

Roll No.

3229

**B. Tech. 5th Semester (CSE)
Examination – March, 2021**

FORMAL LANGUAGES AND AUTOMATA

Paper : PCC-CSE-305-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all, selecting at least one question from each Section. Question No. 1 is compulsory.

1. Explain the following Questions : $6 \times 2.5 = 15$
- (a) Any *two* differences between DFA and NFA.
 - (b) Define PDA.
 - (c) Give an example of an undecidable problem.
 - (d) What are Limitations of FSM ?
 - (e) Define Computability.
 - (f) Define unrestricted Grammer.

SECTION - A

2. (a) For the following non-deterministic finite automata, make equivalent deterministic finite automata. 10

| | | |
|-------------------|------------|------------|
| | a | b |
| $\rightarrow Q_0$ | Q_0, Q_1 | Q_2 |
| Q_1 | Q_0 | Q_1 |
| Q_2 | - | Q_0, Q_1 |

- (b) Prove that regular sets are closed under concatenation. 5
3. What are Mealy/Moore machines? Explain, can these machines work like one another? If yes, then explain with an example to convert Moore to Mealy machine. 15

SECTION - B

4. (a) Prove that a Language is regular if and only if it is accepted by finite automata. 7.5
- (b) Define leftmost and rightmost derivation. Explain by taking suitable examples. 7.5
5. State and prove Arden's Method. 15

SECTION - C

6. (a) Define Chomsky normal form. Simplify the following CFG and convert it into CNF 7.5
- $S \rightarrow ASB/e$
- $A \rightarrow aAS/a$
- $B \rightarrow SbS/A/bb$

- (b) Show that the language

$$L = \{WW^R \mid W \in \Sigma(a,b)^*\} \text{ is not regular.}$$

7. Construct a PDA accepting $\{a^m b^n \mid m, n \geq 1\}$ by null store. Construct the corresponding CFG accepting same set. 15

SECTION - D

8. Discuss the halting problem and PCP problem of Turing machines. 15
9. (a) What are primitive recursive functions? Show that the following is primitive recursive: 8
- $$R(x, y) = x - y$$
- (b) What do you mean by computability? Explain in detail. 7

SECTION - E