Hall Ticket Number:

Code No. : 15646 S N/O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (I.T.) V-Semester Supplementary Examinations, June-2023
Automata Languages & Computation

Time: **3 hours**

Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	What are the differences among DFA, NFA and ε-NFA?	2	2	1	1
2.	State Arden's theorem. Give an example	2	2	1	1
3.	Distinguish between derivation tree and parse tree	2	1	2	1
4.	Define ambiguous CFG. Give an example	2	1	2	1
5.	Give the formal definition of PDA to accept L (M) and N(M).	2	2	3	1
6.	What is left recursive grammar? How to remove left recursion from a grammar? Give an example.	2	1	3	1
7.	The following description of Turing Machine accepting $\{0^n1^n \mid n \geq 1\}$, with q_0 as initial state and q_f as final state. What is the number of head movements of TM on input 0^n1^n.	2	4	4	2

δ	0	1	X	Y	B
q_0	(q_1,X, R)			(q_3,Y, R)	
q_1	$(q_1,0, R)$	(q_2,Y, L)		(q_1,Y, R)	
q_2	$(q_2,0, L)$		(q_0,X, R)	(q_2,Y, L)	
q_3				(q_3,Y, R)	(q_f, B, R)
q_f	Final state; Accept				

Q. No.	Stem of the question	M	L	CO	PO
8.	Describe Instantaneous Description (ID) of a TM	2	1	4	1
9.	Give the relationship between P, NP , NP-Hard and NP-Complete problems.	2	1	5	1
10.	Define PCP and MPCP. Give an example	2	1	5	1

Part-B (5 × 8 = 40 Marks)

Q. No.	Stem of the question	M	L	CO	PO
11. a)	Design a DFA for following languages over the alphabet {0, 1}. L = {w | |w| is divisible by 3 or it ends in 00}	4	3	1	2
b)	Convert the following NFA to DFA	4	2	1	1

δ	a	b	c	d
q_0	--	--	--	$\{q_0,q_1\}$
q_1	--	--	$\{q_1,q_2\}$	--
q_2	--	$\{q_2,q_3\}$	--	--
q_3	$\{q_3,q_0\}$	--	--	--

				4	1	2	1

12. a) Given the following DFA of which A is the start state and D is the accept state, find the equivalent Minimized DFA.

	0	1
→A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

				4	1	2	1

b) Consider the following grammar. Construct left most derivation &parse tree for the following sentences $(a, ((a, a), (a, a)))$

$$S \rightarrow (L) \,|\, a$$

$$L \rightarrow L, S \,|\, S$$

				4	3	3	2

13. a) Convert the following PDA to CFG. At the end give the minimized resultant grammar.

Let $M = (\{q_0, q_1\}, \{a, b, c\}, \{Z_0, A, B\}, \delta, q_0, Z_0, \phi)$, where δ is shown below. Note that '#' is the end marker of the input string.

$$\delta(q_0, a, Z_0) = \{ (q_0, AZ_0) \} \quad \delta(q_1, a, A) = \{ (q_1, \varepsilon) \}$$

$$\delta(q_0, b, Z_0) = \{ (q_0, BZ_0) \} \quad \delta(q_0, a, B) = \{ (q_0, AB) \}$$

$$\delta(q_0, c, Z_0) = \{ (q_1, Z_0) \} \quad \delta(q_0, b, B) = \{ (q_0, BB) \}$$

$$\delta(q_0, a, A) = \{ (q_0, AA) \} \quad \delta(q_0, c, B) = \{ (q_1, B) \}$$

$$\delta(q_0, b, A) = \{ (q_0, BA) \} \quad \delta(q_1, b, B) = \{ (q_1, \varepsilon) \}$$

$$\delta(q_0, c, A) = \{ (q_1, A) \} \quad \delta(q_1, \#, Z_0) = \{ (q_1, \varepsilon) \}$$

				4	2	3	1

b) Convert the following grammar into Greibach Normal Form.

$$A_1 \rightarrow A_2 A_3$$

$$A_2 \rightarrow A_3 A_4 \,|\, a$$

$$A_3 \rightarrow A_4 A_1 \,|\, b$$

$$A_4 \rightarrow A_1 A_2 \,|\, c$$

				4	3	4	2

14. a) Design a Turing Machine for $L = \{a^n b^n c^n \,|\, n \geq 1\}$

You must show the

(i) String processing,   (ii) Transition Diagram

(iii) Transition Table   (iv) Acceptance of any example string