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

<table>
<tr><td colspan="3">Module – 1</td><td></td></tr>
<tr><td rowspan="2">Q.1</td><td>(a)</td><td>Define the following terms with examples: Alphabet, Power of an alphabet, String, Concatenation and Languages.</td><td>10</td></tr>
<tr><td>(b)</td><td>Define DFSM. Design a DFSM to accept each of the following languages:
i) L= {w∈{0,1}* : w has 001 as a substring}
ii) L={ w∈{0,1}* : w has even number of a’s and even number of b’s}</td><td>10</td></tr>
<tr><td colspan="3">OR</td><td></td></tr>
<tr><td rowspan="2">Q.2</td><td>(a)</td><td>Convert the following NDFSM to DFSM.
<table>
<tr><td>δ</td><td>ϵ</td><td>a</td><td>b</td><td>c</td></tr>
<tr><td>->p</td><td>{q,r}</td><td>{}</td><td>{q}</td><td>{r}</td></tr>
<tr><td>q</td><td>{}</td><td>{p}</td><td>{r}</td><td>{p,q}</td></tr>
<tr><td>*r</td><td>{}</td><td>{}</td><td>{}</td><td>{}</td></tr>
</table></td><td>10</td></tr>
<tr><td>(b)</td><td>Define distinguishable and indistinguishable states. Minimize the following DFSM.
<table>
<tr><td>δ</td><td>a</td><td>b</td></tr>
<tr><td>->A</td><td>B</td><td>F</td></tr>
<tr><td>B</td><td>G</td><td>C</td></tr>
<tr><td>*C</td><td>A</td><td>C</td></tr>
<tr><td>D</td><td>C</td><td>G</td></tr>
<tr><td>E</td><td>H</td><td>F</td></tr>
<tr><td>F</td><td>C</td><td>G</td></tr>
<tr><td>G</td><td>G</td><td>E</td></tr>
<tr><td>H</td><td>G</td><td>C</td></tr>
</table></td><td>10</td></tr>
<tr><td colspan="3">Module – 2</td><td></td></tr>
<tr><td rowspan="2">Q.3</td><td>(a)</td><td>Define Regular expression. Write the regular expression for the following languages:
i) Representing for strings of a’s and b’s having odd length.
ii) To accept strings of a’s and b’s such that third symbol from the right is a and fourth symbol from the right is b.</td><td>10</td></tr>
<tr><td>(b)</td><td>Use the fsmtoregexheuristic algorithm to construct a regular expression that describes L(M).
<table>
<tr><td>δ</td><td>a</td><td>b</td></tr>
<tr><td>->*1</td><td>2</td><td>{}</td></tr>
<tr><td>*2</td><td>3</td><td>1</td></tr>
<tr><td>3</td><td>3</td><td>1</td></tr>
</table></td><td>10</td></tr>
<tr><td colspan="3">OR</td><td></td></tr>
<tr><td rowspan="2">Q.4</td><td>(a)</td><td>Show that regular languages are closed under complement and intersection.</td><td>8</td></tr>
<tr><td>(b)</td><td>State and prove pumping lemma theorem for regular languages. And show that the language L={ww^r; w∈{0,1}*) is not regular.</td><td>12</td></tr>
</table>

Module – 3			
Q.5	**(a)**	Define CFG. Design CFG for the languages i) $L=\{0^{2n}1^{m} \mid n>=0,m>=0\}$ ii) $L=\{0^{i}1^{j}2^{k} \mid i=j \text{ or } j=k\}$	10

	(b)	Define Ambiguity. Consider the grammar E->E+E|E*E|(E)|id. Find the leftmost, rightmost derivations and parse trees for the string id+id*id. And show that this grammar is ambiguous.	10
		OR	
Q.6	**(a)**	Define CNF. Convert the following CFG to CNF. S->aACa A->B/a B->C/c C->cC/ϵ	10
	(b)	Define PDA. Design a PDA to accept the following language. L={$a^n b^n$; n>=0}. Draw the transition diagram for the constructed PDA. Show the ID's for the string aaabbb.	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.	8
		OR	
Q.8	**(a)**	Define a Turing machine. Explain the working of a Turing machine.	8
	(b)	Design a Turing machine to accept L={$0^n1^n2^n$| n>=0}. Draw the transition diagram. Show the moves made for string aabbcc.	12
		Module – 5	
Q.9	**(a)**	Explain post correspondence problem.	7
	(b)	Explain Halting problem in Turing machine.	6
	(c)	Explain recursively enumerable language.	7
		OR	
Q.10	**(a)**	Explain Church Turing thesis.	7
	(b)	Explain Quantum computer.	6
	(c)	Explain Growth rate of function.	7

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	1	1,12
	(b)	L1,L3	2	1,2,12
	(c)			
Q.2	(a)	L3	2	1,2,12
	(b)	L1,L3	2	1,2,12
	(c)			
Q.3	(a)	L2	3	1,2,3,4,12
	(b)	L3	3	1,2,3,4,12
	(c)			
Q.4	(a)	L2	3	1,2,3,4,12
	(b)	L2,L3	3	1,2,3,4,12
	(c)			
Q.5	(a)	L1,L3	3	1,2,3,4,12
	(b)	L2	3	1,2,3,4,12
	(c)			
Q.6	(a)	L1,L3	4	1,2,3,4,12
	(b)	L1,L3	3	1,2,3,4,12
	(c)			
Q.7	(a)	L2,L3	3	1,2,3,4,12
	(b)	L2	3	1,2,3,4,12
	(c)			
Q.8	(a)	L2	4	1,2,3,4,12
	(b)	L3	4	1,2,3,4,12
	(c)			
Q.9	(a)	L2	5	1,2,12
	(b)	L2	5	1,2,12
	(c)	L2	5	1,2,12
Q.10	(a)	L2	5	1,2,12
	(b)	L2	5	1,2,12
	(c)	L2	5	1,2,12

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