

Total No. of Questions : 8]

SEAT No. :

P1751

[Total No. of Pages : 3

[5460] - 581

**T.E. (Computer Engineering)**  
**THEORY OF COMPUTATION**  
**(2015 Pattern)**

*Time : 2½ Hours]*

*[Max. Marks :70*

*Instructions to the candidates:*

- 1) *Attempt questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Define the following terms with example - **[6]**

- i) Alphabets
- ii) String
- iii) Regular Expression

b) Design a DFA which accepts a ternary number divisible by 4. **[6]**

c) Design FA accepting the following language over the alphabet {0, 1} **[8]**

- i) Set of all strings having at least three consecutive zeros.
- ii) Set of all strings that begin and end with same symbol.

OR

**Q2) a)** Define the following terms with example **[6]**

- i) DFA
- ii) NFA
- iii) NFA -  $\epsilon$

b) Eliminate the useless symbols in the grammar below **[6]**

$S \rightarrow aA \mid bB$

$A \rightarrow aA \mid a$

$B \rightarrow bB$

$D \rightarrow ab \mid Ea$

$E \rightarrow aC \mid d$

**P.T.O.**

- c) Construct a DFA accepting the following languages over the alphabet  $\{a, b\}$  [8]
- Set of all strings that begin with the substring  $ab$ .
  - Set of all strings with at most two consecutive  $b$ 's.

- Q3)** a) Write short notes on - [4]
- Universal Turing Machine
  - Multi - tape Turing Machine
- b) Construct a Turing Machine for  $R = (a + b)^*bb$ . [6]
- c) Construct a Turing Machine to accept the language  $L = \{a^n b^n a^n \mid n \geq 1\}$ . [8]

OR

- Q4)** a) Write short notes on - [4]
- Unsolvability problems.
  - Applications of TM.
- b) Construct a Turing Machine for  $R = (aba^*b)$ . [6]
- c) Construct Turing Machine that accepts strings with equal number of 0's and 1's over  $\Sigma = \{0, 1\}$ . [8]

- Q5)** a) Prove that CFLs are closed under union, concatenation and Kleene's closure. [6]
- b) Design PDA for the following language - [6]
- $$L = \{a^n b^{2n} \mid n > 0\}$$
- c) Explain the working of Bottom - up parser with example. [4]

OR

- Q6)** a) Convert the following CFG to PDA - [6]
- $$S \rightarrow aSb \mid A$$
- $$A \rightarrow bSa \mid S \mid \epsilon$$
- b) Show that CFLs are not closed under intersection and complementation. [6]

- c) Explain acceptance by PDA - [4]
- i) By final state
  - ii) By empty state

- Q7)** a) Explain Tractable and Intractable problem. [6]
- b) How the Kruskal's Algorithm can be solved by using Turing machine? [6]
- c) Explain the Satisfiability Problem with an example. [4]

OR

- Q8)** a) Prove that the Satisfiability Problem is NP - complete. [6]
- b) What do you mean by Polynomial Time reduction? Explain with suitable example. [6]
- c) Differentiate between P and NP classes. [4]

