

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-2 EXAMINATION - 2024

B.Tech-V Semester (CSE)

COURSE CODE (CREDITS): 18B11CI513 (03)

MAX. MARKS: 25

COURSE NAME: Formal Languages & Automata Theory

COURSE INSTRUCTORS: AMT, ARV\*, JTI, RMS

MAX. TIME: 1 Hour 30 Minutes

**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	<p>(i) Can every Type 3 language be generated by a Type 2 grammar? Explain why.</p> <p>(ii) Design a Type 3 grammar that generates the language <math>ab^+</math>, which consists of strings that start with exactly one 'a' followed by one or more b's.</p> <p>(iii) Why is the language <math>L = \{ww^R \mid w \in \{0,1\}^*\}</math> not regular? Here, <math>w^R</math> denotes the reverse of <math>w</math>.</p>	CO-2	6 [2+2+2]
Q2	<p>(i) Find a regular expression corresponding to the following languages over <math>\Sigma = \{0, 1\}</math>.</p> <p>(a) The set of all strings ending with 1 and don't contain 00.</p> <p>(b) The set of all strings in which both the number of 0's and 1's are odd.</p> <p>(ii) Construct a regular expression for the following finite automata.</p> <p>(iii) Construct an equivalent finite automata for the regular expression <math>a^*b(a+b)^*ab^*</math>.</p>	CO-3	6 [2+3+1]
Q3	<p>(i) Construct a context-free grammar for the following language:  <math>L = \{a^{n+m} b^m c^n d^l \mid m, n, l \geq 1\}</math>.</p> <p>(ii) Consider the following grammar G, which has the following productions:</p> <p style="text-align: center;"> <math>S \rightarrow aB \mid bA</math>  <math>A \rightarrow aS \mid bAA \mid a</math>  <math>B \rightarrow bS \mid aBB \mid b</math> </p>	CO-4	7 [3+2+2]

	<p>State whether the following statements are true or false:</p> <p>a. <math>L(G)</math> is finite.  b. <math>abbbaa \in L(G)</math>  c. <math>aab \notin L(G)</math>  d. <math>L(G)</math> has some string of odd length</p> <p>Here, <math>S</math> is the start symbol, the set of variables is <math>\{S, A, B\}</math> and the set of terminals is <math>\{a, b\}</math>. <math>L(G)</math> denotes the set of strings (or language) generated by the given grammar <math>G</math>.</p> <p>(iii) Is the given grammar ambiguous?  <math>S \rightarrow a \mid abSb \mid aAb</math>  <math>A \rightarrow bS \mid aAAb</math></p> <p>Here, <math>S</math> is the start symbol, the set of variables is <math>\{S, A\}</math>, and the set of terminals is <math>\{a, b\}</math>. If yes, give an example of a string generated by this grammar that has more than one parse tree.</p>		
Q4	<p>(i) Simplify the following Context free grammar by eliminating the useless symbols.</p> $S \rightarrow AC$ $S \rightarrow BA$ $C \rightarrow CB$ $C \rightarrow AC$ $A \rightarrow a$ $B \rightarrow aC \mid b$ <p>(ii) Convert the following Context free grammar to Chomsky Normal Form.</p> $S \rightarrow abAB$ $A \rightarrow aAB \mid \epsilon$ $B \rightarrow Baa \mid \epsilon$	CO-5	6 [3+3]