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
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

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				

Part-B (5 × 8 = 40 Marks)

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	$\{q_3,q_0\}$	--	--	--

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12. a)	Given the following DFA of which A is the start state and D is the accept state, find the equivalent Minimized DFA.	4	1	2	1

	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

b)	Consider the following grammar. Construct left most derivation &parse tree for the following sentences *(a,((a, a),(a, a)))* $S \rightarrow (L) \mid a$ $L \rightarrow L,S \mid S$	4	1	2	1
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}, δ, q_0, Z_0, ϕ), where δ is shown below. Note that '#' is the end marker of the input string. δ(q_0, a, Z_0)= { (q_0, AZ_0) } δ(q_1, a, A)= { (q_1, ε) } δ(q_0, b, Z_0)= { (q_0, BZ_0) } δ(q_0, a, B)= { (q_0, AB) } δ(q_0, c, Z_0)= { (q_1, Z_0) } δ(q_0, b, B)= { (q_0, BB) } δ(q_0, a, A)= { (q_0, AA) } δ(q_0, c, B)= { (q_1, B) } δ(q_0, b, A)= { (q_0, BA) } δ(q_1, b, B)= { (q_1, ε) } δ(q_0, c, A)= { (q_1, A) } δ(q_1, #, Z_0)= { (q_1, ε) }	4	3	3	2
b)	Convert the following grammar into Greibach Normal Form. $A_1 \rightarrow A_2A_3$ $A_2 \rightarrow A_3A_4 \mid a$ $A_3 \rightarrow A_4A_1 \mid b$ $A_4 \rightarrow A_1A_2 \mid c$	4	2	3	1
14. a)	Design a Turing Machine for L=$\{a^n b^n c^n \mid n \geq 1\}$ You must show the (i) String processing, (ii) Transition Diagram (iii) Transition Table (iv) Acceptance of any example string	4	3	4	2

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b)	Explain about different types of Turing Machines	4	1	4	1
15. a)	Explain about Church- Turing thesis	4	1	5	1
b)	Explain about (i) A Language that is not Recursively Endurable (ii)An Undecidable Problem that is Recursively Enumerable	4	2	5	1
16. a)	Give the identity rules of regular expressions.	4	1	1	1
b)	Explain in detail about the Chomsky's hierarchy of languages	4	1	2	1
17.	Answer any ***two*** of the following:				
a)	What are the closure properties of Context Free Languages	4	1	3	1
b)	Design a Turing machine that recognizes the following language {w : w $\in$ {0, 1}* contains at least two same symbols, with one at the end } You need to answer this question by taking the following steps: (1) Give an outline for a TM that recognizes such strings w; (2) Draw a Turing machine diagram based on (1).	4	3	4	2
c)	Give the properties of Recursive and Recursively Enumerable Languages	4	1	5	1

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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