



Regulation R18

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

Subject Code: 2P5EC

B.Tech V Semester Supplementary Examinations, June/July 2023

*Theory of Computation*

(CSE)

Maximum Marks: 70

Date: 28.06.2023 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 What is an alphabet. Give two examples?
- 2 Define Finite Automata?
- 3 List any two applications of regular expression.
- 4 Define Regular Expression.
- 5 Define Ambiguous Grammar.
- 6 Prove the equivalence of acceptance of PDA by empty state and final state.
- 7 List and prove any two closure properties of CFL's
- 8 How Total Turing Machine is Different from Simple Turing Machine.
- 9 Define Recursively Enumerable language.
- 10 What are Class P problems?

Part-B

Answer All the following questions.

(5 X 10M=50Marks)

- 11 A. Give Mealy and Moore machines for the following processes:  
a) For input from  $(0 + 1)^*$ , if the input ends in 101, output is A; if the input ends in 110, output is B; otherwise output is C.  
B. For input from  $(0 + 1 + 2)^*$ , print the residue modulo 5 of the input treated as a ternary (base 3, with digits 0, 1, and 2) number. [5+5]

OR

- 12 A. Design FA to accept strings with 'a' & 'b' such that the number of a's are divisible by '3'?  
B. Construct NFA with  $\epsilon$  which accepts a language consisting strings of any number of 0's followed by any number of 1's followed by any number of 2's. [5+5]

- 13 A. Explain the procedure of converting a regular expression to DFA with an example.  
B. Prove the following

i)  $\epsilon + 1^*(011)^*(1^*(011)^*)^* = (1+011)^*$

ii)  $(1+00^*1)+(1+00^*1)(0+10^*1)^*(0+10^*1) = 0^*1(0+10^*1)^*$  [5+5]

OR

- 14 A. Let  $L1 = \{010\}$ ,  $L2 = \{01,0\}$  then find

(i)  $L1L2$

(ii)  $L1^*$

(iii)  $L2^+$

(iv)  $L1^* + L2^*$

B. Construct Finite Automata for the regular expression  $0^*1^*(101)^*11$ . [5+5]

15 Consider the grammar  $E \rightarrow E + E \mid E * E \mid id$ . Write the right-most derivation and left most derivation for the sentence  $id*id+id$ . Discuss whether the given grammar is ambiguous or not. Justify your assertion. [10]

OR

16 A. Explain deterministic and nondeterministic PDA's with examples and give the differences.  
B. Give an algorithm to convert a CFG to Chomsky Normal Form? Explain in detail with an example. [5+5]

17 A. Discuss closure properties of deterministic context free languages.  
B. When do you say a language L is unambiguous? Show that the language  $L = \{a^n b^n \mid n \geq 1\}$  is unambiguous [5+5]

OR

18 A. Design a TM to recognize the language  $L = \{0^n 1^n 0^n \mid n \geq 1\}$ .  
B. Design TM which will recognize strings containing equal number of a's and b's. [5+5]

19 A. Discuss about Universal Turing Machine.  
B. Define PCP and show that it is undecidable. [5+5]

OR

20 Define the following and give examples  
i. P – type problem  
ii. NP – Hard problem  
Give atleast five problems that can be classified as NP problem. Justify. [10]