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Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110.

(An Autonomous Institution, Affiliated to Anna University, Chennai)

B.E. / B.Tech. End Semester Theory Examinations, April/May 2023.

Fourth Semester

Information Technology

UIT2404 AUTOMATA THEORY AND COMPILER DESIGN

Time: **Three Hours** Maximum:**100 Marks**

K1: Remembering K2: Understanding K3: Applying K4: Analyzing K5: Evaluating

CO1:	Construct automata, regular expressions for any pattern.
CO2:	Write Context free grammar for any construct.
CO3:	Build the different Phases of the compiler and apply the various optimization techniques.
CO4:	Design Turing machine for a given language
CO5:	Explain decidability, semi-decidability, and undecidability

Part – A (5 × 2 = 10 Marks)

		KL	CO	PI
1.	Write the regular expressions for an identifier and a constant.	K1	CO1	1.1.1 1.4.1 1.4.2 2.1.3
2.	List out any two reasons to group the phases of a compiler.	K2	CO2	1.1.1 1.3.1 1.4.1 2.1.3
3.	List four error recovery mechanisms used in predictive parsing technique.	K1	CO3	1.4.1 1.4.2 1.1.2 2.2.2
4.	Compare the Turing machine with DFA.	K2	CO4	2
5.	Define the Rice theorem.	K1	CO5	2

Part – B (5 × 6 = 30 Marks)

		KL	CO	PI
6.	Build a CFG for the RE (0|1)*111.	K3	CO1	1.1.1 1.4.1 1.4.2 2.1.3

7.	Consider the context-free grammar $X \rightarrow XX^* \mid XX^+ \mid a$ Give the leftmost derivation, rightmost derivation, and parse tree for the string **" aa^+a^* "**. Is the grammar ambiguous or unambiguous? Justify?	K3	CO2	1.1.1 1.3.1 1.4.1 2.1.3
8.	Explain the working of recursive descent parser with an example.	K2	CO3	1.4.1 1.4.2 1.1.2 2.2.2
9.	Construct a turning machine for language $L=\{a^nb^n\}$	K3	CO4	3.2.1 3.2.2. 13.1.1
10.	When do we say a problem is decidable? Give an example of undecidable problem.	K2	CO5	3.1.5 13.1.1

Part – C (5 × 12 = 60 Marks)

		KL	CO	PI
11.	a) Determine whether the regular expressions (ab)* and a*b* define the same language?	K3	CO1	1.1.1 1.4.1 1.4.2 2.1.3
	b) Compare Nondeterministic Finite Automata with Deterministic Finite Automata.	K3	CO1	1.1.1 1.4.1 1.4.2 2.1.3
	(Or)			
12.	Construct NFA for the following regular expression (x/y)* xyy. Convert the above constructed NFA to minimized DFA.	K3	CO1	1.1.1 1.4.1 1.4.2 2.1.3
13.	a) Reframe the following ambiguous grammar to unambiguous grammar **E→E@E | E%E | E^E | E$E | E & E | (E) | id** The associativity and precedence of the operators are given below. Operators / Precedence / Associativity @ and % / Low / right-associative $ and & / Medium / left-associative ^ / High / Right-associative. After eliminating the ambiguity, construct the parse tree for the input string "(id%id^id$(id@id&id))" (7 Marks)	K3	CO2	1.1.1 1.3.1 1.4.1 2.1.3

	b) Convert the following Context Free Grammar to Chomsky's Normal Form. (5 marks) S → XA|BB B → b|SB X → b A → a	K3	CO2	1.1.1 1.3.1 1.4.1 2.1.3
	(Or)			
14	a) Remove the useless symbol from the given context free grammar: (7 Marks) S -> aB / bX A -> Bad / bSX / a B -> aSB / bBX X -> SBD / aBx / ad	K4	CO2	1.1.1 1.3.1 1.4.1 2.1.3
	b) Remove unit production from the following (5 marks) S → XY, X → a, Y → Z | b, Z → M, M → N, N → a	K3	CO2	1.1.1 1.3.1 1.4.1 2.1.3
15.	Construct LR(0) parsing table for the following grammar. Explain step by step procedure. Test the string 'bbba' is the valid or not S→ a|Aa |B A→Abb B→ Aa |b	K3	CO3	1.4.1 1.4.2 1.1.2 2.2.2
	(Or)			
16.	Construct Operator Precedence parser for the following grammar. **E→ E%E | E^E | E & E | (E) | id** The associativity and precedence of the operators are given below. Test if the string a & b ^ (c % d) is valid and generate the corresponding parse tree.	K3	CO3	1.4.1 1.4.2 1.1.2 2.2.2

Operators	Precedence	Associativity
%	Low	right-associative
&	Medium	left-associative
^	High	Right-associative.

17.	a) Consider the grammar with the following translation rules and E as the start symbol. Compute E.val for the root of the parse tree for the expression:**3^12@6^2** (8 marks) **E -> E ^ T { E.val = E.val * T.val }** **| T { E.val = T.val }** **T -> T @ F { T.val= T.val + F.val }** **| F { T.val = F.val** **F -> num { F.val = num.val }**	K3	CO3	1.4.1 1.4.2 1.1.2 2.2.2
	b) Draw a Turing machine that subtracts two numbers. Explain with an example. (4marks)	K3	CO4	3.2.1 3.2.2. 13.1.1
	(Or)			
18.	a) Express the Syntax Directed Translation(SDT) to generate the syntax tree for the expression. Draw the SDT annotated parse tree for the following expressions **(w*x)+(y/z)** (8 marks)	K3	CO3	1.4.1 1.4.2 1.1.2 2.2.2
	b) Difference between Turing machine and Universal Turing machine (4 marks)	K3	CO4	3.2.1 3.2.2. 13.1.1
19.	a) Describe the important features of decidable, undecidable problems, and semi-decidability problems. Explain with an example. (7 marks)	K3	CO5	3.1.5 13.1.1
	b) Write the differences between recursive and recursively enumerable languages. (5 marks)	K3	CO5	3.1.5 13.1.1
	(Or)			
20.	a) Explain the two ways of representing the Post Corresponding problems with an example. (7 marks)	K3	CO5	3.1.5 13.1.1
	b) Find whether the lists M = (abb, aa, aaa) and N = (bba, aaa, aa) have a Post Correspondence Solution. (5 marks)	K3	CO5	3.1.5 13.1.1