CS-505(O)

B. E. (Fifth Semester) EXAMINATION, Dec., 2009

(Old Scheme)

(Computer Science & Engg. Branch)

THEORY OF COMPUTATION

[CS – 505(O)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *two* questions from each Unit. All parts carry equal marks.

Unit – I

1. (a) Design NFA to recognize the following set of strings :

    abc, abd and *aacd*

    Assume the alphabet is $\{a, b, c, d\}$.

   (b) Consider the following ∈-NFA :

	∈	a	b	c
→ p	ϕ	$\{p\}$	$\{q\}$	$\{r\}$
q	$\{p\}$	$\{q\}$	$\{r\}$	ϕ
* r	$\{q\}$	$\{r\}$	ϕ	$\{p\}$

   (i) Compute the ∈-closure of each state.

   (ii) Give all the strings of length three or less accepted by the automation.

   (iii) Convert the automation to a DFA.

(c) Design a Mealy machine, which prints 1's complement of input string over alphabet $\Sigma = \{0, 1\}$.

Unit – II

2. (a) Write regular expression for the following language :

The set of all strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's.

(b) Give English descriptions of the language of the following regular expression :

$$(1 + \in)(0\,0^*\,1)^*\,0^*$$

(c) Convert the following regular expression to NFA with $\in$ transition $(0 + 1)\,0\,1$.

Unit – III

3. (a) Prove that the following is not regular language :

$$\{0^n / n \text{ is a perfect square}\}$$

(b) The following grammar generates the language of regular expression $0^*\,1\,(0 + 1)^*$:

$$S \to A \,|\, B$$
$$A \to OA \,|\, \in$$
$$B \to OB \,|\, 1B \,|\, \in$$

Give leftmost and rightmost derivations of the following string :

00101

(c) Consider the grammar :

$$S \to a\,S \,|\, a\,S\,b\,S \,|\, \in$$

Prove that the above grammar generates all and only the strings of a's and b's such that every prefix has at least as many a's as b's.

Unit – IV

4. (a) Design a PDA to accept the following language :

$$\{a^i\,b^j\,c^k \,|\, i \neq j \text{ or } j \neq k\}$$

(b) Convert the following grammar to a PDA that accepts the same language by empty stack :

$$S \to OSI \mid A$$

$$A \to IAO \mid S \mid \in$$

(c) Consider the following grammar :

$$S \to ASB \mid \in$$

$$A \to aAS \mid a$$

$$B \to SbS \mid A \mid bb$$

(i) Are there any useless symbols ? Eliminate them if so.

(ii) Eliminate $\in$ productions.

(iii) Eliminate unit productions.

(iv) Put the grammar into Chomsky normal form.

Unit – V

5. (a) Prove that if both a language L and its complement are RE, then L is recursive.

(b) Explain the following :

(i) Complexity theory

(ii) Undecidability

(c) Explain with example multitape turing machine.