B.E. INFORMATION TECHNOLOGY THIRD YEAR SECOND SEMESTER – 2018
(3rd Year; 2nd Semester)
Subject: Formal language & Automata Theory

Time : Three hours **Full Marks: 100**

CO1 [20]	(a) (i) Design a DFA to accept a string of a's and b's ending with abb. (5) (ii)Design a DFA which accepts even number of 0's and odd number of 1's. (5) (b) Give the Regular expressions of the following languages. (5 + 5) a. L = {W/W is a string of odd number of 0's followed by even number of 1's} b. L= {W/W is in {a,b}* and |W|mod 3 =0}
CO2 [20]	Answer any Two of (a), (b) and (c). (a) Give pushdown automata (PDA) for the following language: $L = \{a^n b^m c^k : n + m = k\}$ Test strings: aabccccccc, aaabbbcc, aabbcccc, aabcc. (10) (b) Convert the following grammar to a PDA (draw the resulting PDA by hand) using the procedure described in class. S → AA | a, A → aAb | ab | λ (10) (c) Let M be the PDA defined by Q = {q0, q1, q2} Σ = {a, b} Γ = {A} F = {q1, q2} δ(q0, a, λ) = [q0, A] δ(q0, λ, λ) = [q1, λ] δ(q0, b. A) = [q2, λ] δ(q1, λ, A) = [q1, λ] δ(q2, b, A) = [q2, λ] δ(q2, λ, A) = [q2, λ] 1. Describe the language accepted by M (6) 2. Give the state diagram of M (2) 3. Show that aabb, aaab ∈ M (2)
CO3 [20]	Answer any Two of (a), (b) and (c). (a) Design a Turing Machine to accept the language: $L_{wwr} = \{ww^R \mid w \in (0+1)^*\}$ (10) (b) Design a Turing Machine to replace 0's with 1's in the input string. (10) (c) Design a Turing Machine to calculate the 1-complement of a binary number (i.e. replace 0's with 1's and 1's with 0's). (10)
CO4 [20]	Answer any Two of (a), (b) and (c). (a) Which of the following grammar is ambiguous? Justify (10) (i) S→S+S|S-S|a (ii) S→iEtS|iEtSeS|a, E→b (iii) S→SbS|a (b) Remove useless productions, null productions, unit productions from the following grammar: (10) S -> ABC A -> aBC B -> C | ε C -> cd | DCF

	D -> dD | ε E -> eFE F -> eC (c) Prove or Disprove that, the language $L = \{a^n b^n c^n\}$ is context sensitive (10)
CO5 [20]	Show that the following problem is decidable -- "Is a less than b?" Compute the complexity of the above problem. (15+ 5) OR Find out whether the following problem is decidable or not – Is a number 'm' prime? (20)

CO1: Explain and construct Finite automata, Regular Languages and their properties. (K3, A2)
CO2: Describe and construct Context Free Languages, Push Down Automata and their properties. (K3, A2)
CO3: Explain and outline Turing Machine, its variants. (K4, A2)
CO4: Classify and analyze different types of grammar and language. (K4, A3)
CO5: Illustrate different decidable languages, unsolvable problems and complexity. (K3, A2)