B.E. (Fifth Semester) EXAMINATION, June, 2003
(Computer Science Engg. Branch)
THEORY OF COMPUTATION
(CS–5511)

Note : Any five questions are to be attempted.

1. (a) Discuss the finite state system with the help of a appropriate example. 8
   (b) Make a Finite state machine for any Decimal Number without fractional part is divisible by 3 or not. If Decimal Number is divisible by 3 it should be accepted by FSM, otherwise not. Let input alphabet $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. 8
2. (a) Write down the properties of Regular expressions 8
   (b) Construct the DFA equivalent to the NFA $(\{p, q, r, s\}, \{0, 1\}, \delta, P, \{S\})$ where δ is given below : 8

	0	1
p	p, q	p
q	r	r
r	s	—
s	s	s

3. (a) Prove that the regular sets are closed under intersection. 5
   (b) Show that $\{0^i 1^j \mid \gcd(i, j) = 1\}$ is not regular. 6
   (c) Give a decision procedure to determine if the set accepted by a DPA is the set of all strings over a given alphabet. 5
4. (a) Define Primitive Recursive functions. 8
   (b) Find a CFG with no useless symbols equivalent to : 4

$$\dot{S} \rightarrow \dot{A}B|CA$$
$$B \rightarrow BC|AB$$
$$S \rightarrow a$$
$$C \rightarrow aB|b$$

   (c) Define the grammar. Explain the types of the grammar. 4
5. (a) Define the push down automata. 4
   (b) Give a grammar for the language N (M) where : 12

$$M = (\{q_0, q_1\}, \{0, 1\}, \{z_0, x\}, \delta, q_0, z_0, \phi)$$

and δ is given by :

$$\delta(q_0, 1, z_0) = \{(q_0, xz_0)\}$$
$$\delta(q_0, \varepsilon, z_0) = \{(q_0, \varepsilon)\}$$
$$\delta(q_0, 1, x) = \{(q_0, xx)\}$$
$$\delta(q_1, 1, x) = \{(q_1, \varepsilon)\}$$
$$\delta(q_0, 0, x) = \{(q_1, x)\}$$
$$\delta(q_0, 0, z_0) = \{(q_0, z_0)\}$$

6. (a) Construct the PDA equivalent to the following grammar : 8

$$A \rightarrow aAA$$
$$A \rightarrow aS|b\ S|a$$

   (b) State and prove Myhill Nerode theorem. 8
7. (a) Explain Turing machine as a mathematical model of computation. 6
   (b) Construct a Turing machine (TM) for accepting the language : 10

$$M = \{a^m, b^m, c^m, a^m \mid m \geq 0\}$$

8. Write short notes on any four of the following : 16
   (i) Off-line turing machines (ii) Decision algorithms
   (iii) Chomsky Normal form (iv) Recursively Enumerabl languages
   (v) Moore machine and Mealy machine