EX/IT/T/325/2019

B.E. INFORMATION TECHNOLOGY THIRD YEAR SECOND SEMESTER – 2019

(3rd Year; 2nd Semester)

Subject: Formal language & Automata Theory

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

CO1 [20]

A. Find the regular expression of all non-negative integers without leading 0's. [3]

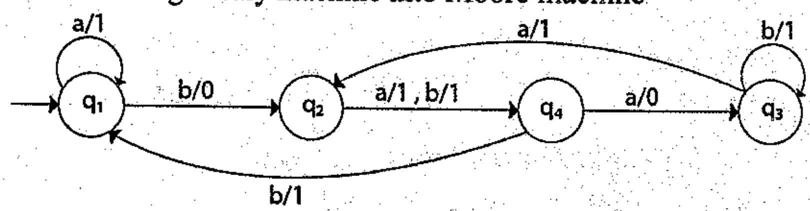
B. Find the regular expression of the binary strings whose 1000th symbol from the end is '1'. [3]

C. Differentiate recognizer (automata) and Transducers (FSM). [2]

D. Attempt any two from the questions. 2x6=12

i. Design a DFA M that accepts the language L(M)={w ∈ {a, b}*: w does not contain three consecutive b's}.

ii. Convert the following Mealy machine into Moore machine



iii. If a DFA M accepts any string at all, it accepts one string whose length is less than the number of states in M. Prove it.

CO2 [20]

Attempt any two questions. 2x10=20

A. Give pushdown automata (PDA) for the following language:
$L = \{a^n b^m : n < m \leq 2n\}$

B.

i. Let 'L' be a GFL and the corresponding grammar 'G' is in CNF. From G, derive the necessary conditions of the pumping lemma for CFL.

ii. Prove that $L=\{a^p: p \text{ is a prime}\}$ is not a CFL.

C. Reduce the following grammar into CNF:
S→ASA | bA
A→B | S
B→c

CO3 [20]

Attempt any two questions. 2x10=20

A. Design a Turing Machine which computes 2's complement of the given binary string.

B. Design a Turing Machine over Σ={a, b, c}, which accepts the language {wcw: w ∈ {a,b}*}.

C. Define TM with following variants:

i. Storage in finite control

ii. Multiple track in the tape

iii. Multiple tape in TM

CO4 [20]	Attempt any four questions.	4x5=20
	A. Let G=(V, Σ, P, S), where V={a, b, S}, Σ={a, b}, and P={ S→ aSb| aSa| bSa| bSb| ε}. Show that L(G) is regular. B. Show that the grammar G=(V, Σ, P, S), where V={a, b, S, A}, Σ={a, b}, and P: S→AA A→AAA | a | bA | Ab A→bA is an ambiguous grammar. C. Find the type of the following grammar and justify your answer. S → ACaB Bc → acB CB → DB aD → Db D. Let two languages L_1 and L_2 are of type-i (i ∈{0, 1, 2, 3}). Prove that L_1 and L_2 are closed under concatenation. E. Define monotonic grammar with an example. Define yield of a parse tree with an example.	
CO5 [20]	A. Show that diagonalization (or non-self-accepting) language is not recursively enumerable.	5
	B. Prove that universal language (L_u) is undecidable.	5
	Attempt any one form rest.	10
	C. State the complete sub graph problem (CSP) and then prove that CSP is NP complete. D. State the set cover problem and then prove that it is NP complete.	

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