

Roll No.

Total Pages : 2

8503**BT-5/DX****AUTOMATA THEORY**

Paper : CSE-305

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. Each question carries 20 marks.

UNIT-I

1. (a) Let $X = \{\$ \}$ and $Y = \{a, b, 0, 1\}$ are the language of Σ , where X and Y are the subsets of Σ . Write the string of the following language :
 - (i) XY
 - (ii) YX
 - (iii) XYX .
- (b) Let $X = \{a\}$ and $Y = \{b\}$. Write X^nY , XY^n , and $(XY)^n$.
2. (a) Write at least 2 (two) strings of each of the following regular expressions :
 - (i) $(a + b)^*$
 - (ii) $(a + b)^*ba$
 - (iii) a^*ba^*ba
 - (iv) $(ba)^*$.
- (b) Explain the concept of DFA minimization. Give a suitable example.

UNIT-II

3. (a) State and prove pumping lemma for regular language.
- (b) Construct a Mealy machine with input over $\{a, b\}$ and output over $\{0, 1\}$ that prints a 0 for each b consumed and a 1 for every other a , starting with the first (otherwise a 0 is printed), e.g. the output for the string "abbaabaa" is "10001001".
4. (a) Design a modulo-4 up-down counter.
- (b) Design a two-input, two-output sequence detector which produces an output 1 every time the sequence 0101 is detected, and output 0 at all other times, e.g., when the input sequence is 010101 the corresponding output sequence is 000101.

UNIT-III

5. (a) Prove that NPDA is more powerful than DPDA.
- (b) Prove that $L(G_{pal})$ is the set of palindromes over $\{0, 1\}$ if G_{pal} is given as follow :

$$P \rightarrow \epsilon \mid 0 \mid 1 \mid 0P0 \mid 1P1.$$
6. (a) Convert the following grammar into Griebach Normal Form (GNF) :

$$S \rightarrow aSa \mid bSb \mid a \mid b \mid aa \mid bb.$$
- (b) Write three different derivation of string "ababaa" using the following grammar. Also give the derivation tree. <http://www.kuonline.in>

$$S \rightarrow AA$$

$$A \rightarrow AAA \mid bA \mid Ab \mid a.$$

UNIT-IV

7. (a) Show that if L is a recursive language, so is \bar{L} .
- (b) Write a note on PCP problem.
8. (a) Write a note on unrestricted grammar.
- (b) The characteristic function of a finite subset of N is primitive recursive.