(OLD COURSE   **QP Code : 12100**

(3 Hours)   [Total Marks : 100

N.B. : (1) Question No. 1 is **compulsory**.
      (2) Attempt any **four** questions out of the remaining **six** questions.
      (3) **Figures** to the **right** indicate **full** marks.
      (4) Make suitable assumptions if **necessary**.

1. (a) Define a Regular Expression with the help of an example. Briefly discuss the   05
applications of Regular Expressions.
   (b) Explain with an example the Chomsky Normal form.   05
   (c) Compare and contrast DPDA and NDPDA   05
   (d) Design a FSM that checks if a given decimal number is even.   05

2. (a) Design a Turing Machine to accept strings of type 0^n1^n, $n \geq 1$ 10
   (b) Convert the following grammer to GNF   10

$$S \rightarrow XA/BB$$
$$B \rightarrow b/SB$$
$$X \rightarrow b$$
$$A \rightarrow a$$

3. (a) Using pumping lemma check if a^nb^n is regular, where $n \geq 1$ 08
   (b) Design a Turing Machine to find value of $\log_2 n$, where n is a unary number.   12

4. (a) Draw NFA with Σ moves that recognizes the RE $(a+b)^*$ ab. Convert the above   10
NFA to DFA
   (b) Design a PDA that accepts all the strings containing equal number of a's and b's.   10

5. (a) What are the steps to convert a MOORE Machine to a Mealy Machine. Design a   10
Moore Machine to convert each occurence of 100 to 101. Convert it into an
equivalent Mealy Machine using the above mentioned steps.
   (b) Consider the following grammar.   10

$$S \rightarrow SAS$$
$$S \rightarrow b$$
$$A \rightarrow ba$$
$$A \rightarrow b$$

For the string "bbabbbbab" derive
    (i) Left most derivation   (ii) Right most derivation
    (iii) Parse Tree.

6. (a) Design a PDA to check for well-formed parentheses.   10
   (b) Discuss different classes of Chomsky heirarchy in detail.   10

7. Write short notes on (any four)   20
    (a) Kleen's Closure
    (b) Post Correspondence Problem
    (c) Myhill Nerode Theorem
    (d) Halting Problem
    (e) Arden's Theorem