JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

B.Tech-V Semester (CSE)

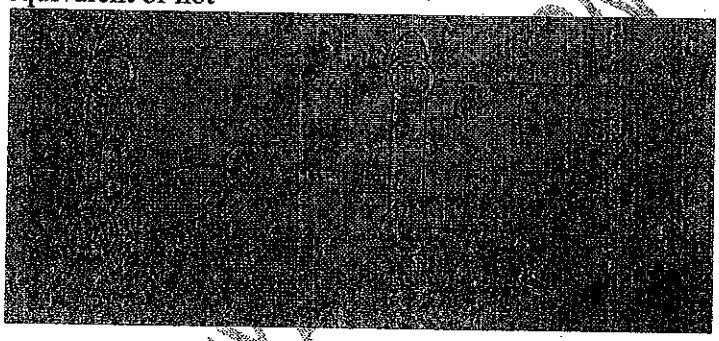
COURSE CODE (CREDITS): 18B11CI513 (03) MAX. MARKS: 35

COURSE NAME: Formal Languages & Automata Theory

COURSE INSTRUCTORS: AKJ, ARV*, JTI, RMS MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	CO	Marks
Q1	(a) Compare the two given DFAs and find out whether they are equivalent or not 	CO 2	[4]
	(b) Construct a DFA over $\sum = \{0, 1\}$ that accepts an $L = \{w \mid w$ has exactly three 0's and at least three 1's$\}$	CO 3	[4]
Q2	(a) Construct PDA accepting the following languages by final state:		
	(i) $L_1 = \{ a^n b^m \mid n, m >= 0$ and $m = 2n + 1 \}$. Here, the number of b's is always one more than twice the number of a's.	CO 6	[3]
	(ii) $L_2 = \{ w \mid w \in \{a, b, c\}^*$ and $n_a(w) = n_c(w)\}$. This language consists of strings where the number of a's is equal to the number of c's, regardless of the order.	CO 6	[2]
	(b) Is a Nondeterministic Push down automaton more powerful than deterministic push down automaton? If yes, Justify with an example.	CO 7	[2]
	(c) Convert the CFG $\{S \rightarrow aSb \mid A, A \rightarrow bSa \mid S \mid \varepsilon\}$ to a PDA that accepts the same language by empty stack.	CO 7	[2]
Q3	(a) Construct a Turing Machine which accepts the language with the regular expression (a + b)*aba.	CO 8	[4]

	(b) Construct a Turing Machine for the language L={ $a^n b^m c^n$ | m, n is greater than or equal to 1} and explain its transitions.	CO 9	[5]
Q4	(a) Design a Turing Machine to find the value of $\log_2(n)$, where n is any binary number and a perfect power of 2.	CO 8	[4]
	(b) Consider the language L = {w ∈ {a,b}* : |w| is odd} (i) Give a Turing machine that decides L. (ii) Give a Turing machine that semidecides L.	CO 9	[3]
	(c) Given the following language L categories: A: L is not context free but is Turing decidable B: L is not Turing decidable but is Turing acceptable Assign the appropriate category to the following language. Make sure you can justify your answer. $L = \{a^n b^m c^{mn} : n \geq 0, m \geq 0\}$	CO 10	[2]