R22 Regulation *Subject code:4E5EA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Supplementary Examinations, April 2026

FORMAL LANGUAGES AND AUTOMATA THEORY

(CSE)

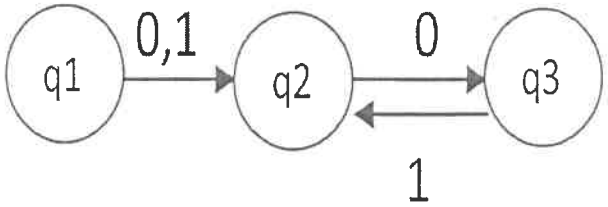
Maximum Marks: 60 Date:20.04.2026 Duration: 3 hours

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

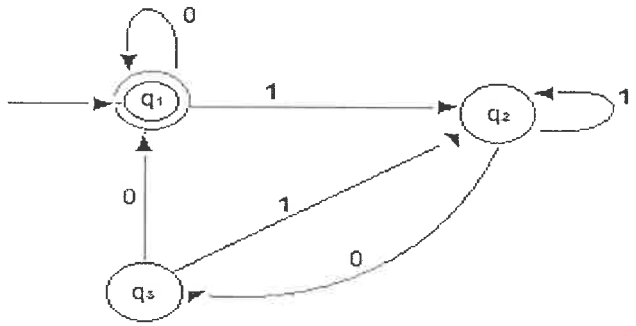
All the following questions carry equal marks (10x1M=10 Marks)		Marks	CO	BTL
1a)	What is transition diagram? How is it related to finite automata?	1M	1	L2
b)	List out applications of FA	1M	1	L1
c)	State Arden's theorem	1M	2	L1
d)	List the decision prosperities of regular languages	1M	2	L1
e)	When do you say that a string is accepted by PDA?	1M	3	L1
f)	Define the ID of PDA	1M	3	L1
g)	List any two closure properties of context-free languages.	1M	4	L1
h)	Describe the transition function of Turing machine	1M	4	L2
i)	Define polynomial space	1M	5	L1
j)	What is a language that is not recursively enumerable?	1M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) Design NFA to accept the set of all strings over {a,b} that ends with 'aba' and find its equivalent DFA to accept the same set.	5M	1	L5
	b) How DFA is different from NFA. Convert the DFA to NFA. q1 is initial state and q3 is final state. 	5M	1	L2
	OR			

3	a) Design NFA without ε-transitions for a given NFA with ε-transition, where q0 and q2 are the initial and final states respectively. b) Draw a Moore machine to determine the residue mod 4 for each binary string treated as integer.	5M 5M	1 1	L5 L3
4	a) Show that L = $\{0^i 1^j / \gcd(i, j) = 1\}$ is not regular. b) Find the regular expression generated by the given finite automata	5M 5M	2 2	L3 L3
	OR			
5	a) Construct a Є-NFA equivalent to the regular expression (10+11)*00. b) Reduce the Following DFA where q_1 is the initial state and q6 is the final state	5M 5M	2 2	L3 L3
6	a)Given a Grammar G=({E},{+,*,id},P,E) where P=E-E+E/E*E/id. Give all possible LMD's, RMD's and also parse tree for the string id+id*id+id. b)Convert the PDA P={{p,q}, {0,1}, {X,Z}, q, Z, { }, δ} into a CFG where δ is given as 1) δ(q,1,Z)={(q,XZ)}, 2) δ(q,1,X)={(q,XX)}, 3) δ(q,0,X)={(q,X)} 4) δ(p,0,Z)={(q,Z)}, 5) δ(q, ε,X)={(q, ε)}, 6) δ(p,1,X)={(p, ε)}	5M 5M	3 3	L2 L2

	a	b	c	ε
q0	{q0}	Φ	Φ	{q1}
q1	Φ	{q1}	Φ	{q2}
q2	Φ	Φ	{q2}	Φ



Q\Σ	0	1
q_1	q_2	q_3
q_2	q_4	q_5
q_3	q_6	q_7
q_4	q_4	q_5
q_5	q_6	q_7
q_6	q_4	q_5
q_7	q_6	q_7

	OR			
7	a)What is an ambiguous grammar? Check the grammar G having productions S → aB/bA, A → a/aS/ bAA, B → b/bS/aBB is ambiguous or not? b) Construct a PDA to the following CFG S→0BB; B→0S/1S/0	5M 5M	3 3	L3 L3
8	a) Define CNF grammar and convert the following CFG into its equivalent CNF S->ABC A->BC/a B->bAC/ε C->cAB/ ε b) Explain the model of a Turing Machine	5M 5M	4 4	L2 L2
	OR			
9	a) Design a Turing machine to compute factorial of a given number. b) Compare and contrast Finite Automata, Pushdown Automata, and Turing Machines.	5M 5M	4 4	L5 L4
10	a) Give the correspondence between P, NP and NP-complete problems. b) Write the properties of recursive and non-recursive enumerable languages	5M 5M	5 5	L2 L3
	OR			
11	a) Define Post Correspondence Problem. Check and tell whether the following PCP instance has a solution. A=(01,001,10) B=(011,10,00) b) Discuss the concept of intractability and why NP-complete problems are considered intractable.	5M 5M	5 5	L3 L2