E Sem 3 NEP Reg Winter 2025- INFT

10.12.2025

Time: 3 Hours

Marks: 60

N.B.: 1) All Question carry equal Marks.
2) Solve any Four of the six questions.
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks.

Q.1) Answer the following questions (**Any Three**):

a. Differentiate between Deterministic Finite Automata (DFA) & Non-Deterministic Finite Automata (NFA). **[05]**

b. Define Push Down Automata (PDA) & its tuples. **[05]**

c. Write a short note on Multi-tape Turing Machine (TM) **[05]**

d. What do you mean by Regular Expression (RE)? Construct RE for all even binary numbers. **[05]**

Q.2) (a) Design a PDA for accepting a language L = $\{0^n 1^n / n \geq 1\}$. **[10]**

(b) Compare Moore and Mealy machines with an example. **[05]**

Q.3) a) Compare Regular and Context Free Grammar with suitable examples. **[05]**

b) Design the NFA transition diagram for the transition table given below: **[05]**

States	0	1
q_0	$\{q_0, q_1\}$	$\{q_0, q_2\}$
q_1	$\{q_f\}$	
q_2	$\{q_2, q_f\}$	$\{q_f\}$
q_f	$\{q_f\}$	$\{q_f\}$

Where, NFA is given as M = $(\{q_0, q_1, q_2, q_f\}, \{0,1\}, \delta, q_0, \{q_f\})$.

c) Consider the grammar S → 0S0 | 1S1 | SS | λ. Given the string 0101101110, draw a parse tree for the leftmost derivation. **[05]**

Q.4) a) Describe in English the language represented by the following regular expressions: **[05]**

(a) $(a + ab)^*$

(b) $(a + b)^* a (a + b)^*$

(c) $(a^* ab^* ab^*) + b^*$

(d) $a^* b^* c^*$

(e) $a(a + b)^* bb$

b) Give applications of finite automata & push down automata. [05]

c) Convert the following grammar into Chomsky Normal Form (CNF). [05]

$S \rightarrow ASB$
$A \rightarrow aAS \mid a \mid \varepsilon$
$B \rightarrow SbS \mid A \mid bb$

Q.5) a) Design a TM to accept the language $L = \{a^n b^n / n \geq 1\}$. [8]

b) Design a DFA which accepts strings with even number of 0's followed by single 1 over $\sum = \{0,1\}$. [7]

Q.6) Write short notes on **(Any Three):** [15]

a. Minimization of DFA
b. Chomsky Hierarchy
c. Phases of a Compiler
d. Limitations of PDA
e. Halting problem of TM
