INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Title	THEORY OF COMPUTATION				
Course Code	AITB03				
Program	B.Tech				
Semester	FOUR				
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	**1**	**4**	**-**	**-**
Chief Coordinator	Ms. V.Divyavani, Assistant professor				

COURSEOBJECTIVES:

Students will try to learn:	
I	The fundamental knowledge of automata theory which is used to solve computational problems.
II	The reorganization of context free language for processing infinite information using push down automata.
III	To simulate computer based algorithms with the help of mathematical model of an abstract machines.

COURSE OUTCOMES:

After successful completion of this course, students will be able to:		
CO	**Course Outcomes**	**Knowledge Level (Bloom's Taxonomy)**
CO 1	Understand the fundamental concepts of alphabet, strings and languages to represent properties of grammars and automata.	Remember
CO 2	Remember deterministic finite automata and non deterministic finite automata for modeling lexical analysis and text editors.	Apply

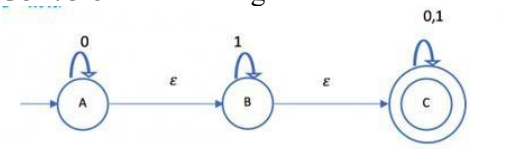
CO 3	Describe regular sets and regular expressions are used to match character combinations in strings.	Understand
CO 4	Apply the pumping lemma on regular and context free languages to perform negative test .	Apply
CO 5	Describe right linear and left linear grammars used for parsing and designing programming languages.	understand
CO 6	Identify the recursive rules of context free grammars to generate patterns of strings.	Remember
CO 7	Apply normalization techniques (Chomsky normal form, Greibach normal form) on context free grammars to minimize the ambiguity in parsing the given strings.	Apply
CO 8	Construct push down automata for context free languages to develop parsing phase of a compiler.	Apply
CO 9	Recall and relate the deterministic context free languages and pushdown automata for accepting the regular languages.	Remember
CO 10	Apply the concept of Turing machines for solving real time computations and complex functions like recursively enumerable problem.	Remember
CO 11	Make use of linear bounded automata for recognizing context sensitive languages and implementation of genetic programming.	Apply

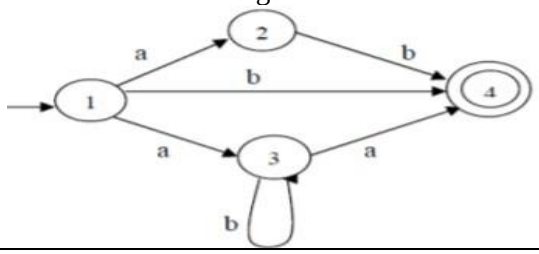
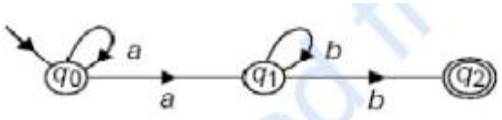
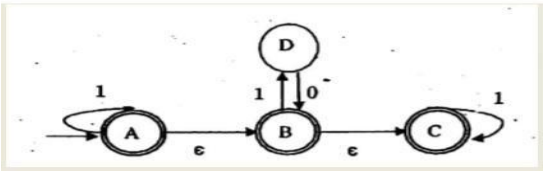
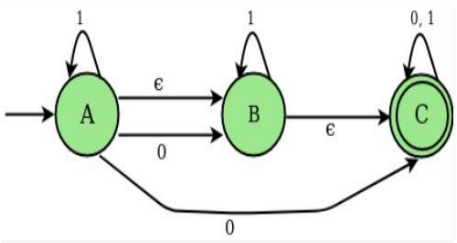
MAPPING OF EACH CO WITH PO(s), PSO(s):

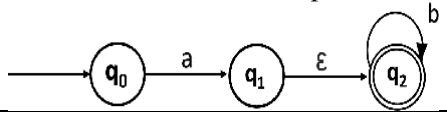
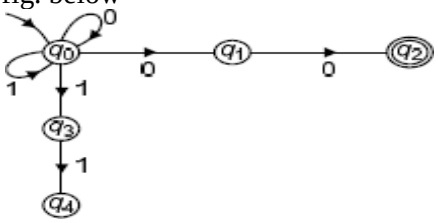
Course Outcomes	Program Outcomes												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	√	-	-	-	-	-	-	-	-	-	-	-	√	-	-
CO 2	√	-	-	-	-	-	-	-	-	-	-	-	-	-	√
CO 3	√	-	-	√	-	-	-	-	-	-	-	-	-	-	-
CO 4	√	-	-	-	-	-	-	-	-	√	-	-	√	-	-
CO 5	√	√	√	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	√	√	-	-	-	-	-	-	-	-	-	-	-	√	-
CO 7	√	√	-	-	-	-	-	-	-	√	-	-	√	-	-
CO 8	√	√	-	-	-	-	-	-	-	-	-	-	-	-	√
CO 9	√	√	-	-	-	-	-	-	-	-	-	-	-	√	-
CO 10	√	√	√	√	-	-	-	-	-	-	-	-	√	-	-
CO 11	√	√	√	-	-	-	-	-	-	-	-	-	√	-	-

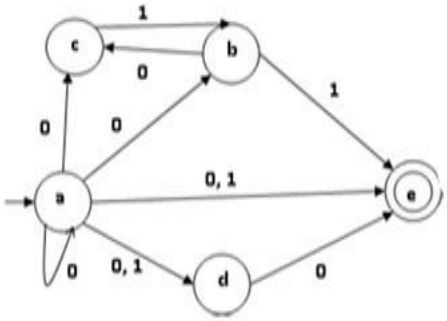
TUTORIAL QUESTION BANK

MODULE-1				
FINITE AUTOMATA				
PART – A (Short Answer Questions)				
S. No	**Questions**	**Blooms Taxonomy Level**		**Course Outcomes**
1	**Define** Automata.	Remember	---	CO1
2	**Compare** DFA and NFA.	Understand	This would require the learner to **recall** the finite automata and **explain** the differences between NFA and DFA.	CO2
3	**Define** the String.	Remember	---	CO1
4	**Define** transition function of DFA.	Remember	---	CO2
5	**Define** ε–transitions.	Remember	---	CO2
6	**Define** power of an alphabet (∑*).	Remember	---	CO1
7	**List** the applications of finite automata.	Remember	---	CO1
8	**Define** Null string.	Remember	---	CO1
9	**Define** Kleene Star?	Remember	---	CO1
10	Define NFA with example.	Remember	---	CO2
11	**Describe** transition diagram for DFA accepting string ending with 00	Remember	---	CO2
12	**Describe** DFA for a string accepting odd number of 0's.	Remember	---	CO2
13	**Describe** transition diagram for DFA to accept exactly one 'a' defined. over an alphabet ∑= {a,b}.	Remember	---	CO2
14	**Demonstrate** DFA for odd number of 1's.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
15	**Define** ε - closure.	Remember	---	CO2
16	**Describe** FSM and its structure with an example.	Remember	---	CO1
17	**State** the Mathematical definition of Finite Automata.	Remember	---	CO1

18	**Demonstrate** DFA for even number of 1's.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
19	**Define** DFA mathematically.	Remember	---	CO2
20	**Demonstrate** DFA for the language accepting strings which contains 001 as substring.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
PART - B (LONG ANSWER QUESTIONS)				
1	**Demonstrate** DFA to accept set of all strings ending with 0101.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
2	**Describe** the DFA with the set of strings having "aaa" as a substring over an alphabet $\sum$ ={a,b}.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
3	**List** out the various differences between DFA and NFA	Remember	---	CO2
4	**Describe** NFA with ε to NFA conversion with an example.	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA with ε to NFA.	CO2
5	**Describe** a DFA to accept the string a"s and b"s ending with abb over an alphabet $\sum$ ={a,b}	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
6	**List** the properties and operations of strings and languages.	Remember	---	CO1
7	**Demonstrate** a DFA that any given decimal number is divisible by 3.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
8	**Describe** DFA for the following languages shown below Σ = { a,b} a) L={w/ w is any string that doesn't contain exactly two a"s} b) L={w/ w is any string that contain atmost3a"s}	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
9	**Convert** the following NFA with ε to NFA. 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA with ε to NFA.	CO2
10	**Describe** Finite Automata and draw FA for the strings over an alphabet Σ = { 0,1} a. The string with even no of 0"s and odd no of1"s b.	Understand	This would require the learner to **recall** the finite automata and **discuss** the steps for the construction of FA.	CO2

	b. The string with odd no of 0"s and odd no of 1"s			
11	**Describe** a DFA, the language recognized by the Automaton being L={w/ w contains neither the substring ab nor ba}.Draw the transition table.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
12	**Convert** the following NFA into DFA. 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO2
13	**Describe** a DFA for the following language L={w/|w|mod3=0,w belongs to $(a,b)^*$} L={w/|w|mod3=1,w belongs to $(a,b)^*$}	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
14	**Describe** a DFA for the following language over an alphabet ∑ = { 0,1} a)The string with even no of 0"s and even no of1"s b)The string with odd no of 0"s and even no of1"s	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
15	**Convert** the following NFA into equivalent DFA. 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO2
16	**Convert** the following NFA-ε to NFA. 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA-ε to NFA.	CO2
17	**Describe** a DFA for the following language i)L={w/n_a|w|mod3=0,w belongs to$(a,b)^*$} ii)L={w/n_a|w|mod3=1,w belongs to$(a,b)^*$}	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
18	**Convert** the following NFA with ε to NFA. 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA-ε to NFA.	CO2

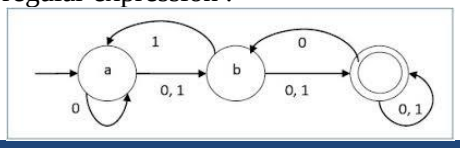
19	**Describe** a DFA that accepts set of strings starts with 01and ends with 01 over alphabet ∑ = {0, 1}	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
20	**Illustrate** the model and behavior of finite automata with neat block diagram.	Understand	This would require the learner to **recall** the finite automata and **discuss** the steps for the construction of DFA.	CO1
Part – C (Problem Solving and Critical Thinking Questions)				
1	**Describe** NFA for accepting any binary string that contains 11 as a substring and Convert to DFA.	Understand	This would require the learner to **recall** the Non Deterministic finite automata and **discuss** the steps for the construction of NFA and the conversion of NFA to DFA.	CO2
2	**Convert** NFA with ε to equivalent DFA 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA with ε to DFA.	CO2
3	**Describe** a DFA that any given decimal number is divisible by 5.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
4	**Describe** a DFA for the followinglanguage L={w/|w|mod5=0,w belongs to$(a,b)^*$} L={w/|w|mod5=1,w belongs to$(a,b)^*$}	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
5	**Convert** NFA with ε to equivalent NFA M=($\{q_0,q_1,q_2\}$,{0,1,2}, δ, q_0, $\{q_2\}$) where δ is given by [δ (q_0,0)=$\{q_0\}$, δ (q_0,1)=ϕ, δ (q_0,2)=ϕ, δ(q_0, ε)=$\{q_1\}$] [δ (q_1,0)=ϕ, δ (q_1,1)=$\{q_1\}$, δ (q_1,2)=ϕ ,δ (q_1, ε)=$\{q_2\}$] [δ (q_2,0)=ϕ, δ (q_2,1)= ϕ , δ (q_2,2)= $\{q_2\}$,δ (q_2, ε)= ϕ]	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA with ε to NFA.	CO2
6	**Demonstrate** NFA that strings such that the third symbol from the right end is a 0 over an alphabet ∑ ={0,1}. And Convert it into equivalent DFA.	Understand	This would require the learner to **recall** the Non Deterministic finite automata and **discuss** the steps for the construction of NFA and the conversion of NFA to DFA.	CO2
7	**Convert** NFA to equivalent DFA as shown in fig. below 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO2

8	**Describe** the transition Table for the below NFA and then convert its equivalent transition diagram for DFA.  	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO2
9	**Describe** a DFA that will accept those words from ∑= {a, b} where the number of a's is divisible by two and the number of b's is divisible by three. Sketch the transition table of the finite automata.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
10	**Describe** a DFA that will accept those words from alphabets Σ={a, b} where the number of b"s is divisible by three. Sketch the transition table and diagram of the finite Automata.	Understand	This would require the learner to **recall** the Deterministic finite automata and **discuss** the steps for the construction of DFA.	CO2
MODULE-II				
REGULAR LANGUAGES				
PART – A (Short Answer Questions)				
1	**Define** Regular Languages.	Remember	---	CO3
2	**List** out any two applications of regular expression.	Remember	---	CO3
3	**Define** Pumping Lemma for Regular Languages.	Remember	---	CO4
4	**Show** an example for a regular set?	Remember	---	CO3
5	**Define** the Regular Expression for the empty string.	Remember	---	CO3
6	**Describe** regular expression for denoting language containing empty.	Understand	This would require the learner to **recall** regular languages and **explain** the regular expressions for given laguage.	CO3
7	**Define** right linear grammars.	Remember	---	CO5
8	**Show** the Regular Expression for the set of binary strings.	Remember	---	CO3
9	**Define** Regular grammars.	Remember	---	CO3
10	**List** out the advantages of regular expressions.	Remember	---	CO3
11	**Define** Regular set?	Remember	---	CO3

12	**Describe** regular expressions for the Set of strings over {0, 1} whose last two symbols are the same.	Understand	This would require the learner to **recall** strings, regular expressions and **explain** the regular expressions for given set of strings.	CO3
13	**Describe** the regular language generated by regular expression (0+1)*001(0+1)*.	Understand	This would require the learner to **recall** regular expressions and **explain** the languages for given expression.	CO3
14	**List** the difference between left linear and right linear grammars.	Remember	---	CO5
15	**Describe** the Regular Expression to generate at least one b over Σ={a,b}	Understand	This would require the learner to **recall** regular sets and **explain** the regular expression for given regular set.	CO3
16	**Describe** that following languages are not regular L={$a^n b^m$ | n, m and n<m }	Remember	---	CO4
17	**Describe** that following languages are not regular L={a^n | n is a perfect square }	Remember	---	CO4
18	**Define** Regular Expression for even number of 0's.	Remember	---	CO3
19	**Define** Regular Expression for odd number of 0's.	Remember	---	CO3
20	**Define** Regular Expression for the regular sets consists strings having two consecutive a's.	Remember	---	CO3
Part - B (Long Answer Questions)				
1	**Convert** Regular Expression 01* + 1 to Finite Automata.	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Finite Automata.	CO3
2	**Convert** Regular Expression 01* + 1 Right linear, Left linear Regular Grammars.	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Regular Grammars.	CO5
3	**Describe** Regular expression? Simplify the following Regular Expression i)ε + 1*(011)*(1*(011)*)*=(1+011)* ii)(0+11*0)+ (0+11*0)(10+10*1) * (10+10*1) *=1*0(10+10*1) *	Remember	---	CO3
4	**Convert** the given Finite Automata (a+b)*ab* to Regular grammar .	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion of Finite Automata to Regular Grammar.	CO5
5	**Convert** the given Finite Automata 0*11(0+1)*to Regular grammar .	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion of Finite Automata to Regular Grammar.	CO5

6	**Describe** Regular expression, Regular set and Finite Automata. Distinguish those with example representations.	Remember	---	CO3
7	**Convert** Regular Expression (0+1)*00(0+1)* to the Finite Automata(NFA-ε) .	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Finite Automata..	CO3
8	**Convert** Regular Expression (b+aa)*a* to Finite Automata(NFA-ε).	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Finite Automata..	CO3
9	**State** Pumping Lemma for Regular Languages with a suitable example.	Remember	---	CO4
10	**Convert** given Regular expression (a*b*) * to FA(NFA-ε).	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Finite Automata.	CO3
11	**Convert** the following automata into Regular expression M=($\{q_1,q_2,q_3\}$,{0,1}, δ, q_1, $\{q_1\}$) where δ is given by [δ (q_1,0)=$\{q_1\}$, δ (q_1,1)=$\{q_2\}$] [δ (q_2,0)= $\{q_3\}$, δ(q_2,1)=$\{q_2\}$] [δ (q_3,0)= $\{q_1\}$, δ (q_3,1)=$\{q_2\}$]	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion of Finite Automata to Regular expression.	CO3
12	**Describe** Pumping lemma. Prove that the language L={yy/y belongs {0,1}*} is not regular.	Remember	---	CO4
13	**Describe** Regular grammar? Explain the types of regular grammar with examples.	Remember	---	CO5
14	**IIustrate** the steps for conversion of regular grammar to finite automata? Construct the FA for the following grammar S→aS/bA/b A→aA/bS/a	Understand	This would require the learner to **recall** the Regular Grammar and **show** the steps for the conversion of Regular Grammar to Finite Automata.	CO5
15	**Convert** the given Regular Expression 1(11) * to FA and convert it into NFA.	Remember	---	CO3
16	**Show** that the following languages is not regular L = $\{a^nb^n/n>=1\}$ L=$\{a^P/p$ isprime$\}$	Remember	---	CO4
17	**Convert** the following regular expression to Regular grammar (0+1)*00(0+1)*	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Regular Grammar.	CO3
18	**Describe** the Left Linear Grammar for the strings start with 'a' over an alphabet ∑ ={a,b}.	Remember	---	CO5
19	**Illustrate** the steps for conversion from Finite Automata to Regular Expression with example?	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion	CO3

			of Finite Automata to Regular Expression.	
20	**Describe** Pumping lemma. Prove that the language L={yy/y belongs {0,1}*} is not regular.	Remember	---	CO4
Part – C (Problem Solving and Critical Thinking Questions)				
1	**Convert** Regular Expression (11+0)*(00+1)* to Finite Automata.	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Finite Automata.	CO3
2	**Convert** Regular Expression to Regular Grammar for the following Expressions i.a(a +b)* ii.(aa +bb)	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Regular Grammar.	CO5
3	**Describe** Pumping Lemma for Regular Languages. Prove that the language L = {a^n/ n is a n^5} is not regular	Understand	This would require the learner to **recall** the Regular Languages and **show** the steps for the checking the language is not regular.	CO4
4	**Describe** the DFA Transition diagram for equivalent Regular expression (ab+a) *(aa+b)	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Deterministic Finite Automata.	CO3
5	**Convert** the following Regular Expression (0 + 1)*(00 + 11)(0 + 1)* to DFA.	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Deterministic Finite Automata.	CO3
6	**Convert** the following Regular expression (0+1)*(01+110) to NFA.	Understand	This would require the learner to **recall** the Regular Expression and **show** the steps for the conversion of Regular Expression to Non Deterministic Finite Automata.	CO3
7	**Convert** the following automata into Regular expression M=({q_1,q_2,q_3},{0,1}, δ, q_1, {q_2,q_3}) where δ is given by [δ (q_1,0)={q_2}, δ (q_1,1)={q_3}] [δ (q_2,0)= {q_1}, δ(q_2,1)={q_3}] [δ (q_3,0)= {q_2}, δ (q_3,1)= {q_2}]	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion of Finite Automata to Regular Expression.	CO3
8	**Describe** the following language is not regular i)L= { a^n ba^n / n=0,1,2……. } ii) L= {a^nb^{2n}/ n≥ 0 }	Understand	This would require the learner to **recall** the Regular Languages and **show** the steps for the checking the language is not regular.	CO4
9	**Convert** the automata in which strings end with 101 over an alphabet ∑ ={0,1} to the Left Linear Grammar and Right Linear grammar.	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion of Finite Automata to Regular Grammars.	CO5

10	**Convert** the following Finite Automata to regular expression . 	Understand	This would require the learner to **recall** the Finite Automata and **show** the steps for the conversion of Finite Automata to Regular Expression.	CO3
MODULE -III				
CONTEXT FREE GRAMMARS				
Part - A (Short Answer Questions)				
1	**Define** a context free grammar(CFG).	Remember	---	CO6
2	**Define** the parse tree with example.	Remember	---	CO6
3	**Differentiate** the Rightmost derivation with Left most derivation with example.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the differences between right most derivation and left most derivation.	CO6
4	**Describe** a short notes about leftmost derivation with example.	Remember	---	CO6
5	**List** any two applications of Context Free Grammar.	Remember	---	CO6
6	**Define** the left sentential form?	Remember	---	CO6
7	**Describe** the different ways to derive a string from a CFG.	Remember	---	CO6
8	**Describe** the language generated by CFG or G?	Remember	---	CO6
9	**Describe** the concept of parse tree?	Remember	---	CO6
10	**Describe** the concept of subtree.	Remember	---	CO6
11	**Describe** the CFL for S->aSb | aAb , A->bAa , A->ba.	Remember	---	CO6
12	**Describe** the usage of normalization?	Remember	---	CO3
13	**Define** the ambiguous grammar with example?	Remember	---	CO3
14	**Describe** the language generated by the following grammar S-> AB A->aAa|bAb|a|b B->Ab|Bb|ε	Remember	---	CO3
15	**List** the steps for the CFG to reduce UNIT production.	Remember	---	CO3
16	**Describe** the elimination of useless symbols in productions.	Remember	---	CO3

17	**List** the steps for the given grammar to get the minimized CFG – S □ a S/A, A->a / B	Remember	---	CO3
18	**Describe** the ambiguity concept in CFG with an example	Remember	---	CO3
19	**Differentiate** the CNF and GNF.	Understand	This would require the learner to **recall** the normalization of context free grammars and **Explain** the differences between CNF and GNF.	CO3
20	**List** the steps for the given grammar to get the minimized CFG - S □ aS1b S1□ aS1b/ε.	Remember	---	CO3
	Part – B (Long Answer Questions)			
1	**Describe** Leftmost Derivation. , Rightmost Derivation, Derivation Tree for the following grammar with respect to the string aaabbabbba. S□ aB | bAA□ aS| bAA|a B□ bS | aBB | b	Remember	---	CO6
2	**Describe** a CFG for the languages L={$a^i b^j$ | i<=2j}	Remember	---	CO6
3	**Describe** leftmost and rightmost derivations for the strings, if the language is given as S□ AS| εA□ aa|ab|ba|bb Strings: aabbba baabab aaabbb	Remember	---	CO6
4	**Describe** the minimization of CFG - S□ AbAA□ Aa/ ε.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG.	CO6
5	**Describe** the minimization of CFG - S□ aSa S □ bSbS□ a/b/ ε.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO6
6	**Describe** the minimization of CFG - S□ A0/B A□ 0/12/B	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO6
7	**Convert** the grammar to CNF - S□ aSa/aaS□ bSb/bb S □ a/b.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO6
8	**Describe** Chomsky Normal Form and Greibach Normal Form.	Remember	---	CO7
9	**Define** Normalization of CFG? What is the use of Normalization? Explain different types of normal forms.	Remember	---	CO7

8	**Illustrate** the construction of Greibach normal form with an example.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG into GNF	CO7
9	**Show** that the following CFG ambiguous. S□ iCtS | iCtSeS | a, C□ b.	Remember	---	CO7
10	**Describe** the Pumping lemma for Context Free Languages concept with example $\{a^n b^n c^n$ where n>=0}.	Remember	---	CO4
11	**Describe** the minimized CFG productions in S □ a S1b S1 □ a S1b/ Є	Remember	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO7
12	**Convert** the following CFG into GNF. S□ AA/a,A□ SS/b	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG to GNF.	CO7
13	**Describe** unit production? Explain the procedure to eliminate unit production.	Remember	---	CO7
14	**Describe** the procedure to eliminate ϵ-productions in grammar.	Remember	---	CO7
15	**Convert** the following grammar into GNF G=({A1,A2,A3},{a,b},P,A) A1□ A2A3 A2□ A3A1/b A3□ A1A2/a	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG to GNF.	CO7
16	**Describe** the minimized CFG productions from the following grammar A□aBb/bBaB□aB/bB/ϵ	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO7
17.	**Describe** CFG and Explain a CFG for the following language L = { $0^i 1^j 0^k \mid j > i + k$ }and write the minimization steps.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO7
18	**Describe** the minimized CFG for the following grammar S□ ABCa | bD A□ BC |b B□ b | ε C□ Đ| ε, D□ d	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO7
19	**Covert** the CFG to Greiback Normal form by taking an example	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG to GNF.	CO7
20	**Convert** the grammar G given by S->aAa A->Sb| bcc|DaA C->abb| DD E-> ac D->aDa into an equivalent grammar by removing useless symbols and useless productions from it.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO7
Part – C (Problem Solving and Critical Thinking Questions)				
1	**Describe** a grammar for valid expressions over operator - and /. The arguments of expressions are valid identifiers over symbols a,b, 0 and	Understand	This would require the learner to **recall** the context free grammars and **Explain** the left most	CO6

	Derive Left Most Derivation and Right Most Derivation for string W= (a11-b0) / (b00-a01). Draw parse tree for Left Most Derivation.		derivation and Right most derivation	
2	**Describe** Leftmost Derivation. , Rightmost Derivation,Derivation Tree for the following grammar with respect to the string aaabbabbba. S□ aB | bA A□ aS| bBA|a B□ bS | aAB | b	Understand	This would require the learner to **recall** the context free grammars and **Explain** the left most derivation and Right most derivation	CO6
3	**Convert** the following grammar into GNF S□ ABA/AB/BA/AA/B A□ aA/a, B□ bB/b	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG to GNF.	CO6
4	**Describe** the context free grammars in the four tuple form.(V,T,P,S) for the given languages on Σ={a,b} i. All strings having at least two a‟s ii. All possible strings not containing triple b‟s	Understand	This would require the learner to **recall** the context free grammars and **Explain** the CFG for the given set of strings.	CO6
5	**Describe** the string “aabbabba” for leftmost derivation and rightmost derivation using a CFG given by S->Ab|Ba A->a|aS|Baa B->b | bS |aBB	Understand	This would require the learner to **recall** the context free grammars and **Explain** the left most derivation and Right most derivation	CO6
6	**Describe** the minimized CFG productions for CFG S->Ab|Bb A->a |aS |Baa B->b|bS |aBB	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO3
7	**Convert** the following grammar into GNF A1□ A2 A3A2□ A3 A1 /b A3□ A1 A2/a	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG to GNF.	CO7
8	**Convert** the following grammar into Chomsky Normal form L(G) – { Λ} S□AaA | CA | BaBA□aaBa | CDA | aa | DC B □bB | bAB | bb | aS C □ *Ca*| *bC*| *D* D □ *bD*| *Λ*	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the conversion of the CFG to CNF.	CO7
9	**Describe** the steps to show the following is not CFG. { $a^m b^n c^p$| $m < n$ or $n < p$}	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the checking of the given grammar is CFG or not.	CO4
10	**Describe** the CFG for the language L={$a^n b^{2n}$ where n>=1}and Explain the steps for the minimization of the CFG.	Understand	This would require the learner to **recall** the context free grammars and **Explain** the steps for the minimization of the CFG	CO7

MODULE-IV				
PUSH DOWNAUTMATA				
Part - A (Short Answer Questions)				
1.	**Differentiate** between deterministic and nondeterministic PDA.	Understand	This would require the learner to **recall** the context free grammars & PDA and **Explain** the difference between DPDA - NPDA	CO8
2.	**Define** the concept of PDA.	Remember	---	CO8
3.	**Describe** the concept of NPDA.	Remember	---	CO8
4.	**Define** the language of DPDA.	Remember	---	CO9
5.	**Convert** the following PDA to CFG $\delta(q0,0,z0)=\{q0,xz0)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
6.	**Convert** the following PDA to CFG $\delta(q0,0,x)=(q0,xx)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
7.	**Convert** the following PDA to CFG $\delta(q0,1,x)=(q1,\epsilon)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
8.	**Convert** the following PDA to CFG $\delta(q1,1,x) = (q1,\epsilon)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
9.	**List** out the steps to convert CFG to PDA.	Remember	---	CO8
10	**Describe** the acceptance of PDF by final state.	Remember	---	CO8
11	**Describe** the acceptance of PDF by empty stack.	Remember	---	CO8
12	**Convert** the following PDA to CFG $\delta(q0,b,z0)=\{q0,zz0)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
13.	**Convert** the following PDA to CFG $\delta(q0,b,z) = (q0,zz)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
14.	**Convert** the following PDA to CFG $\delta(q0, \epsilon,z0)=(q0,\epsilon)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
15	**Define** the PDA and design PDA for L = $\{ x \in \{ a, b\}^* \mid na(x) > nb(x) \}$	Remember	---	CO8

Part – B (Long Answer Questions)				
1.	**Define** the NPDA(Nondeterministic PDA) and DPDA(deterministic PDA) equivalent? Illustrate with an example.	Remember	---	CO8
2.	**Describe** the grammar for the following PDA. M=({q0, q1},{0,1},{X,z0},δ,q0,Z0,Φ) and where δ is given by δ(q0,0,z0)={(q0,XZ0)}, δ(q0,0,X)={(q0,XX)},δ(q0,1,X)={(q1, ε)}, δ(q1,1,X)={(q1, ε)},δ(q1, ε,X)={(q1, ε)}, δ(q1, ε, Z0)={(q1, ε)}.	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the CFG from PDA	CO8
3.	**Describe** PDA for string of form $a^n b^{2n}$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
4.	**Define** PDA mathematically. With a neat diagram explain the working of a Turing Machine		---	CO8
5.	**Describe** the PDA that accepts the language {a^mb^n/n>m}	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the CFG accepts the given language.	CO8
6.	**Describe** a PDA for the following grammar S□ 0A, A□ 0AB/1,B□ 1	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
7.	**Convert** the following PDA to CFG M=({q0,q1},{a,b},{z0,za}, δ,q0,z0,Φ) δ is given by, δ(q0,a,z0)=(q0,zz) δ(q0,a,z)=(q0,zz0) δ(q0,b,z)=(q1,ϵ) δ(q1,b,z)=(q1,ϵ) δ(q1,ϵ,z0)=(q1,ϵ)	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA to CFG	CO8
8.	**Describe** the PDA mathematically. Describe the PDA for the following language. L= {w /w of form $a^n b^n$}.	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
9	**Describe** PDA For the language L = { xcxr / x Є {a,b}* } and trace it for string "bacab "	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
10	**Describe** the Pushdown automaton A is specified by A = ({q0, q1}, {a, b}, {Z, X}, δ, qin, Z, ∅), where δ contains the following transitions: (q0, a, Z) ›→ (q0, λ), (q0, a, Z) ›→ (q0, XZin), (q0, a, X) ›→ (q0, XX),(q0, b, X) ›→ (q1, λ), (q1, b, X) ›→ (q1, λ),(q1, a, Z) ›→ (q0, Z). Infer a (reduced) context-free grammar G for the empty stack language of A, i.e., L(G) = Le(A).	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8

11	**Describe** PDA for the below grammar as shown below S->aABB |aAA A->aBB |a B->bBB | A that accepts the language generated by given grammar	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
12	**Describe** a PDA for the below CFG which generates the palindrome accepted by L(G) S->aSa| bSb|a|b	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
13	**Define** a PDA and describe a context free grammar for the language L={ $a^ib^jc^k$; i<j or j<k}	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
14	**Covert** the following context free grammar to push down automata S->aA|bB A->aB|a B->b Verify the string aab accepted by equivalent PDA	Understand	This would require the learner to **recall** the Context Free Grammars and **Explain** the steps for the conversion of CFG to PDA	CO8
15	**Describe** DPDA for L= a^nb^n where n>=1	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the DPDA	CO9
16	**Describe** PDA accepts PDA M for the language L={ WWR|W ϵ {a,b}* }such that L=L(M)	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
17	**Illustrate** PDA M for the language L={x ϵ {a,b}* | n_a (x)>n_b(x)}	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
18	**Show** that the below languages are deterministic context free languages? L1={0^n1^m|n=m and n>=1} L2 = {o^n1^m|n=2m andn>=1}	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the checking DCFL or not	CO9
19	**Describe** deterministic context free languages and deterministic push down automata	Remember	---	CO8
20	**Describe** PDA that recognizes the language L={x=x^R : x ϵ{a,b}$^+$}	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the construct of the PDA	CO8
Part – C (Problem Solving and Critical Thinking Questions)				
1	**Construct** PDA for equal number of x's and y's. eg: xyyxxy	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the PDA	CO8

2	**Construct** NDPDA for L = { W#W^R /W ϵ(X + Y)*}	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the NPDA	CO8
3	**Convert** the following PDA to CFG $\delta(q0,0,z0)=\{q0,xz0)$ $\delta(q0,0,x)=(q0,xx)$ $\delta(q0,1,x)=(q1,\epsilon)$ $\delta(q1,1,x) = (q1,\epsilon)$ $\delta(q1,\epsilon,x)=(q1,\epsilon)$ $\delta(q1,\epsilon,z0)=(q1,\epsilon)$	Understand	This would require the learner to **recall** the Push Down Automata and **Explain** the steps for the conversion of PDA CFG	CO8
4	**Construct** DPDA for L = { W#W^R /W ϵ (X + Y)*}	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the DPDA	CO8
5	**Construct** pushdown automata for the following languages. Acceptance either by empty stack or by finalstate. $\{ a^n b^m a^n \mid m, n \in N\}$ $\{a^n b^m c^m \mid m,n \in N\}$ aibjck | i, j, k ∈ N, i > j} $\{a^i b^j c^k \mid i,j,k \in N, i+j=k\}$ $\{a^i b^j c^k \mid i,j,k \in N, i+k=j\}$ $\{a^n b^m \mid n \le m \le 2n\}$ (g)PAL=$\{w \in \{a,b\}^* \mid mir(w)=w\}$ (h) $\{w_1 c w_2 c \cdots c w_k c x \mid x,w_1,\ldots,w_k \in \{a,b\}^*, k \in N, x =$ mir(w_j) for some $j\}$ (i)$\{w \in \{a,b\}^* \mid \#_a(w)=\#_b(w)\}$, $\#_a(w)$representsthenumberof$a$"sin$w$ (j)$\{w \in \{a,b\}^* \mid \#_a(w)=2\cdot\#_b(w)\}$	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the PDA	CO8
6	**Construct** a PDA with final state acceptance for the language B=$\{$bin(i)\$mir(bin(i+1))$\mid i \ge 0\} \subseteq \{0,1,\$\}^*$ Here is bin(i) ∈ {0, 1}∗ the binary representation (without leading zero"s) of the number i. Eg. bin(11) =1011and mir(bin(12)) =0011	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the PDA	CO8
7	**Construct** CFG corresponding to PDA whose transition mapping is as follows. $\delta(S,a,X)= (s, A,X)$ $\delta(S,b,A) =(s, AA)$ $\delta(S,a,A) = (s, AA)$	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the conversion of the PDA to CFG.	CO8
8	**Show** that given CFG with following productions S->aBc A->abcB->aAbC->AB C->c constructs a PDA M such that the language generated by M and G are equivalent.	Apply	This would require the learner to **recall** the Context Free Grammars and **Understand** the concept of the PDA and **Apply** the concepts for the construct of the PDA	CO8

9	**Construct** a PDA for the following grammar. S->0A A->0AB B->1	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the PDA	CO8
10	**Construct** PDA for the following grammar S->AA | a A->SA |b	Apply	This would require the learner to **recall** the Context Free Grammars and **Explain** the concept of the PDA and **Apply** the concepts for the construct of the PDA	CO8
MODULE-V				
TURING MACHINE				
Part - A (Short Answer Questions)				
1	**Describe** the Chomsky hierarchy of languages.	Remember	---	CO10
2	**Define** Context sensitive language.	Remember	---	CO11
3	**Describe** the Turing Machine	Remember	---	CO10
4	**Describe** the Type 0 grammars .	Remember	---	CO10
5	**Describe** the Type 1 grammars .	Remember	---	CO10
6	**Describe** the Type 2 grammars .	Remember	---	CO10
7	**Describe** the Type 3 grammars .	Remember	---	CO10
8	**List** out the types of grammars.	Remember	---	CO10
9	**Describe** the moves in Turing Machine.	Remember	---	CO10
10	**Define** an Instantaneous Description of a Turing Machine.	Remember	---	CO10
11	**Describe** the Language of Turing Machine.	Remember	---	CO10
12	**List** out types of TMs.	Remember	---	CO10
13	**Differentiate** the PDA and TM	Remember	---	CO10
14	**Describe** the multi head Turing Machine.	Remember	---	CO10
15	**Describe** the multi dimensional Turing Machine.	Remember	---	CO10
16	**Describe** the multiple tapes Turing Machine.	Remember	---	CO10
17	**Describe** the recursive languages.	Remember	---	CO10
18	**Describe** the recursively enumerable languages.	Remember		CO10
19	**Describe** the two way infinite Turing Machine.	Remember	---	CO10

20	**Describe** the the non deterministic Turing Machine.	Remember		CO10
21	**Describe** the Turing Machine for 1's complement for binary numbers.	Understand	---	CO10
22	**Describe** the Recursive languages and Recursively enumerable languages.	Remember	This would require the learner to **recall**the concept of the TM and **explain** the construction of the TM.	CO10
23	**Define** Church's Hypothesis.	Remember	---	CO10
Part - B (Long Answer Questions)				
1	**Describe** short notes on Context sensitive language and linear bounded automata.	Remember	---	CO11
2	**Classify** briefly about Chomsky hierarchy of languages..	Understand	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the all types of languages.	CO10
3	**Describe** a Turing Machine. With a neat diagram explain the working of a Turing Machine.	Remember	---	CO10
4	**Compare** Turing Machine with other automata.	Understand	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the differences between TM and other automata.	CO10
5	**Construct** a Transition diagram for Turing Machine to accept the language L= { $w\#w^R$ | w ϵ(a + b) *}	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
6	**Express** short notes on Recursive and Recursively Enumerable languages.	Understand	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the Recursive and Recursively enumerable languages.	CO10
7	**Describe** the properties of recursive and recursively enumerable languages.	Remember	---	CO10
8	**Develop** a Turing Machine to accept strings formed with 0 and1 and having substring 000.	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
9	**Construct** a Transition diagram for Turing Machine to accept the language L= { ww^R | w ϵ(a + b) *}	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10

10	**Design** a Transition table for TM $L=\{a^n b^n c^n / n>=1\}$	Apply	This would require the learner to **recall** the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
11	**Construct** a Transition table for Turing Machine to accept the following language. $L = \{ 0^n1^n0^n \mid n \geq 1\}$	Remember	---	CO10
12	**Construct** a Turing Machine that accepts the language $L = \{1^n2^n3^n \mid n \geq 1\}$. Give the transition diagram for the Turing Machine obtained and also show the moves made by the Turing machine for the string 111222333.	Apply	This would require the learner to **Recall** the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
13	**Enumerate** Linear bounded automata and explain its model?	Remember	---	CO11
14	**Demonstrate** the power and limitations of Turing machine.	Remember	---	CO10
15	**Construct** Transition diagram for Turing Machine - $L=\{a^n b^n c^n / n>=1\}$	Remember	---	CO10
16	**Construct** a Transition diagram for Turing Machine to implement addition of two unary numbers(X+Y).	Understand	This would require the learner to **recall** the concept of the TM and **explain** the construction of the transition diagram for the TM.	CO10
17	**Construct** a Linear Bounded automata for a language where $L=\{a^n b^n / n>=1\}$	Understand	This would require the learner to **recall** the concept of the LBA and **explain** the construction of the Linear Bounded automata for the given language.	CO11
18	**Classify** the types of Turing machines.	Understand	This would require the learner to **recall** the Turing machines and **Explain** the all types of Turing machines.	CO10
19.	**Describe** briefly about the following a)Church's Hypothesis b)Counter machine	Remember	---	CO10
20	**Construct** Transition diagram for Turing Machine that accepts the language $L = \{0^n1^n \mid n \geq 1\}$. Give the transition diagram for the Turing Machine obtained and also show the moves made by the Turing machine for the string 000111.	Understand	This would require the learner to **recall** the Chomsky hierarchy of languages and **Explain** the differences between FSM,PDA,TM.	CO10
Part – C (Problem Solving and Critical Thinking Questions)				
1	**Construct** a Turing Machine that accepts the language $L = \{a^{2n}b^n \mid n \geq 0\}$.Give the transition diagram for the Turing Machine obtained.	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10

2	**Construct** a Turing Machine that gives two's compliment for the given binary representation.	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
3	**Examine** Type 3 and Type 2 grammars with example.	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
4	**Extend** the Type 1 and Type 0 grammars with example.	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
5	**Design** a Turing Machine that accepts the set of all even palindromes over{0,1}	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
6	**Design** Turing Machine for $L=\{a^nb^nc^n \mid n \geq 1\}$	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
7	**Construct** Turing Machine to calculate GCD of two given numbers	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
8	**Compare** and contrast the Finite state machine , PDA and Turing Machine	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10
9	**Construct** a Turing Machine to accept the following languages $L = \{ w^n x^n y^n z^n \mid n \geq 1\}$	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10

10	**Design** a Turing Machine that accepts the language denoted by regular expression (000)*	Apply	This would require the learner to **recall**the Chomsky hierarchy of languages and **Explain** the concept of the TM and **Apply** the concepts for the construct of the TM	CO10

Prepared by:
Ms. V Divyavani, Assistant Professor

HOD, CSE