

b) Find Greibach Normal Form grammar equivalent to following context free grammar

$$G = (\{A1, A2, A3\}, \{a, b\}, P, A1) \text{ where } P \text{ is}$$

$$A1 \rightarrow A2A3$$

$$A2 \rightarrow A3A1 \mid b$$

$$A3 \rightarrow A1A2 \mid a$$

(c) Construct push down automata to accept following language. 06

$$L = \{ a^m b^n c^m \mid m, n \geq 1 \}$$

4. (a) Construct push down automata to accept following language. 06

$$L = \{ ww^R \mid w \text{ is in } (0+1)^* \}$$

(b) Design Turing machine for  $f(n) = \lceil \log_2 n \rceil$  06

5. (a) Design Turing machine automata to accept following language. 06

$$L = \{ ww^R \mid w \text{ is in } (0+1)^* \}$$

(b) Find whether the following instance of PCP is decidable. 06

5

i	List A	List B
1	10	Xi
2	011	101
3	1010	011

6

Qo2:

Qo1 Qo4 133

Winter – 2016

Course Code: CSU 502

Course Name: Theory of Computation

Time: 2 hr. 30min.

Max. Marks: 60

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

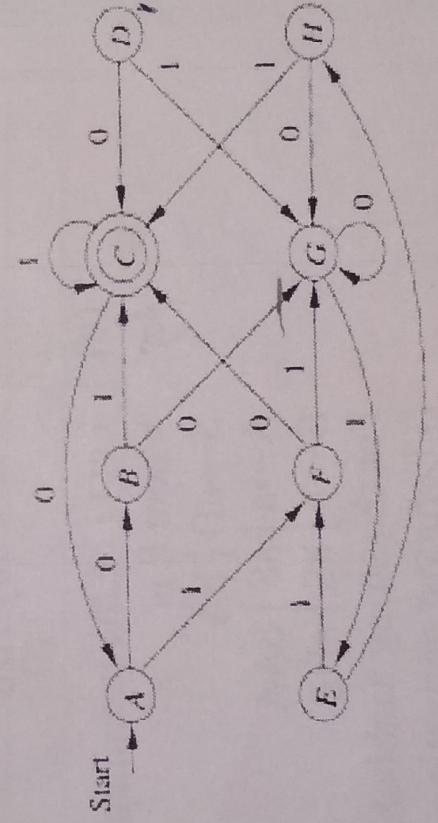
1.

06

- Solve any two**  
(a) Construct a DFA to accept all strings containing exactly 4 0s and at least 2 1s

06

- (b) Find minimum state finite automata equivalent to  
*5* following finite automata



*Contd...*

06

(c) Construct the corresponding Moore machine for the Mealy machine  $M = (\{q_0, p_0, p_1\}, \{0, 1\}, \delta, q_0, \lambda)$  described by the following transition table:

Present state	Input = 0	Input = 1
	Next state	Output
q <sub>0</sub>	p <sub>0</sub>	N
p <sub>0</sub>	p <sub>0</sub>	Y
p <sub>1</sub>	p <sub>0</sub>	N
	p <sub>1</sub>	y

4.

2.

**Solve any two**

(a)

i) Construct regular expression for set of strings of 0's and 1's containing string starting with 0 and end with 1

v

5.

ii) Construct regular expression for set of strings of 0's and 1's such that length of string is even

(b) Explain Pumping lemma for regular set

(c) *Q* Construct finite automata for regular expression  $01[((1+0)^* + 011)^* + 0]^+$ 

3.

**Solve any two**

(a)

Let G be the grammar  $G = (\{S, A, B\}, \{a, b\}, P, S\}$   
where P is

$$\begin{array}{l} S \rightarrow aB \mid bA \\ A \rightarrow a \mid aS \mid bAA \\ B \rightarrow b \mid bS \mid aBB \end{array}$$

For the string aaabbabbba find a

- i) Leftmost derivation
- ii) Right most derivation
- iii) Parse Tree

**Government College of Engineering, Amravati**  
(An Autonomous Institute of Government of Maharashtra)

**Fifth Semester B. Tech. (CS/IT)**

Winter – 2017

**Course Code:** CSU 502

**Course Name:** Theory of Computation

**Time:** 2 hr.30min.

**Max. Marks:** 60

**Instructions to Candidate**

- 1) All questions are compulsory.
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- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

**1.** **Solve any two**

**(a)** construct finite automata which accept decimal number divisible by 3 **06**

**(b)** Construct finite automata that accepts the set of all strings of zeros and ones that contains even numbers of zeros and even numbers of ones **06**

**(c)** Construct DFA equivalent to NFA given below  
 $M = (\{p, q, r, s\}, \{0,1\}, \delta, p, \{s\})$  Where  $\delta$  is given by

Cont.

	0	1
p	q,s	q
q	r	q,r
r	s	p
s	-	p

2.

(a)

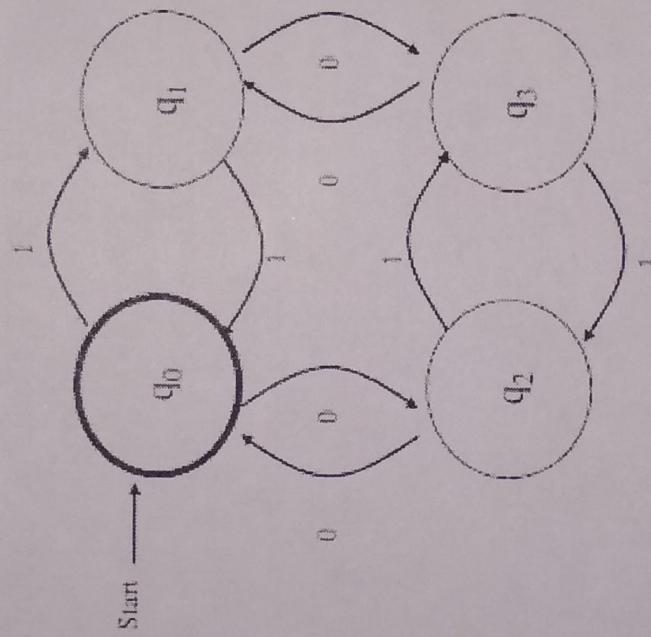
Solve any two

Construct NFA with  $\epsilon$  moves for Regular expression  $(0(00)^*1+01^*0)^*$  06

(b)

Construct regular expression for deterministic finite automata given below  $M = (\{q_0, q_1, q_2, q_3\}, \{0, 1\}, \delta, q_0, \{q_0\})$  06

4



5.

Construct left linear and right linear grammar for  $(0+1)^*00(0+1)^*$  06

(c)

3.

(a)

Solve any two

Consider grammar  $G = (\{S, A, B\}, \{0, 1\}, P, S)$  06  
where p consist of  
 $S \rightarrow aB \mid bA$   
 $A \rightarrow a \mid aS \mid bAA$

$B \rightarrow b | bS | aBB$

For the string aaabbabbba find leftmost and rightmost derivation and parse tree

- (b) Find Greibach Normal Form grammar 06  
equivalent to following context free grammar  
 $G = (\{A1, A2, A3\}, \{a, b\}, P, A1)$  where P is  
 $A1 \rightarrow A2A3$   
 $A2 \rightarrow A3A1 \quad | \quad b$   
 $A3 \rightarrow A1A2 \quad | \quad a$

- (c) Construct the context-free grammar for 06  
language  $L = \{0^n 1^{2n} \mid n \geq 0\}$

4. (a) Construct Pushdown automata to accept 06  
language  $L = \{wCw^R \mid w \text{ is in } (0+1)^*\}$

- (b) Design a Turing machine that reads binary strings and performs the following actions. If the input represents an odd number, subtracts one to the number. If the input represents an even number, add one to the number. For example, for input "101" the output should be "100" and for input "1010" the output should be "1011".

5. (a) Prove that 06

- i) The Complement of recursive language is recursive.
- ii) The union of recursive language is recursive.
- iii) The union of two recursively enumerable languages is recursively enumerable.

- (b) Construct Turing machine to accept language 06  
 $L = \{ww^R \mid w \text{ is in } (a+b)^*\}$

4. a) Design Turing machine for Addition

06

b) Design Turing machine Construct a Turing Machine that recognized the language on {a,b}

$$L = \{a^n b^n \mid n \geq 1\}$$

5. (a) What is Post Correspondence Problem? Explain with suitable example.

06

(b) Prove that the union of two recursive language is recursive and the union of two recursively enumerable language is recursively enumerable

06

## Fifth Semester B. Tech. (CS/IT)

Winter - 2018

Course Code: CSU 502

Course Name: Theory of Computation

Time: 2 hr. 30min.

Max. Marks: 60

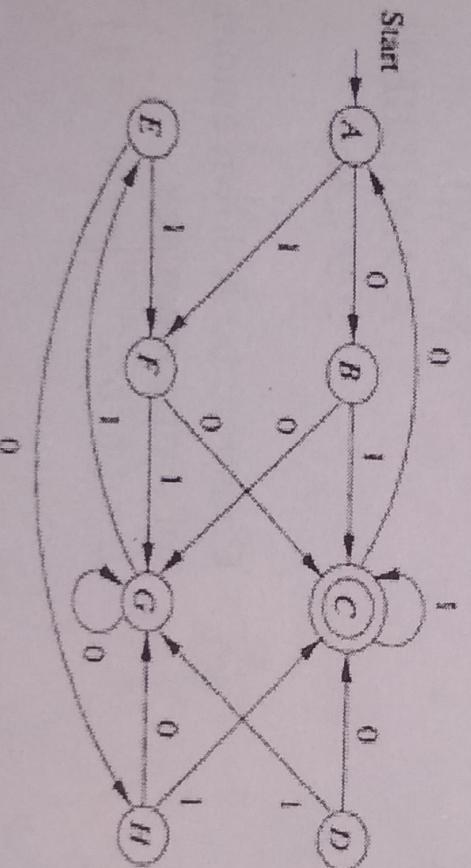
### Instructions to Candidate

- 1) All questions are compulsory.
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- 5) Figures to the right indicate full marks.

### Solve any two

- (a) Construct a DFA to accept all strings containing substring 001

- (b) Find minimum state finite automata equivalent to following finite automata



one and units N otherwise. Where inputs are 0's and 1's.

2. Solve any two

(a) Explain Pumping lemma for regular set 06

(b) Construct finite automata for regular expression  $[((1+0)^* + 011)^* + 10]^+ 1$  06

(c) Find regular grammars for  $\{aa^*(ab+a)^*\}$  06

3. Solve any two

(a) Let G be the grammar  $G = (\{S, A, B\}, \{a, b\}, P, S)$  where P is

$$\begin{array}{l} S \rightarrow aB \mid bA \\ A \rightarrow a \mid aS \mid bAA \\ B \rightarrow b \mid bS \mid aBB \end{array}$$

For the string aaabbabbba find a

- i) Leftmost derivation
- ii) Right most derivation
- iii) Parse Tree

b) Find Greibach Normal Form grammar equivalent to following context free grammar

$G = (\{S, A, B\}, \{a, b\}, P, S)$  where P is

$$\begin{array}{l} S \rightarrow AB \\ A \rightarrow BSB/BB/b \\ B \rightarrow aAb/a \end{array}$$

c) Construct push down automata to accept following language.

$$L = \{ a^m b^n c^{m+n} \mid m, n \geq 1 \}$$

06

5