

4E1306

Roll No. _____

Total No. of Pages: **3****4E1306****B. Tech. IV - Sem. (Main) Exam., - 2022****Computer Science & Engineering****4CS4 – 06 Theory of Computation****CS, IT, AID, CAI****Time: 3 Hours****Maximum Marks: 70***Instructions to Candidates:*

Attempt all ten questions from Part A. Five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

Q.1 Define the Automata theory.

Q.2 Is the following set regular -

$$\{0^{2n} \mid n \geq 1\}$$

If yes, write down the corresponding regular expression. Else, prove that language is not regular.

Q.3 Is the set of odd – length strings over 0 regular, where the alphabet is $\Sigma = 0$?Q.4 Construct a Deterministic Finite Automata (DFA) that accepts the language over $\Sigma = \{a, b\}$ in which length of string is divisible by three.**[4E1306]****Page 1 of 3****[4360]**

Q.5 What is Pigeonhole Principle?

Q.6 Define ambiguous grammar.

Q.7 Consider the following grammar and draw the left most and right most tree. (S, A, B are non terminals and rest are terminals symbols)

$S \rightarrow aScB \mid A \mid b$

$A \rightarrow cA \mid c$

$B \rightarrow d \mid A$

Q.8 What is transition function? Write the transition function of Pushdown Automata.

Q.9 Draw the diagram of Turing Machine.

Q.10 What is NP – complete? Give one example.

PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions (Word limit 100)

Q.1 Design a Mealy Machine that computes 2's complement of the given input binary number?

Q.2 Write regular expression (R) for the following ($\Sigma = a, b$) –

(a) R that generate all string where length of string is at least 3

(b) R that generate all string where every 'a' must followed by 'b'

(c) R that generate all string contain second symbol from RHS is 'a'

(d) R that generate all string where each string contain atmost two b's

Q.3 Convert the following Context Free Grammar (CFG) into an equivalent CFG in Chomsky Normal Form. <https://www.rtuonline.com>

$A \rightarrow BAB \mid B \mid \epsilon, B \rightarrow 00 \mid \epsilon$

(Only A and B are non terminal and rest are terminal)

Q.4 Design a Pushdown Automata (PDA) accepting $\{a^n b^m c^n \mid m, n \geq 1\}$ by null store.

Q.5 Give the 5 examples of languages that cannot be accepted by Finite Automata but can be accepted by Pushdown Automata. Contrast the reasons behind it.

Q.6 What is the Chomsky Hierarchy of languages? Explain in detail.

Q.7 What is Hamiltonian path problem? Explain with suitable example.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[3×10=30]**

Attempt any three questions

- Q.1 Design a DFA (Deterministic Finite Automation) to accept the language $L = \{\alpha \in \{a, b, c\}^* \mid \alpha \text{ starts and ends with the same symbol}\}$. Only draw the transition diagram, and clearly indicate the start state and final state (s).
- Q.2 What is the regular languages? Explain any three applications of regular languages in software (Compiler or web) design.
- Q.3 Explain the model of Pushdown Automate with the help of suitable diagram.
- Q.4 Design a Turing Machine which recognizes the language, $L = \{1^n 2^n 3^n, \text{ where } n > 0\}$.
- Q.5 Write an unrestricted grammar to accept the language, $L = \{a^i b^j c^k d^l \mid i = k \text{ and } j = l\}$.
Mention the start symbol of your grammar. Use upper – case Roman letters for non-terminal symbols.
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