Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN | | | | | | | | | | |

Fifth Semester B.E. Degree Examination

AUTOMATA THEORY AND COMPUTABILITY

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

<table>
<tr><th colspan="3">Module – 1</th><th></th></tr>
<tr><td rowspan="3">Q.1</td><td>(a)</td><td>Define the following with example. i). Alphabet ii). Power of an alphabet.
iii). Concatenation iv). Language</td><td>5</td></tr>
<tr><td>(b)</td><td>Define DFSM. Draw a DFSM to accepts
i) decimal strings which are divisible by three.
ii) L = {w / w ∈ {a,b}* is the string with even no. of a’s and odd no. of b’s}
iii) L ={w/ w ∈ {a,b}* is the string of a’s and b’s and end with the sub string abb}</td><td>10</td></tr>
<tr><td>(c)</td><td>With a neat diagram, explain a hierarchy of language classes in Automata Theory</td><td>5</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td rowspan="3">Q.2</td><td>(a)</td><td>Convert the following NDFSM to its equivalent DFSM.
<table><tr><th></th><th>ε</th><th>a</th><th>b</th><th>c</th></tr><tr><td>➔ p</td><td>{q, r}</td><td>Φ</td><td>{q}</td><td>{r}</td></tr><tr><td>q</td><td>Φ</td><td>{p}</td><td>{r}</td><td>{p, q}</td></tr><tr><td>*r</td><td>Φ</td><td>Φ</td><td>Φ</td><td>Φ</td></tr></table></td><td>8</td></tr>
<tr><td>(b)</td><td>Write a note on finite state transducers.</td><td>4</td></tr>
<tr><td>(c)</td><td>Minimize the following DFSM.
<table><tr><th></th><th>0</th><th>1</th></tr><tr><td>→A</td><td>B</td><td>A</td></tr><tr><td>B</td><td>A</td><td>C</td></tr><tr><td>C</td><td>D</td><td>B</td></tr><tr><td>*D</td><td>D</td><td>A</td></tr><tr><td>E</td><td>D</td><td>F</td></tr><tr><td>F</td><td>G</td><td>E</td></tr><tr><td>G</td><td>F</td><td>G</td></tr><tr><td>H</td><td>G</td><td>D</td></tr></table></td><td>8</td></tr>
<tr><td colspan="4">Module – 2</td></tr>
<tr><td rowspan="3">Q.3</td><td>(a)</td><td>Define Regular expression. Write RE for the following Languages
i) L = {$a^{2n} b^{2m}$ | n>=0, m>=0}
ii) L = {w : |w| mod 3 = 0 where w ∈ {a,b}*}
iii) Language of all strings of 0's and l's that has at least one pair of consecutive 0's</td><td>8</td></tr>
<tr><td>(b)</td><td>State and prove the Pumping Lemma Theorem for Regular languages.</td><td>8</td></tr>
<tr><td>(c)</td><td>Write the Applications of Regular Expressions.</td><td>4</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td rowspan="2"></td><td>(a)</td><td>Using Kleen's theorem, prove that any language that can be defined with a Regular Expression can be accepted by some FSM.</td><td>8</td></tr>
<tr><td>(b)</td><td>Prove that the Regular Languages are Closed Under Complementation and Intersection.</td><td>6</td></tr>
</table>

Q.4	**(c)**	Obtain NDFSM for the Regular expression **(a+b)* abb** and **(a* + ab) aab***	6
		Module – 3	
Q.5	**(a)**	Define Context Free Grammer. Write the CFG for the following Languages. i) $L=\{a^n\ b^n\ c^m: n, m>=0\}$ ii) $L=\{a^n\ b^{n+2} : n>=0\}$ iii) $L=\{w \in \{a,b\}^*: n_a(w)=n_b(w)\}$	8
	(b)	Define the following with example i) Leftmost Derivation ii) Rightmost Derivation iii) Parse Tree	6
	(c)	Define Ambiguous Grammar. Show that following grammar is Ambiguous. S→ iCtS | iCtSeS | a C→ b	6
		OR	
Q.6	**(a)**	Discuss Chomsky normal form and Greibach normal form. Convert the following Grammar to Chomsky Normal form. S → aACa A → B | a B → C | c C → cC | **ε**	`10
	(b)	Define NPDA. Write NPDA for the following languages i) $L = \{wcw^R \mid w \in \{a, b\}^*\}$ ii) $L=\{a^n\ b^n \mid n>=0\}$	10
		Module – 4	
Q.7	**(a)**	With a neat diagram, explain variants of Turing Machines.	10
	(b)	Explain Language Acceptability and Design of Turing Machines.	10
		OR	
Q.8	**(a)**	Define Turing Machine Model. Explain the representation of Turing Machines.	10
	(b)	Explain the Model of Linear bound Automation.	10
		Module - 5	
Q.9	**(a)**	Explain the following with example, i) Decidability ii) Decidable languages iii) Undecidable languages.	10
	(b)	Discuss Halting problem and post correspondence problem with respect to TM.	10
		OR	
Q.10	**(a)**	Write Short notes on i) Growth rate of Function ii) Classes of P and NP iii) Quantum Computers iv) Church Turing Thesis	20

Table showing the Bloom's Taxonomy Level, Course Outcome and Programme Outcome				
Question		**Bloom's Taxonomy Level attached**	**Course Outcome**	**Programme Outcome**
Q.1	(a)	L1	CO1	PO1,PO2,PO3,PO4,PO12
	(b)	L2	CO1	PO1,PO2,PO3,PO4,PO12
	(c)	L1	CO1	PO1, PO2,PO3,PO4,PO12
Q.2	(a)	L3	CO1	PO1, PO2,PO3,PO4,PO12
	(b)	L1	CO1	PO1, PO2,PO3,PO4,PO12
	(c)	L3	CO1	PO1, PO2, PO3, PO4, PO12
Q.3	(a)	L2	CO2	PO1, PO2,PO3,PO4,PO12
	(b)	L1	CO2	PO1,PO2,PO3,PO4,PO12
	(c)	L1	CO2	PO1, PO2,PO3,PO4,PO12
Q.4	(a)	L1	CO2	PO1, PO2, PO3, PO4, PO12
	(b)	L1	CO2	PO1, PO2,PO3,PO4,PO12
	(c)	L2	CO2	PO1, PO2, PO3, PO4, PO12
Q.5	(a)	L2	CO3	PO1, PO2,PO3,PO4,PO12
	(b)	L1	CO3	PO1, PO2, PO3, PO4, PO12
	(c)	L3	CO3	PO1, PO2,PO3,PO4, PO12
Q.6	(a)	L3	CO3	PO1, PO2, PO3, PO4
	(b)	L2	CO3	PO1, PO2, PO3, PO4
Q.7	(a)	L2	CO4	PO1, PO2, PO3, PO4
	(b)	L2	CO4	PO1, PO2, PO3 , PO4
Q.8	(a)	L2	CO4	PO1, PO2, PO3, PO4
	(b)	L2	CO4	PO1, PO2, PO3, PO4
Q.9	(a)	L2	CO5	PO1, PO2, PO3, PO4
	(b)	L1	CO5	PO1, PO2, PO3, PO4
Q.10	(a)	L1	CO5	PO1, PO2, PO3, PO4

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering(knowledge):L_1	Understanding Comprehension): L_2	Applying (Application): L_3
	Higher order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6