09 SEP 2025

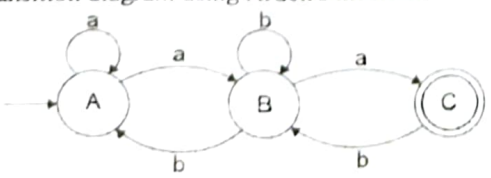
IN-SEMESTER EXAMINATION-I
TE (Semester-V)
SUBJECT – Automata Theory

Branch: IT
Div.: ALL
Duration: 60 Minutes

Date: 03/09/2025
Timing: 4:00 PM to 5:00 PM
Maximum Marks: 20

Instructions –

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.1		Answer any 5 of the following questions	Marks	Course Outcomes	Learning Levels
	a.	State Finite State Machine formally with it's components?	2	1	R
	b.	Define Formal Definition of NFA with tuple and give its example.	2	1	U
	c.	List the Applications of Finite Automata(FA).	2	1	R
	d.	Write a regular expression (RegEx) for the given language: a) Binary strings has an even number of 0's and an even number of 1's. b) Strings over $\sum$ ={a, b} in which the fourth symbol from the end is 'b'.	2	2	R
	e.	i) How many states are required in a DFA that accepts all strings over $\sum$={a,b} that contain at least one a followed by one b a) 3, b) 4, c) 5, d) 2, e) 6, f) 1 ii). Which of the following strings belong to the language L = {w | w has an even number of a's} over $\sum$={a, b}? I. aabbaa II. abba III. aaabb IV. baaab	2	2	U
	f.	Discuss the closure property of regular languages under intersection and provide an example.	2	3	U
	g.	Define right linear grammar with an example.	2	3	U
Q.2	a.	Compare & contrast Moore and Mealy machines.	5	2	AN
		OR			
	b.	Construct a DFA accepting strings, having substrings either 'aba' or 'bab' over $\sum$={a,b}.	5	2	A
Q.3	a.	State the Pumping Lemma and prove that the language $L=\{a^n b^n c^n \mid n \geq 1\}$ is not regular.	5	3	AN
		OR			
	b.	Describe Arden's Theorem and Find the regular expression for above state transition diagram using Arden's theorem. 	5	3	AN

IN-SEMESTER EXAMINATION-II

T.E. (Semester-V)

SUBJECT – Automata Theory

Branch: IT
Div.: ALL
Duration: 60 Minutes
Instructions –

Date: 15/10/2025
Timing: 3:30-4:30PM
Maximum Marks: 20

1. All questions are compulsory.
2. Assume suitable data wherever necessary and state the assumptions made.
3. Diagrams / sketches should be given wherever necessary.
4. Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5. Figures to the right indicate full marks.

Q.1		Answer any 5 of the following questions	Marks	Course Outcomes	Learning Levels
	a.	Define useless variable and give example.	2	4	U
	b.	Which of the following languages is generated by the given grammar? S -->aS | bS | ϵ	2	4	U
	c.	Compare and contrast between deterministic and non-deterministic PDAs	2	5	AN
	d.	Describe the transition function of a pushdown automaton (PDA) and its significance in language recognition.	2	5	AN
	e.	List down variants of Turing Machine	2	6	R
	f.	Mention one real-world application of a Turing Machine concept.	2	6	A
	g.	Discuss the halting problem in Turing Machine	2	6	U
Q.2	a.	Find a leftmost derivation and a rightmost derivation with corresponding parse trees for strings "aaabbabbba" using the following CFG. S → aB / bA A → aS / bAA / a B → bS / aBB / b	5	4	A
		OR			
	b.	Simplify the following context free grammar S--> aAbB | ba A --> aA | ϵ B --> bB | ϵ	5	4	AN
Q.3	a	Construct a PDA to recognize L = $\{(ab)^n c^n \mid n>=1\}$	5	5	A
		OR			
	b.	Design the PDA equivalent to the following S -> AB A->aA |ϵ B->b	5	5	A

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TCET/EXAM/FRM/IP-03/06 REVISION: B

END SEMESTER EXAMINATION, NOV 2025
T.E. SEMESTER V (CBCGS-HME 2023)

28 NOV 2025

Branch:	**Information Technology**	**Q.P. Code:**	**E566RN253-2**
Subject:	**Automata Theory**	**Duration:**	**2 Hours**
Subject Code:	**PCC –IT 502**	**Max. Marks:**	**60**

Instructions:
1. **All sections are compulsory**
2. **Figures to the right indicate full marks.**
3. **Assume suitable data if necessary and state the assumptions clearly.**

Section-I	**Short Answer Questions (Answer any 05 questions out of 06) (Fundamental, Core Types)**				**(10 Marks)**
Q. No.		**Marks**	**CO**	**RBT Level**	**PI**
1	List down the components of an Finite State Machine and give one example.	2	1	R	1.2.1
2	Discuss Arden's Theorem with an example.	2	2	U	1.2.1
3	Write a regular expression representing a language over the alphabet {0, 1} that contains Even no. of 0's.	2	3	A	3.6.2
4	Find context free grammar generating all string containing a's and b's with atleast one a.	2	4	A	3.6.2
5	Define a pushdown automaton (PDA) and explain its components.	2	5	R	3.5.1
6	Illustrate the "halting problem" in the context of Turing Machines?	2	6	R	3.5.1
Section-II	**Descriptive Answer Questions (Answer any 04 out of 06) (Descriptive, Comprehension Types)**				**(20 Marks)**
1	Design a Moore Machine For input from (0+1)*. if the input ends in 101, output A; if the Input ends in 110. output B otherwise output C.	5	1	A	2.6.3
2	Consider the regular grammar G=({S,A,B}, {a,b}, P, S) where P consists of the following production rules: S→aA, A→bB, and B→ϵ . Describe the language generated by this grammar and provide examples of strings in the language.	5	2	E	1.7.1
3	Apply the Pumping Lemma to prove that the language L={ww^R|w∈{0,1}*} is not regular.	5	3	AN	1.7.1
4	Find a leftmost derivation and a rightmost derivation with corresponding parse trees for strings "001222" using the following CFG, S -->aS | bA | cB | Є A --> bA | cB | Є B --> cB | Є	5	4	AN	2.5.2
5	Design PDA to recognize L= { a^n b ^2n |n>=1}	5	5	A	3.6.2

6	Design turing machine to replace each occurances of "aba" by "aab" over {a,b}*	5	6	A	2.6.3
Section-III	**Long Answer Question (Answer any 03 out of 05) (Application, Analytical, Evaluation, Design Type)**				**(30 Marks)**
1	Design DFA that accepts the following language i) L = Set of all strings with odd number of 0's followed by even number of 1's ,E={0,1} ii) L = Set of all strings which begin and end with different letters E={x,y}	10	2	AN	3.6.1
2	Apply the Pumping Lemma to prove following languages are regular or not i)L ={$a^k b^k$ | k>0} ii) L ={a^n| where n is a Prime Number}	10	3	A	1.7.1
3	Convert the following CFG into Chomsky Normal Form (CNF) i)S → aAB | b A → aA | b B → cB | A | ∈ ii)S → AB | CD A → aA | b B → cB | d C → eC | f D → gD | h	10	4	AN	3.6.1
4	Design a Pushdown Automaton (PDA) for the language L={w∈{0,1}* |the number of 0's is twice the number of 1's}	10	5	AN	3.6.2
5	Construct Turing Machine for the following a) To increment a binary number by one b) To accept the language L={$a^n b^{2n}$ }| n>=1 }	10	6	A	3.6.2