Roll No. .....

3229

B. Tech. 5th Semester (CSE)

Examination – December, 2022

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 *one* question from each Section. Question No. 1 is *compulsory*.

1. Explain the following Questions :

   (a) Define finite automata with output briefly.

   (b) What is context sensitive language ?

   (c) When do you say that Turing machine accept a string ?

   (d) State Halting Problem of Turing machine.

   (e) Define PCP problem.

   (f) Closure properties of Regular Sets. $6 \times 2.5 = 15$

SECTION – A

2. (a) $M = (\{q_1, q_2, q_3\}, (0, 1), \delta, q_1, \{q_3\})$ is a NFA, where δ is given by :

$\delta(q_1, 0) = \{q_2, q_3\}$, $\quad \delta(q_1, 1) = \{q_1\}$

$\delta(q_2, 0) = \{q_1, q_2\}$, $\quad \delta(q_2, 1) = \{\phi\}$

$\delta(q_3, 0) = \{q_2,\}$ $\quad \delta(q_3, 1) = \{q_1, q_2\}$

construct an equivalent DFA. 10

(b) What do mean by regular expression ? Explain in detail. 5

3. (a) Construct a Finite Automata equivalent to the regular expression : 10

$$ba + (a + bb)\, a^* b$$

(b) Take an example of Melay and Moore machine each and process any string of at 4 alphabets from these machines and produce the resulting strings. 5

SECTION – B

4. (a) What do mean by Pumping Lemma and applications of pumping lemma ? 7.5

(b) What do you mean by ambiguity ? How do prove that the grammar is ambiguous or not ? Explain by taking suitable example. 7.5

5. Construct a DFA accepting all strings over {a,b} ending in ab. 15

SECTION – C

6. (a) What do mean by reduced form of a CFG ? Explain with example. 7.5

(b) What are normal forms of CFG ? Explain convert a CFG into CNF.

$S \rightarrow AACD, A \rightarrow aAb \mid a, D \rightarrow aDa \mid bDb \mid d, C \rightarrow aC \mid C$

7.5

7. (a) Design a PDA for the language 8

L={w $\in (a,b)^*$ | w has equal number of a's and b's}

(b) Differentiate between PDA and NPDA with the help of example. 7

SECTION – D

8. (a) Define Turing machine. Design a Turing machine that computes the integer function f defined as follows : 8

$f(n)=3^n$ where n is integer and $n \geq 0$.

(b) Explain TMs as Enumerators. 7

9. Explain the following with example : $2 \times 7.5 = 15$

(a) Partial recursive functions

(b) Primitive recursive functions