# CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

Sixth Semester of B. Tech. Examination (CE)
May 2012
CE-306 Theory of Computation (TOC)

Date: 09.05.2012, Wednesday    Time: 01:30 p.m. To 04:30 p.m.    Maximum Marks: 70

**Instructions:**
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Rough work is to be done in the last page of main supplementary, please don't write anything on the question paper.
5. Indicate clearly, the option(s) you attempt along with its respective question no.
6. Figures to the right indicate marks.

## SECTION-I

**Q-1    Answer the following questions.**

1. Differentiate between: Pattern, Lexeme and Token. How are these concepts related with Regular Expressions (REs)? — 3

1. Define PDA. Differentiate between DPDA and NPDA. — 3

2. L1 and L2 are languages that can be accepted by NFA-Λs, prove that L1UL2 can also be accepted by NFA-Λs. — 3

3. Differentiate between the 'Strong principle of Mathematical Induction' and the 'Weak principle of Mathematical Induction'. — 2

**Q-2**

[A]    Define DFA. Construct a DFA for given regular expression $(010+00)*(10)*$ — 4

**OR**

[A]    Construct NFA-^ for given expression and convert it into NFA. — 4
$((0+1)*10 + (00)*(11)*)*$

[B]    **Answer the following questions** — 4

1. Relation on set {1,2,3} is given. Of the three properties, determine which ones Relation $R = \phi$ satisfies.
2. What is the relation between $2^{A \cup B} = 2^A \cup 2^B$? Give reasons for your answers.
3. Show that f is a bijection and find a formula for $f^{1}$
   a.  $f: R \times R \to R \times R$ defined by $f(x.y)=f(x+y, x-y)$
4. For a finite language L, denoted by |L| the number of elements of L. is it always true that for finite language A and B, $|AB| = |A| + |B|$?. Either prove Equality or find counter example.

[C]    Define Λ -closure of a set of states and give recursive definition of $\delta*$ for NFA- Λ. — 4

**OR**

[C]    Find the Regular Expression corresponding to given statement, subset of {0,1}* — 4

1. The Language of all strings containing at least one 0 and at least one 1.
2. The Language of all strings containing 0's and 1's both are even.
3. The Language of all strings containing at most one pair of consecutive 1's.
4. The Language of all strings that do not end with 01.

**Q-3**

[A] State true or false for given statements.  4
 1. Every NDPDA has equivalent DPDA
 2. PDA is more powerful than Turing Machine
 3. All the context free languages are also regular.
 4. Every regular language has a corresponding DPDA.

**OR**

[A] Find Context Free Grammar generating following language  4
 1. The set of odd length strings in {a,b}* whose first, middle and last symbols are all the same.
 2. $L = \{a^i b^j c^k \mid i < j \text{ or } i > k\}$

[B] Show that regular expressions sets are closed under the following  4
 operations:
 (i) Union
 (ii) Concatenation

[C] Convert the following grammar to a PDA that accepts the same language  4
 by empty stack.
 S→ aSb | A
 A→ bSA | S | Λ

**OR**

[C] Define Chomsky Normal Form and Convert a CFG to Chomsky Normal  4
 Form
 S→AACD
 A→aAb|Λ
 C→aC|a
 D→aDa|bDb|Λ

## SECTION-II

**Q-4**
 1. What is need for a Universal Turing Machine? Explain in brief.  3
 2. What are the sets represented by the following regular expressions:  4
  (i) (11+0)* (00+1)*
  (ii) (1+01+001)* (^+0+00)
 3. Show that given grammer is ambiguous.  4
  S→ABA
  A→aA| Λ
  B→bB| Λ

**Q-5**
[A] Define recursive language and recursively enumerable language. Show that  4
 every recursive language is Recursively Enumerable language.
[B] State and Prove Kleene's Theorem.  4
[C] Convert the following NFA-∧ into equivalent NFA. Here ε is a ∧-transition  4
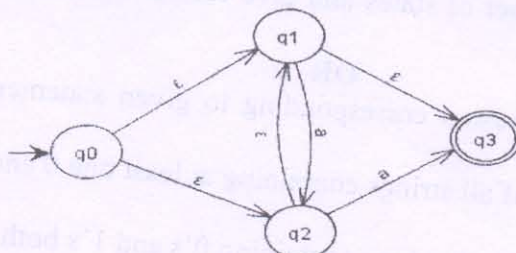
**Q-5**

[A] Give Chomsky-hierarchy for grammars and Define Each Grammar.     4

[B] Minimize the following DFA into equivalent machine accepting same     4
Lang.
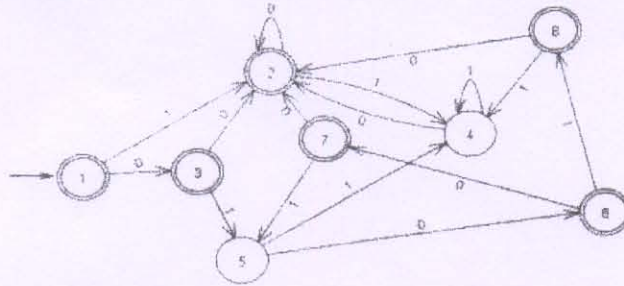


[C] Give Transition table for DPDA recognize following Language:     4
L= $\{a^i b^j c^k |$ i, j, k$\geq$0 and j=i or j=k$\}$

**Q-6**

[A] Prove that language L is non-regular.     4
**L= $\{0^n 10^{2n} | n>=0\}$**

[B] Design a Turing Machine for Reversing a String.     4

OR

[B] Check whether given Language a CFL or not.     4
**L=$\{a^n b^m c^m d^n | m,n>=0\}$**

[C] Design a Turing Machine for deleting a symbol from a tape.     4

OR

[C] Construct a DPDA for given Language.     4
**L=$\{xcy | x,y \in \{a,b\}^* \}$**