

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**V SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019**

**Course Code: IT303**

**Course Name: THEORY OF COMPUTATION**

Max. Marks: 100

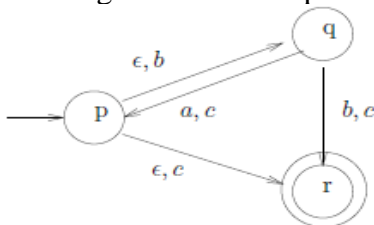
Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) Define the terms: (6)
- Concatenation
  - Union
  - Kleene Closure
- b) Design a Mealy machine which convert the binary input string to its 2's complement. (5)
- c) Distinguish between NFA and DFA. (4)
- 2 a) What is finite state machine? What are its applications ? (4)
- b) How is an NFA is converted into DFA? Convert NFA for accepting  $(a+b)^*c(d+e)^*$  into corresponding DFA. (7)
- c) Design a DFA which accepts strings of  $\{a,b\}$  which are having the substring ababa (4)
- 3 a) How do you represent an automaton using transition diagram and tables? Explain with an example. (6)
- b) What is mean by  $\epsilon$ -closure( ) and move(q,a) associated with  $\epsilon$ -NFA . Convert the following NFA to corresponding DFA. (5)



- c) Give a DFA for the following language over the alphabet  $\{0,1\}$  (4)  
 $L = \{ w \mid w \text{ starts with 1 and has odd length, or starts with 0 and has even length} \}$ .

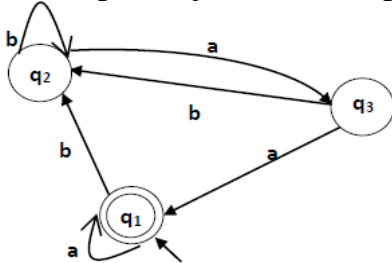
**PART B**

*Answer any two full questions, each carries 15 marks.*

- 4 a) Give a regular expression for each of the following languages. (6)
- The set of binary strings not containing consecutive 1's.
  - The set of binary strings containing exactly one instance of 11 somewhere inside.
  - The set of binary strings with at most one pair of consecutive 1's | i.e, if 11 is present, it can occur exactly once.
- b) Prove that the following language is not regular using the pumping lemma. (4)  
 $L = \{ a^n \mid n \text{ is a perfect square} \}$
- c) The following grammar generates postfix expressions with operands a and b (5)  
 and binary operators +, -, \* and /:  
 $G : E \rightarrow EE + \mid EE - \mid EE * \mid EE / \mid a \mid b$

For the string ababa-\*/, give a parse tree, a leftmost derivation and a rightmost derivation.

- 5 a) Obtain the Chomsky Normal Form equivalent to the grammars  $S \rightarrow bA/aB$ ,  $A \rightarrow bAA/aS/a$ ,  $B \rightarrow aBB/bS/b$ . (5)
- b) Explain the term Ambiguity in Grammars and Languages (4)
- c) Find the regular expression for the given DFA (6)



- 6 a) Construct a PDA accepting  $\{a^n b^m a^n / m, n \geq 1\}$  by empty stack. Write the corresponding context-free grammar accepting the same set. (4)
- b) Find a GNF grammar with no useless symbol equivalent to  $S \rightarrow AB/CA$ ,  $B \rightarrow BC/AB$ ,  $A \rightarrow a$ ,  $C \rightarrow aB/b$ . (6)
- c) Explain closure properties of regular sets (5)

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) Explain Turing machine construction techniques. (12)
- b) What is polynomial time transducer? (4)
- c) Explain the Halting Problem of Turing Machine. (4)
- 8 a) Construct a Turing machine for the language of even number of 1's and even number of 0's over  $\Sigma = \{0,1\}$  (6)
- b) What is a Linear-bounded automata? Explain with example. (8)
- c) Explain Church's thesis. (6)
- 9 a) What are the applications of TM? (6)
- b) Construct a Turing machine for reversing a binary string on the input tape. (8)
- c) Prove that the Satisfiability Problem(SAT) is NP-complete. (6)

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