Enrol. No. | S | R | H | U | | | | | | | | **Regn. No.** | D | D | | | | | | | | | |

END SEMESTER EXAMINATION, JUNE 2019
MCA THIRD SEMESTER

COURSE CODE: MCA206 COURSE TITLE: THEORY OF AUTOMATA

[Time allotted: Three hours] **[Max. Marks: 100]**

Note: *Attempt all Sections &Questions.*

Section (A)

Q. 1. Attempt **all** questions. **(2 x 10 = 20)**

a. Design a DFA that will accept a unary string divisible by 5.
b. Write short note on regular grammar.
c. Write short note on Moore & Mealy Machine.
d. A Language for which no DFA exist is a_____(Choose any one).
  i. Regular Language
  ii. Non- Regular Language
  iii. May be Regular
  iv. Cannot be said
e. A push down automata can be represented as PDA= ε-NFA + [stack]. (True or false).
f. Design a DFA hat will accept a string of even number of 0's.
g. The format: A->aB refers to which of the following? (Choose any one).
  i. Chomsky Normal Form
  ii. Greibach Normal Form
  iii. Backus Naur Form
  iv. None of the mentioned
h. Which of the following are always unambiguous? (Choose any one)
  i. Deterministic Context free grammars
  ii. Non-Deterministic Regular grammars
  iii. Context sensitive grammar
  iv. None of the mentioned
i. State and Proof Arden's Theorem.
j. Discuss about Chomsky Classification of Grammars in short.

Section (B)

Q. 2. Attempt **any 5** questions. **(7 x 5 = 35)**

a. Construct a Turing Machine to accept the set L of all String over {0,1} ending with 111.
b. Consider the following production:
  S→aB/bA, A→aS/bAA/a, B→bS/aBB/b
  For the string aaabbabbba, find
  a. Leftmost derivation b. Rightmost derivation c. Parse tree
c. Design a DFA which accepts the language
  $L=\{w \in (0,1)^* / \text{second symbol of w is '1' and fourth symbol of w is '1'}\}$.
d. Design a DFA for the language
  $L=\{ w \in (a,b)^* / n_a(w) \bmod 3 > 0\}$
e. Find a regular expression corresponding to each of the following subsets of {a,b}.
  a. The set of all strings containing exactly 2b's.

b. The set of all strings containing at least 2b's.
c. The set of all strings containing a most 2b's.
d. The set of all strings containing the substring bb.

f. Construct the transition system for given regular expression: $R = 00 + 1 + 010^*1$

g. Turing Machine M described by the transition table given in table. Describe the processing of (a) 011 (b) 0011 (c) 001 which of the above strings are accepted by M?

Transition Table					
Present State	Tape Symbol				
	0	1	x	Y	b
→q_1	xRq_2				bRq_5
q_2	0Rq_2	yLq_3		yRq_2	
q_3	0Lq_4		xRq_5	yLq_3	
q_4	0L q_4		xRq_1		
q_5				yRq_5	bRq_6
q_6					

Section (C)

Attempt **any 3** questions. **(15 x 3 = 45)**

Q. 3.

a. Define CNF & GNF with rule. Convert given grammar in GNF:
E → E + T / T
T → T * F / F
F → (E) / a

b. Convert Mealy Machine into Moore Machine:

PRESENT STATE	NEXT STATE			
	Input a		Input b	
	State	Output	State	Output
→q_0	q_0	0	q_1	1
q_1	q_1	1	q_2	0
q_2	q_2	0	q_0	1

Q. 4.

a. Differentiate between Turing machine & Linear bounded automata. Design a Turing machine to recognize the language $\{a^nb^nc^n / n>=1\}$. Check the string "aabbcc" for acceptance.

b. Consider the following grammar : S→ A/bb A→ B/b B→ S/a identified unit production and remove them.

Q. 5.

a. Differentiate between DPDA & NPDA. Design a PDA accepting the set of all strings over {a,b,c} for $\{a^n b^{n+m} c^m / n >= 1, m >= 1\}$.

b. What is an ambiguous grammar? Check that grammar S → aAS/a, A → SbA/SS/ba is an ambiguous grammar or unambiguous grammar.

Q. 6.

a. Design a PDA for the language $\{ww^R / w \in (a,b)^*\}$.

b. Construct a reduced grammar equivalent to the grammar G:

S→aAa, A→Sb/bCC/DaA, C→abb/DD, D→aDA, E→aC

Q. 7.

a. Construct a context-free grammar G which accepts a given PDA where PDA moves are:

$(q_0,b,z_0) = \{(q_0,zz_0)\}$
$(q_0,^,z_0) = \{(q_0,^)\}$
(q0,b,z) = {(q0,zz)}
(q0,a,z) = {(q1,z)}
(q1,b,z) = {(q1,^)}
(q1,a,z0) = {(q0,z0)}

b. Convert the following NFA into DFA.