BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : V**
BRANCH: CSE/IT **SESSION : MO/2023**

SUBJECT: CS331 FORMAL LANGUAGES AND AUTOMATA THEORY

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	i. In short explain the process of performing union of two DFA's. ii. Given two languages over ∑= {0,1} L1: w | w starts with "01" L2: w| w contains substring "10" Construct DFA's for each language separately and then construct a DFA that recognizes language L1 U L2 from designed DFA's for languages L1 and L2.	[5]	2	2,6
Q.1(b)	Design a DFA that will simulate functioning of a traffic signal system installed at a "+" section (see figure) of a roadway. Left turn for each side traffic is free while other movements are controlled by signals. 	[5]	2	4,6
Q.2(a)	Write regular expressions for representing numbers (>= 0) in i. Unary number system ii. Hexadecimal number system Note: choose symbol for representing Unary numbers accordingly while Hexadecimal number will start with OX like OX12E.	[5]	2	1,2
Q.2(b)	Design a minimal DFA that recognizes numbers represented in Octal, Decimal and Hexadecimal number systems. Note: Usual representation of numbers in these number systems should be considered.	[5]	2	4,5,6
Q.3(a)	Design a Context Free Grammar for Assignment statement. Note: Statement will have a single assignment operator (=). Left hand side will have a single variable. Right hand side will be a mathematical expression with addition (+), Multiplication (*) and exponentiation (^) operators. Preserve the properties of the operators. Use common variable name "id" for variables that comes in statement.	[5]	2	3
Q.3(b)	Define Ambiguity in Grammar. Can we write an algorithm to check Ambiguity? Design an Unambiguous grammar for the designed CFG of Q3(a)	[5]	2,5	1,5
Q.4(a)	Define Pushdown Automata (acceptance with empty stack) mathematically. Design a PDA (acceptance with final state) that will accept language $a^{3n}b^mc^md^n$ |m,n>=1.	[5]	1,3	1,3,6
Q.4(b)	Write Context Free grammar for the language of Q4(a). Write rightmost derivation for the string "aaaaaabbccdd". Is leftmost derivation for the same string same as the written rightmost derivation? If not give the leftmost derivation.	[5]	2,3	3,6
Q.5(a)	Define Turing Machine with its block diagram and explain functioning of each part. Design a single head Turing machine to perform concatenation of two strings over ∑ = {0, 1}. Note: Head is initially pointing to a symbol of first operand.	[5]	1,4	1,3,6
Q.5(b)	Design a Turing machine that will perform LOGICAL AND of two binary operands. Note: Operands may not be of same length. Heads are initially pointing to blanks in left of operands.	[5]	4	3,6

:::::21/11/2023 M:::::