Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 411037.
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Examination: ESE

Year: 2023-24 **Branch:** AIDS

Subject: Automata Theory **Subject Code:** AI2017

Max. Marks: 100 **Total Pages of Question Paper:** 02

Day & Date: Friday 24/11/23 **Time:** 2:30pm TO 5:30pm

Instructions to Candidate

1. All questions are compulsory.
2. Neat diagrams must be drawn wherever necessary.
3. Figures to the right indicate full marks.

Q. N.	CO No	BT* No		Max marks
Q. 1.	1	1	a) Define General Finite State Machine(FSM) and explain working of FSM.	5
	1	3	b) Difference between DFA and NFA with suitable examples.	5
	1	2	c) What is Kleene Closure and Kleene Star explain with suitable example	5
Q. 2.	2	4	**A) Attempt any 1** a) Convert following R.E. into NFA with ϵ (a(b)*)+b	5
	2	4	b) Write a regular expression for language over input symbol {a,b} which accept 1) Even number of b. 2) All string do not have substring 'ab'	5
	2	5	B) Draw and Convert following NFA to DFA M=({q0,q1,q2,q3},{a,b},δ,q0,{q3}) where q3 is final state and δ function is	10
Q. 3.	3	3	**A) Attempt any 2** a) Convert the following grammar to Chomsky Normal form (CNF) S→a | Aa | B A→BaB | ε B→aA | b	5
	3	5	b) Write a grammar without unit production from following CFG S→ A|dd A→B | d B→S | c	5

δ	0	1
-> q0	{q0,q1}	q0
q1	q2	q1
q2	q3	q3
* q3	Φ	q2

	3	3	c) Write a grammar in reduced form 1.Eliminate useless symbol 2. ϵ-production from following CFG S→ ABA|AD A→aA | ε B→bB | ε	5
	3	4	**B) Attempt any 2** a) Consider the following grammar. E-> E - E | E*E | id Derive the string id-id*id using i) Leftmost derivation ii) Rightmost derivation. also draw a derivation tree for both leftmost and rightmost derivation.	5
	3	3	b) What is ambiguous grammar ? Explain with suitable example .	5
	3	6	c)Show that the following grammar is ambiguous. A -> AA | (A) | a	5
Q. 4.	4	2	a) What is PDA? Explain deterministic and non deterministic PDA.	5
	4	3	b) Compare FA and PDA by using formal definitions.	5
	4	2	c) Explain working of PDA with a neat diagram .	5
	4	4	d) What is Context Sensitive Grammars? Explain with suitable examples.	5
Q.5	5	2	**Attempt any 3** a) What is a Turing Machine? Give the formal definition of a Turing machine .	5
	5	5	b) List applications of Turing Machine.	5
	5	6	c) Explain working of Turing Machine.	5
	5	6	d) Design a TM for 0^n1^n language	5
Q.6	6	1	a) Define the Class P and Class NP with their example in detail	5
	6	4	b) Justify "Halting Problem of Turing machine is undecidable"	5
	6	2	c) What is the undecidability problem ? Explain	5

CO Statements:

CO1:Students should be able to design Automata / Regular expression for given computational problems
CO2:Students should be able to correlate given computational model with its Formal Language
CO3:Students should be able to understand Chomsky hierarchy and write grammar for languages
CO4:Students should be able to design PDA / TM for given computational problem
CO5:Students should be able to analyze power of different computational models
CO6:Students should be able to understand complexity classes and un / decidability of problems

***Blooms Taxonomy (BT) Level No:**

- 1 Remembering; 2. Understanding; 3. Applying; 4. Analyzing; 5. Evaluating; 6. Creating