

(REVISED COURSE)

(3 Hours)

[Total Marks : 100

N.B. (1) Question No. 1 is **compulsory**.(2) Attempt any **four** from question Nos. 2 to 7.(3) **Figures** to the **right** indicates **full** marks given to the questions.(4) Assume **suitable** data, if **necessary**.

1. (a) Justify the term 'Automata Theory'. 4
 (b) What is NP-hard problem ? Explain. 5
 (c) How FSM is different from NFA and DFA ? 3
 (d) Design a Turing machine for the addition of two whole numbers. 8
2. (a) Construct DFA accepting the following language :— 8
 $W \in \{ a, b \}^*$ each a in W is immediately preceded and immediately followed by "bb".
 (b) Design a Turing machine which recognizes the language consisting of all strings 12
 of 0's whose length is a power of 2. i.e. it decides the language $L = \{ 0^{2^n} / n \geq 0 \}$.
3. (a) Construct a PDA equivalent to the CFG 8
 $S \longrightarrow OBB, \quad B \longrightarrow OS, \quad B \longrightarrow IS, \quad B \longrightarrow O.$
 (b) Using pumping lemma prove that the language :— 12
 (i) $L = \{ WW \mid W \in \{ 0, 1 \}^* \}$ is not a CFL
 (ii) $L = \{ 0^{i^2} \mid i \text{ is an integer, } i \geq 1 \}$ is not regular.
4. (a) Convert the grammar with productions : 8
 $S \longrightarrow abAB, \quad A \longrightarrow bAB \mid \lambda, \quad B \longrightarrow BAa \mid A \mid \lambda$ into Chomsky normal form.
 (b) Design a PDA to accept all prefix arithmetic expression terminated by \$. 12
5. (a) Determine a NFA accepting strings, having substrings either 'ab' Or 'ba' and use 10
 it to find a DFA accepting it.
 (b) Design moore and mealy machines to convert substring 121 to 122 for strings of 10
 languages having $\Sigma = \{ 0, 1, 2 \}$.
6. (a) Show that the grammar with production : 10
 (1) $s \longrightarrow a s b \mid s s \mid \lambda$
 (2) $s \longrightarrow a s b s \mid b s a s \mid \lambda$ is ambiguous
 (b) Explain recursive and recursively enumerable languages. Give two examples of each. 10
7. Write short notes on any **four** :— 20
 (a) Closure properties
 (b) Greibach normal form
 (c) Undecidability and Unsolvability
 (d) Power of NPDA
 (e) UTM
 (f) Power of TM.