR			
9	Design a Turing machine over Σ={a,b} to accept the language L={WW^R |W∈(a,b)+}.	10M	4	L3
10	a) Explain the concepts of Undecidable Problems about Turing Machines.	5M	5	L2
	b) Let ε = {0,1} and A,B be the list of 3 strings each. Verify below PCP has a solution or not?	5M	5	L2
	OR			
11	a) Explain about Post's Correspondence Problem with an example.	5M	5	L2
	b) Discuss in detail about P and NP problems.	5M	5	L2