B.E. (Computer Science Engineering) Fourth Semester (C.B.S.)

Theoretical Foundations of Computer Science Paper - IV

P. Pages : 3 **TKN/KS/16/7384**

Time : Three Hours * 0 7 7 4 * 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 wherever necessary.
10. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Answer following. **8**

i) Unrestricted grammar is also a context free grammar.
a) True b) False

ii) Type 2 grammar is used in.
a) Turing machine b) Push down Automata
c) Linear bounded Automata

iii) Which of the following is regular grammar & why ?
a) $S \rightarrow aaBa \mid \in$
b) $S \rightarrow aaB \mid ab \mid a$
c) $Sa \rightarrow aSaba \mid ab$

iv) Which of the following is type o grammar but not type 1 & why ?
i) $S \rightarrow \in$
ii) $aS \rightarrow abaS$
iii) $abSa \rightarrow abA$

b) Prove that by principal of induction. **5**

$1.2.3+2.3.4+...+n\,(n+1)\,(n+2)$

$= \frac{n(n+1)(n+2)(n+3)}{4}$

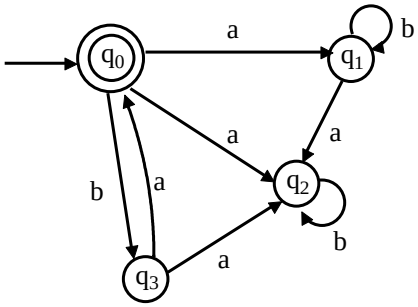
OR

2. a) State and define Pigeon-hole principle with example ? **5**

b) Explain following terms. **5**
i) Prefix of string ii) Sufix of string
iii) Proper prefix & proper sufix. iv) Alphabet
v) Length of String

c) Write a note on countability and Diagonalization. **3**

3. a) Convert the following NFA into equivalent DFA. **6**



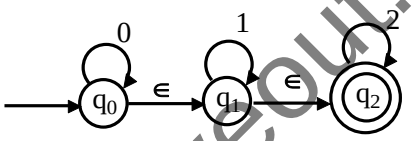
b) Design a mealy machine to count no. of occurrence of ab and convert the resultant machine into Moore M/C. **8**

OR

4. a) Design a DFA for a string of decimal digits that are divisible by 3. **6**

b) State and explain application of FA. **5**

c) Convert following NFA with $\in$-move into NFA without $\in$-moves. **3**



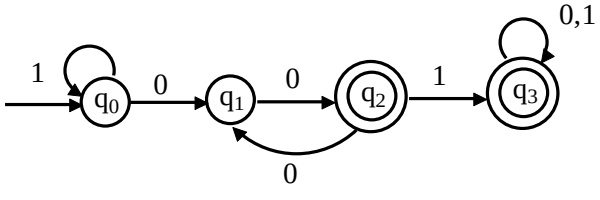
5. a) Design the minimum state DFA from following regular expression. **8**
$(ab)^*bab^* + ab^*(bb)^*$.

b) Convert the following right linear grammar into left linear grammar. **5**
$S \rightarrow abS \mid aA$
$A \rightarrow aaA \mid ba$

OR

6. a) Convert the grammar into GNF. **6**
$S \rightarrow aSa \mid bBb$
$B \rightarrow abB \mid aaAa$
$A \rightarrow Aa \mid a$

b) Construct a Regular expression from following FA. **7**



7. a) Construct CFG from the following $L = \{a^n b^n \mid n \geq 1\}$ i.e construct PDA from given language then convert the generated PDA into CFG. **14**

OR

8. a) Explain following terms. **9**
i) NPDA & DPDA
ii) Model of PDA
iii) Acceptance by stack and acceptance by final state

b) Design a PDA from CFG. **5**
$S \rightarrow aSa \mid aSb \mid a$

9. a) Explain the types of Turing machine. **6**

b) Design a the Turing machine to multiply two unary numbers ? **7**

OR

10. a) Design a Turing M/c to copy a string over $\Sigma = \{a, b\}^*$. **7**

b) Explain the model of Linear Bounded Automata. **6**

11. a) Explain the properties of recursively Enumerable language ? **7**

b) Write short note on following. **6**

i) Decidability & Solvability

ii) Primitive recursive function

OR

12. a) What is PCP ? Explain modified PCP. **6**

b) Solve using Ackerman function A (1,1), A (2,1), A (2,2) A (2,3). **7**

****