Total number of printed pages – 4

B. Tech

BCSE 3308

Fifth Semester Examination – 2008

AUTOMATA THEORY

Full Marks – 70

Time – 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer all questions : 2×10

   (a) What is a finite automaton ?

   (b) List down five different characteristics of an automaton.

   (c) What is a regular expression ?

   (d) What is the Non-Deterministic Automaton ?

P.T.O.

(e) Define the meaning of terminals and non-terminals.

(f) What is the difference between grammar and language ?

(g) Write at least two differences between natural language and formal language.

(h) Distinguish between context free and context sensitive language.

(i) What do you understand by decidable ?

(j) Which automata correspond to context free language ?

2. (a) What is the formal definition of a DFA ? How it is different from NFA ? 5

(b) Prove that for every NFA, if L is the set accepted by NFA, then there exists a DFA which also accepts L. 5

3. (a) Construct a DFA equivalent to $M = (\{q_0, q_1\}, \{0,1\}, \delta, q_0, \{q_0\})$ where δ is defined by its state table as follows : 5

State/Alphabet	0	1
$\rightarrow q_0$	q_0	q_1
q_1	q_1	q_0, q_1

(b) Construct DFA for the following regular expressions,

(i) $a(ab)^*aa$

(ii) $(ab + bb)^*$ 5

4. (a) Illustrate with examples that the automaton serves a bridge between the very high-level functional description of a circuit and its logical implementation through transistions, gates and flip-flops. 5

(b) What is the difference between MOORE and MAELY machines. 5

5. (a) What is the difference between a recursive language and recursively enumerable language ? 5

(b) Show that the union of two recursively enumerable languages is recursively enumerable and the union of two recursive languages is recursive. 5

6. (a) Let f(n) = 4n3 + 5n2 + 7n + 3. Prove that f(n) = O(n3). 5

(b) If $p(n) = a_k n^k + a_{k-1} n^{k-1} + \ldots + a_1 n + a_0$ is a polynomial of degree k over Z and $a_k > 0$, prove that $p(n) = O(n^k)$. 5

7. (a) Differentiate between P, NP, NP-Complete and NP-Hard problems with appropriate examples. 5

(b) Show that P is closed under (a) union, (b) concatenation, and (c) complementation. 5

8. (a) Explain the Chomsky hierarchy along with the corresponding data. 5

(b) Show that $L = \{a^{n!} , n>=1\}$ is not context-free but context-sensitive. 5