

Sl-no. 07 Q-P: 6062

Unique Paper Code : 2341502  
Name of the Paper : Theory of Computation  
Name of the Course : B. Tech. Computer Science  
Semester : Fifth (V) F-9  
Duration of Examination : Three Hours  
Maximum Marks : 75 Marks

(Write your Roll no. on the top immediately on receipt of this question paper.)

Question No. 1 (Section A) is compulsory.

Attempt any *four* questions from Section B.

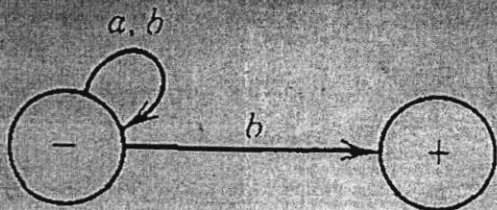
Parts of a question should be attempted together.

Assume alphabet  $\Sigma = \{ a, b \}$  for all questions unless stated otherwise.

### Section A

Q1.

- Consider the language  $S^*$ , where  $S = \{ a \text{ aba} \}$ . How many words of length 5 does this language have? 3
- Build an FA that accepts only those words that end with ba. 3
- Give regular expression for all strings that do not end in double letter. 4
- Show that the language  $L = \{ a^n b^{n+2} : n \geq 0 \}$  is not regular. 5
- Convert the following NFA to DFA 5



- Give CFG for the following 5
  - $ab^*$
  - $a^*b^*$
- Construct a PDA to accept  $L = \{ a^n b^{2n} \text{ where } n = 1, 2, 3, \dots \}$  5
- Write a short note on halting problem of Turing Machines 5

### Section B

Q2.

- Give FA for the languages and find out  $L_1 + L_2$ : 5  
 $L_1 = a(a+b)^*$        $L_2 = (a+b)^*b$
- For each pair of regular languages find a regular expression and FA that define  $L_1 \cap L_2$  5  
 $L_1 = (a+b)^*a$        $L_2 = (a+b)^*aa(a+b)^*$

Q3.

- Show that the language  $L = \{ a^n b^n a^n : n \geq 0 \}$  is not regular. 5
- Design a DFA corresponding to regular expression  $b^*(ba)^*$  5

Q4.

a. Using parse tree, verify whether the given grammar is ambiguous or not

$S \rightarrow aS \mid aSb \mid X$

$X \rightarrow Xa \mid a$

5

b. Show that if L is regular then its complement is also regular.

5

Q5.

a. Convert the grammar with productions

$S \rightarrow ABa$

$A \rightarrow aab$

$B \rightarrow Ab$

to Chomsky normal form.

5

b. Show that the language  $L = \{a^{2n}b^n : n \geq 0\}$  is not context free.

5

Q6.

a. Explain in brief Universal Turing Machine.

5

b. Construct a PDA (Deterministic or Non Deterministic) to accept

$L = \{w w^R \mid w \text{ belongs to } (0+1)^* \text{ where } w^R \text{ is reverse } w\}$ .

5

Q7.

a. Design a turing machine which multiplies the given binary input value by 2.

5

b. Give CFG for the language  $L = \{a^n S \text{ where } S \text{ starts with } b \text{ and length } (S) = n\}$

5