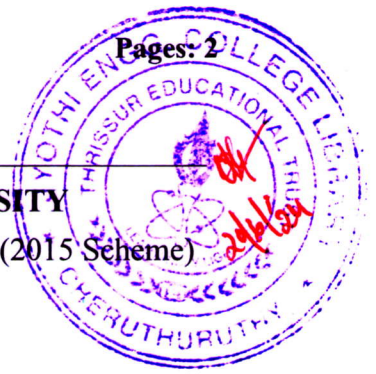


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S,FE) Examination June 2024 (2015 Scheme)

**Course Code: CS301****Course Name: THEORY OF COMPUTATION**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 3 marks.*

Marks

- 1 Write a regular grammar for generating the language $L = \{a^m b^n \mid m, n > 0\}$ (3)
- 2 Design a DFA for the language $L = \{x \text{ in } \{a,b\}^* \mid x \text{ contains } a \text{ as third character}\}$ (3)
- 3 Explain Mealy machine. (3)
- 4 Explain the working of 2-way Finite State Automata (3)

PART B*Answer any two full questions, each carries 9 marks.*

- 5 a) Prove that the language accepted by NFA and DFA are same (5)
- b) Define e-closure of a state in an e-NFA. Give an example. (4)
- 6 a) State Myhill-Nerode theorem. Prove that $L = \{a^n b^n \mid n > 0\}$ is not regular using Myhill-Nerode theorem. (9)
- 7 a) With the help of an example explain Thompsons Construction (Regular Expression to NFA) (5)
- b) Write regular expressions for the following languages (4)
 - i) $L = \{x \text{ in } \{a,b\}^* \mid x \text{ starts with } a\}$
 - ii) $L = \{x \text{ in } \{a,b\}^* \mid x \text{ contains } a \text{ as third character}\}$

PART C*Answer all questions, each carries 3 marks.*

- 8 Explain the two modes of language acceptance of a PDA (3)
- 9 Design a CFG to generate $L = \{a^m b^n c^n d^m \mid m, n > 0\}$ (3)
- 10 Describe Chomsky's Normal Form. (3)
- 11 $L1 = \{x \text{ in } \{a,b\}^* \mid x \text{ contains odd number of } b\text{'s}\}$ and $L2 = \{x \text{ in } \{a,b\}^* \mid x \text{ contains even number of } b\text{'s}\}$. What is the union of $L1$ and $L2$? (3)

PART D

Answer any two full questions, each carries 9 marks.

- 12 a) State Pumping Lemma for regular languages. (3)
b) Prove that $L = \{a^n \mid n \text{ is prime}\}$ is not regular using Pumping Lemma. (6)
- 13 a) Write the formal definition of a PDA. (3)
b) Design a PDA which accepts the language $L = \{WcW^R \mid \text{where } W \text{ is in } \{a,b\}^*\}$ (6)
- 14 a) Explain different steps involved in the simplification of a CFG. (6)
b) Show that $S \rightarrow E+E \mid E^*E \mid a$ is ambiguous. (3)

PART E

Answer any four full questions, each carries 10 marks.

- 15 a) Prove that the language $L = \{ww \mid w \text{ in } \{a,b\}^*\}$ is not CFL using Pumping Lemma for CFL (6)
b) Write a CSG for $L = \{a^n b^n c^n \mid n > 0\}$ (4)
- 16 a) Design a TM which accepts palindromes over the alphabet $\{a,b\}$ (7)
b) Write and explain the instantaneous description of a Turing Machine (3)
- 17 a) Design a TM to increment a binary number (6)
b) Explain Universal TM (4)
- 18 a) Explain Chomsky's classification of grammars (7)
b) Describe the language acceptability of LBA (3)
- 19 a) Explain recursively enumerable set? (4)
b) Show that the complement of a recursive language is recursive. (6)
- 20 a) State and prove that halting problem of TM is undecidable (10)
