Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2018**

**Subject Code:2160704 Date:27/11/2018**

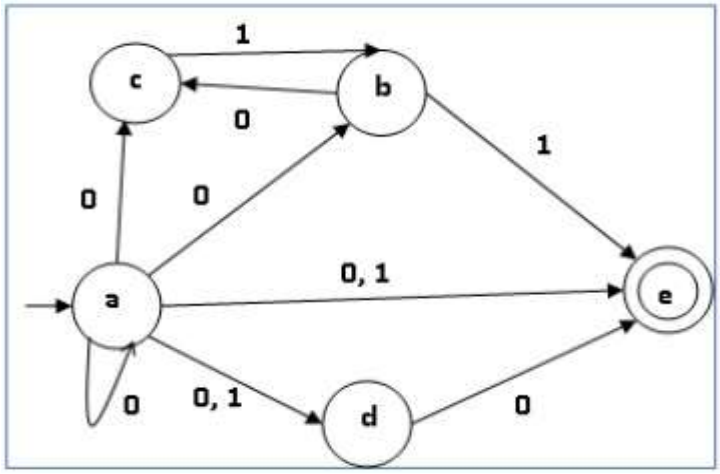
**Subject Name:Theory of Computation**

**Time: 02:30 PM TO 05:00 PM Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Define one-to-one, onto and bijection function. | **03** |
| | **(b)** | Explain reflexivity, symmetry, and transitivity properties of relations. | **04** |
| | **(c)** | State the principle of mathematical induction and prove by mathematical induction that for all positive integers n 1+2+3+……..+n = n (n+1)/2. | **07** |
| **Q.2** | **(a)** | What are the closure properties of regular languages? | **03** |
| | **(b)** | Explain moore machine and mealy machine. | **04** |
| | **(c)** | What are the applications of finite automata? Draw Finite Automata to accept following.<br>(i) the language accepting strings ending with ’01’ over input alphabets Σ = {0, 1}<br>(ii) the language accepting strings ending with ‘abba’ over input alphabets Σ = {a, b} | **07** |
| | | **OR** | |
| | **(c)** | Define NFA-Λ. Explain how to convert NFA-Λ into NFA and FA with suitable example. | **07** |
| **Q.3** | **(a)** | State pumping lemma for regular languages. | **03** |
| | **(b)** | Explain Union Rule and Concatenation Rule for Context Free Grammar. | **04** |
| | **(c)** | Write difference between DFA and NDFA. Convert the following NDFA to DFA. | **07** |




**OR**

| | | | |
|---|---|---|---|
| **Q.3** | **(a)** | Define Context-Sensitive Grammar. What is the language of following context-sensitive grammar?<br>$S \rightarrow aTb \mid ab$<br>$aT \rightarrow aaTb \mid ac.$ | **03** |
| | **(b)** | Find a regular expression corresponding to each of the following subsets of {0, 1}*<br>(i) The language of all strings that begin or end with 00 or 11. | **04** |

(ii) The language of all strings beginning with 1 and ending with 0.

**(c)** What is CNF? Convert the following CFG into CNF. **07**

$S \rightarrow ASA \mid aB,$

$A \rightarrow B \mid S,$

$B \rightarrow b \mid \varepsilon$

**Q.4** **(a)** What is Turing Machine? Write advantages of TM over FSM. **03**

**(b)** Define CFG. When a CFG is called an 'ambiguous CFG'? **04**

**(c)** Define PDA. Describe the pushdown automata for language $\{0^n1^n \mid n \geq 0\}$. **07**

**OR**

**Q.4** **(a)** Write a short note on Universal Turing Machine. **03**

**(b)** Describe recursive languages and recursively enumerable languages. **04**

**(c)** Explain push down automata with example and their application in detail. **07**

**Q.5** **(a)** Define grammar and chomsky hierarchy. **03**

**(b)** What are the applications of regular expressions and finite automata? **04**

**(c)** Draw a transition diagram for a Turing machine for the language of all palindromes over {a, b}. **07**

**OR**

**Q.5** **(a)** Compare FA, NFA and NFA-^. **03**

**(b)** Write a short note on church-turing thesis. **04**

**(c)** Explain primitive recursive function by suitable example. **07**

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