B.E. (Computer Technology) Fourth Semester (C.B.S.)

Theory of Computation Paper - IV

P. Pages : 2 **TKN/KS/16/7379**

Time : Three Hours * 0 7 7 7 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Prove the following relations using principle of Mathematical Induction : **8**

a) $1\cdot 2\cdot 3+2\cdot 3\cdot 4+\cdots\cdots+n(n+1)(n+2)=\dfrac{n(n+1)(n+2)(n+3)}{4}$

b) $\sum_{i=1}^{n}\dfrac{1}{i(i+1)}=\dfrac{n}{n+1}$ is true for all $n\geq 0$.

b) Explain Pigeonhole principle with suitable example. **5**

OR

2. a) Explain in detail about Chomsky hierarchy of Grammar. **8**

b) Find R^* and R^+ if $R=\{(1,1), (1,2), (2,3), (3,1), (1,4), (2,4)\}$ on a set $A=\{1, 2, 3, 4\}$. **5**

3. a) Design a DFA for string which consists of Even number of 0's and Odd number of 1's over $\Sigma=\{0, 1\}$. **6**

b) Design Moore machine for the input from $\Sigma=\{0, 1, 2\}$ which prints the residue mod 5 of the input treated as a ternary (base 3, with digits 0,1,2) number. **8**

OR

4. a) Construct a minimum state DFA equivalent to the NFA given below : **8**

$NFA=(\{A, B, C, D\}, \{a, b\}, \delta, A, \{B, D\})$

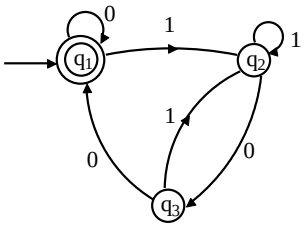
where δ is defined using Transition Table :

	a	b
A	{B, D}	{B}
B	{C}	{B, C}
C	{D}	{A}
D	ϕ	{A}

b) Differentiate between : **6**

i) NFA and DFA ii) Moore and Mealy machine.

5. a) Construct RE from Transition Diagram given below. **6**



b) Explain Pumping Lemma for Regular Languages. Also prove that **7**
$L = \{a^n . b^{2n} \mid n \geq 1\}$ is non regular language.

OR

6. a) Describe the language defined by following regular expression. **7**

i) $a(a \mid b)^* b$ ii) $c^* (a \mid (bc^*))^*$

b) Consider the Grammar : **6**

$S \rightarrow 0B/1A$

$A \rightarrow 0/0S/1AA$

$B \rightarrow 1/1S/0BB$

For the string "00110101", find

i) LMD (Leftmost Derivation) ii) RMD (Rightmost Derivation)

7. a) State and explain closure properties of context free languages. **5**

b) Give formal definition of PDA with block diagram. Explain it. **4**

c) Consider the context free language $L = \{a^{2n} b^n / n \geq 0\}$, obtain its equivalent CFG. **4**

OR

8. a) Construct PDA for the matching parenthesis "(" (" ")")". **7**

b) Construct PDA for $L = \{w \subset \omega^R / C$ is some special symbol not in w} **6**

9. a) Explain Linear Bounded Automata. **6**

b) Design a Turing Machine for following language $L = \{a^n b^n c^n / n \geq 1\}$. **8**

OR

10. a) Design a Turing Machine that can accept the string over (0, 1) to recognise all strings containing even number of 0's. **8**

b) Design T.M. for language to find 2's complement of a binary number. **6**

11. a) Define Ackerman's function. Compute **8**
(i) A (1, 1) (ii) A (2, 1) (iii) A (2, 3)

b) Explain Church's Hypothesis in brief. **5**

OR

12. a) What do you mean by PCP? Decide whether the following (A, B) pair have a solution or not. If Yes, give a solution. If No, then why? **9**

i) $A(b, bab^2, ba)$, $B = \{b^2, ba, aa\}$ ii) $A(01, 1, 11)$, $B = \{011, 10, 11\}$

b) Define decidable and undecidable language. **4**

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