Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2018 - 19 Examination

Semester: 5 **Date: 18/05/2019**
Subject Code: 03105303 **Time: 10:30 am to 01:00pm**
Subject Name: Theory of Computation **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

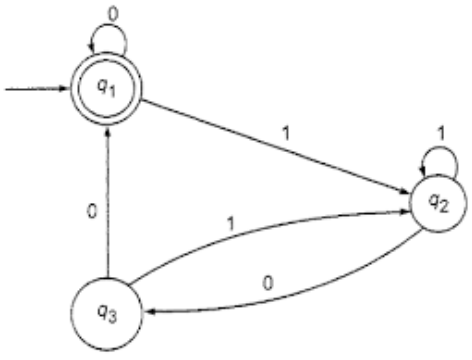
Q.1 **Objective Type Questions** - (Part 1 to 5 is MCQ, Part 6 to 10 is Fill in the blanks and Part 11 to 15 is one word answer (All are compulsory) (Each of one mark) **(15)**

1. Context-free languages are closed under:
   A) Union, intersection B) Union, Kleene closure C) Intersection, complement
   D) Complement, Kleene closure
2. Minimum length of the string formed by regular expression (a+b)* aba* (a+b)*
   A) 2 B) 6 C) 4 D) 8
3. A regular grammar is
   A) Type-0 B) Type-1 C) Type-2 D) Type-3
4. Regular expression for all strings starts with ab and ends with bba is.
   A) aba*b*bba B) ab(ab)*bba C) ab(a+b)*bba D) All of the mentioned
5. In the context-free grammar below, S is the start symbol, a and b are terminals, and ϵ denotes the empty string.
   $S \rightarrow aSa \mid bSb \mid a \mid b \mid \epsilon$
   Which of the following strings is NOT generated by the grammar?
   A) aaaa B) baba C) abba D) babaaabab
6. There are _____ tuples in DFA.
7. Transition function of NDFA maps δ = _____
8. Grammar that produce more than one derivation tree for same sentence is _____
9. The language accepted by a Push down Automata is _____ language.
10. According to Arden's theorem if every regular expression is in the form of R= Q + RP then there is a unique solution is _____
11. The output of the Mealy machine is determined only by its current state. It's True or False?
12. Write the condition for the left recursive grammar.
13. If $L = \{a^n b^n \mid n>0\}$ it is not a Regular Language. True or False?
14. Any regular language has an equivalent CFG. It's True or False?
15. All languages can be generated by context- free grammar. True or False?

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Convert the following CFG to CNF :
   $S \rightarrow ABA$
   $A \rightarrow aA / \varepsilon$
   $B \rightarrow bB / \varepsilon$

B) Define ARDEN's Theorem. Construct a regular expression corresponding to the automata given below using ARDEN's Theorem.



C) Convert the following Mealy machine into its equivalent Moore machine:

Present State	Next State			
	Input 0		Input 1	
	State	Output	State	Output
q_0	q_1	N	q_2	N
q_1	q_1	Y	q_2	N
q_2	q_1	N	q_2	Y

D) Using principle of Mathematical induction, Prove that for every $n \geq 1$,

$1 + 3 + 5 + \ldots\ldots + (2n - 1) = n^2$

Q.3 A) Define ambiguous grammar. Also Prove that the following language is ambiguous and convert into unambiguous: **(07)**

$X \rightarrow X + X \mid X * X \mid a$

B) Design a Turing Machine for the following Language: **(08)**

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

OR

B) Convert the grammar into Greibach Normal Form: **(08)**

$S \rightarrow AB$

$A \rightarrow BS / b$

$B \rightarrow SA / a$

Q.4 A) Construct a PDA for the following Language: **(07)**

$L = \{a^n b^m c^n \mid m, n \geq 0\}$

OR

A) 1) For the following Regular Expression draw a DFA recognizing the corresponding language. **(07)**

$(0 + 1)^* 10 (0+1)^*$ **4 Marks**

2) Explain Multi-Tape Turing Machine. **3 Marks**

B) Define language. Draw Deterministic Finite Automata for the following languages **(08)**

i) L1 = { x Є (0,1)* | x contains101 as a substring}

ii) L2 = { x Є (0,1)* | x contains odd number of zero}

iii) L3 = { x Є (0,1)* | x ends with 11}

iv) L4 = { x Є (0,1)* | x start with 001}