Con. 7047-13.   **LJ - 11377**

(3 Hours)   [**Total Marks : 100**

N. B. :   (1)   Question No. **1** is **compulsory**.

(2)   Attempt any **four** questions from remaining **six** questions.

(3)   **Assumptions** made should be **clearly** stated.

(4)   **Figures** to the **right** indicate **full** marks.

1.   (a) Define with examples Moore and Mealy machine.   **5**

(b) Find the equivalent DFA accepting the regular language defined by right linear   **5**
grammar given as:–

$$S \rightarrow aA|bB$$

$$A \rightarrow aA|bC|a$$

$$B \rightarrow aB|b$$

$$C \rightarrow bB$$

(c) State and prove pumping Lemma theorem for regular language.   **5**

(d) Differentiate between Deterministic PDA and Non-deterministic PDA.   **5**

2.   (a) Design a finite state machine to determine whether a ternary number base 3 is   **10**
divisible by 5. [**Hint**: $\Sigma = \{0,1,2\}$]

(b) Design a Mealy machine for the language $(0+1)^* (00+11)$ and convert it to a   **10**
Moore machine.

3.   (a) Convert the following NFA with $\in$ moves to DFA :-   **10**
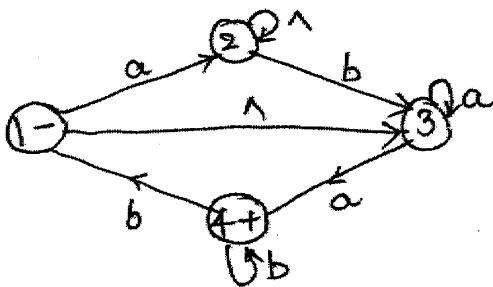
(b) Let G be the grammar. G = {(S, X), {a,b}, P, S} where productions are:–   **10**

$$S \rightarrow aSX|b$$

$$X \rightarrow Xb|a$$

Find:– (i) Leftmost derivation. (ii) Rightmost derivation and
(iii) Parse tree for the string "aababa".

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4. (a) Design turing machine for the language $L = \{a^n b^n | n >= 1\}$ **10**

    (b) Design a turing machine to compare the binary numbers m and n such that if   **10**
    (m > n) output is G, if (m < n) output is L and when (m = n) output is E.

5. (a) List and explain decision properties of regular language.   **10**
    Explain the test for checking emptiness of a regular language.

    (b) Construct left linear and right linear grammar for the regular expression :-   **10**
    $$(((01 + 10)^* \; 11)^* 00)^*$$

6. (a) Construct a PDA equivalent to following grammar:–   **10**

    $$S \to oBB$$

    $$B \to OS|S|O$$

    and show the acceptance of 010^4 by the PDA.

    (b) Reduce the following grammar to Greibach Normal form.   **5**
       (i) $S \to AB$

          $A \to BSB|BB|b$

          $B \to a$
       (ii) $S \to 01S|01$ **5**

          $S \to 10S|10$

          $S \to 00|\wedge$

7. Write short notes on (any **four**):–   **20**
       (a) Post Correspondence Problem
       (b) Chomsky Hierarchy
       (c) Universal turing machine
       (d) Recursive and Recursively emurable language
       (e) Classes of complexity.