B. E. Fifth Semester (Computer Technology) Examination

Course Code : CT 1301 / CT 301 **Course Name : Theoretical Foundation of Computer Science**

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Due credit will be given to neatness.
(4) Assume suitable data wherever necessary.
(5) Diagrams should be given wherever necessary.

1. Solve any **One** of the following :

(a) Design DFA equivalent to following NFA for the language.

Σ	0	1
p	{q, s}	{q}
q	{r}	{q, r}
r	{s}	{p}
s	ϕ	{p}

8

(b) Design finite automata over alphabet Σ = {0, 1} which accepts the set of strings that either starts with 01 or end with 01. 8

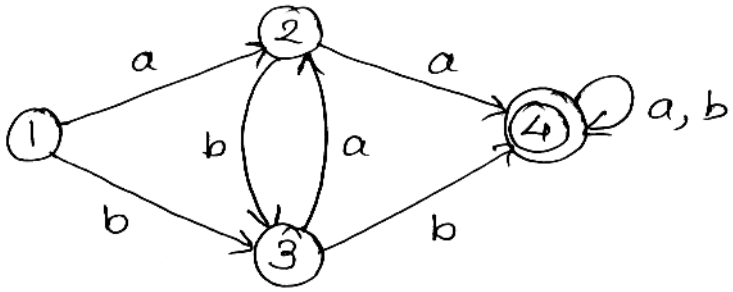
2. Solve any **One** of the following :

(a) Prove the following regular expression identities :

(i) $(a + b)^* = (a + b) + (a + b)^*$

(ii) $(a^* b^*) = (a + b)^*$ 7

(b) Find the regular expression for the following finite automata.



7

3. Solve any **One** of the following :

(a) Convert the following grammar to CNF form.

$S \longrightarrow bA|aB \quad A \longrightarrow b \quad AA|aS|a \quad B \longrightarrow aSS|bS|b$ 8

(b) Find CFG for the language defined by the following regular expression :

(I) ab^* 2

(II) $a^* \ b^*$ 2

(III) (Letter) (Letter/digit)* 4

4. Solve any **One** of the following :

(a) Construct PDA accepting the following language

$L = \{a^n \ b^n | n \geq 0\}$

Also simulate the acceptance of the string "aabb" 7

(b) Construct PDA for the following language

$L = \{a^m b^m c^n | m, \ n >= 1\}$

Also give the simulation for the string "aaabbbccc" 7

5. Solve any **Two** of the following :

(a) Describe Turing machine model. Also design a turing machine that accepts

$\{a^n\ 1^n \mid n \geq 1\}$ 7.5

(b) Design turing machine that replaces all occurrences of "111" by "101" from sequence of 0'S and 1'S. 7.5

(c) Describe the model of linear bounded automation. Also construct a Turing machine that accepts $L = \{0^{2n} | n \geq 0\}$ 7.5

6. Solve any **Two** of the following :

(a) What do you mean by post correspondance problem ? Show whether the given PCP has solution OR not

	List A	List B
1	α_i	β_i
1	a	baa
2	ab	aa
3	bba	bb

7.5

(b) Describe decidable and undecidable language in detail with proper example. 7.5

(c) Describe Church's Hypothesis in detail. 7.5