**Code No: 134BD** **R16**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year II Semester Examinations, May - 2019**
**FORMAL LANGUAGES AND AUTOMATA THEORY**
**(Common to CSE, IT)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

## PART – A

**(25 Marks)**

1.a) Define Kleene Closure and Positive Closure? [2]
b) Define Moore Machine? [3]
c) Define a Regular Expression. [2]
d) Find the simplified regular expression for the following regular expression r (r*r + r*) + r*? [3]
e) Define Context Free Grammar. [2]
f) Define Push Down Automata. [3]
g) Define Turing machine. [2]
h) What is Chomsky Normal Form? [3]
i) What is undecidable problem? [2]
j) Compare recursive and recursive enumerable languages. [3]

## PART – B

**(50 Marks)**

2. Construct NFA with ε which accepts a language consisting the strings of any number of 0's followed by any number of 1's followed by any number of 2's And also convert into NFA without ε transitions. [10]

**OR**

3. Construct the Moore machine to determine residue mod 3 and convert into Mealy machine. [10]

4.a) Test whether the following two FSM's are equivalent.

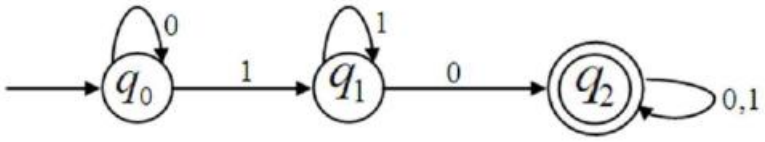
| M1 | 0 | 1 |
|---|---|---|
| → A | B | D |
| (B) | A | C |
| C | D | B |
| (D) | C | A |

| M2 | 0 | 1 |
|---|---|---|
| → P | R | R |
| Q | R | P |
| (R) | P | Q |

b) Apply pumping lemma for the language $L=\{a^n/n$ is prime$\}$ and prove that it is not regular? [5+5]

**OR**

5. Construct the regular expression corresponding to the language accepted by following DFA. [10]




6.a) Elaborate on left most derivation and right most derivation.
b) Design Push down Automata for L = $\{a^{2n}b^n \mid n \geq 1\}$ 3. [5+5]

**OR**

7. Construct the CFG for the PDA M = $(\{q_0,q_1\}, \{0,1\}, \{R,Z_0\}, \delta, q_0, Z_0, \Phi)$ and $\delta$ is given by
$\delta(q_0,1,Z_0)=(q_0,RZ_0)$
$\delta(q_0,1,R)=(q_0,RR)$
$\delta(q_0,0,R)=(q_1,R)$
$\delta(q_1,0, Z_0)=(q_0, Z_0)$
$\delta(q_0,\varepsilon, Z_0)=(q_0,\varepsilon)$
$\delta(q_1,1,R)=(q_1,\varepsilon)$. [10]

8.a) List out and discuss the closure properties of CFL.
b) Construct CFG without ε – production from the one which is given below
S → a | Ab | aBa
A → b | ε
B → b | A [5+5]

**OR**

9. Design a Turing Machine to accept $L=\{WcW^R \mid W \text{ is in } (a+b)^*\}$. [10]

10.a) Discuss in brief about NP Hard problems.
b) Discuss the examples of undecidable problems. [5+5]

**OR**

11.a) Explain about the undecidable problems about turing machines.
b) Distinguish between class P and class NP Problems. [5+5]

**---ooOoo---**