BT-5/D11 : 7703
CSE-305 : Automata Theory

Three Hours
Attempt any 5 question

Maximum Marks : 100

SECTION-A

a) Show that the regular expression 
(a+b)* a(a+b)* b(a+b)* is equivalent to (a+b)* ab(a+b)* in the sense that they define the same language.  

b) Prove that
i) \( \lambda + 1^*(011)^*(1*(011)^*)^* = (1+011)^* \)
ii) \( (1+00*1) + (1+00*1) (0+10*1)^* (0+10*1) = 0*1(0+10*1)^* \)
iii) \( 10+(1010)^* [\lambda^* + \lambda (1010)^*] = 10 + (1010)^* \) \( 3+3+4=10 \)

a) Write all differences between deterministic & non-deterministic finite automata.  

b) Find the language generated by the grammar
S \rightarrow AB, A \rightarrow A1/0, B \rightarrow 2B/3

1 Contd.
Q.3.  
a) Construct a DFA equivalent to the regular expression $(a+b)^*a$.  
b) Design an FSM that accepts all strings over $\{a, b\}$ such that the number of $a$'s is divisible by 2. 
How many different states does your FSM have? Explain.

Q.4.  
a) Find a CFG that generates the following languages over alphabet $\Sigma = \{a, b\}$:  
   i) All strings that end in $b$ and have an even number of $b$'s in total.  
   ii) All strings of odd length. 

b) Convert the given grammar into GNF:  
   $S \rightarrow AB, A \rightarrow BS/b, B \rightarrow S/A/a$

Q.5.  
a) Construct a PDA named $A$ equivalent to the following context-free grammar $S \rightarrow OBB, B \rightarrow BB/a, O \rightarrow a$. 
   OS/15/O Test whether 010 is in $N(A)$. 

b) Construct a PDA accepting the set of all even length palindromes over $\{a, b\}$ by empty stack.