(i) **Printed Pages : 2** **Roll No.** .....

(ii) **Questions : 9** **Sub. Code :** 3 6 1 9

Exam. Code : 0 4 6 1

M.Sc. Information Technology 3rd Semester

(1129)

THEORY OF COMPUTATION

Paper—MS–69

Time Allowed : Three Hours] **[Maximum Marks : 80**

Note :— Attempt **five** questions in all. Question No. **9** (Section E) is compulsory and selecting **one** question each from Sections A to D.

SECTION—A

1. (i) Discuss at least five applications of automata theory in computer science. 8

   (ii) Design minimization of finite automata with an example. 8

2. (i) Write short note on equivalence of DFA and NFA with an example. 8

   (ii) Write short notes on languages and their relations, languages and automata. 8

SECTION—B

3. (i) Let $M = (\{q_0, q_1, q_2, q_3\}, \{0, 1\}, \delta, q_0, \{q_0, q_1\})$ be NFA where,

   $\delta(q_0, 0) = \{q_0, q_1\}$, $\delta(q_1, 0) = \{q_1, q_2\}$, $\delta(q_2, 1) = \{q_1, q_3\}$, $\delta(q_3, 0) = q_2$.

   Construct its equivalent DFA. 8

   (ii) Let $\Sigma = \{0, 1\}$, show that $L = \{0^i1^i \mid i \geq 1\}$ is regular language or not ? 8

4. (i) For the regular languages L_1 and L_2, show that $L_1 - L_2$ is regular. Also prove that regular languages are closed under closure. 8

(ii) Discuss construction of NFA and DFA from a regular expression with examples. 8

SECTION—C

5. (i) Convert the given CFG to GNF :

$$S \rightarrow ABA,\ A \rightarrow aA \mid \in,\ B \rightarrow bB \mid \in.$$ 8

(ii) Prove that two context free languages are closed under union. Are these closed under intersection too ? Justify. 8

6. (i) Discuss PDA and NPDA with examples. 8

(ii) Design PDA for accepting a language $\{L = a^n b^n \mid n \geq 1\}$. 8

SECTION—D

7. (i) Construct a Turing machine for checking the palindrome of the string of even length. 8

(ii) Discuss Halting problem and post correspondence problem. 8

8. (i) Construct a Turing machine for language of even number of 1's and even number of 0's over $\Sigma = \{0, 1\}$. 8

(ii) Discuss Turing machine and Church-Turing thesis. 8

SECTION—E

(Compulsory Question)

9. (i) Write short note on Chomsky hierarchy of languages.

(ii) What is Arden's theorem ?

(iii) What is role of pumping lemma ? Define pumping lemma for CFG.

(iv) Discuss an example of Halting problem. 4×4=16