



R20 Regulation

Subject code: 3P4EE

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

## B.Tech IV Semester Supplementary Examinations, February 2024

### FORMAL LANGUAGES & AUTOMATA THEORY

(Common to CSE & CSE(AI&ML) )

Maximum Marks: 70

Date: 26.02.2024 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 which carries 10M.
  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) |                                                                                                                         | CO  | Bloom Tx |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----|----------|
| 1                                                              | Define DFA.                                                                                                             | CO1 | L1       |
| 2                                                              | Write about the applications of Finite Automata                                                                         | CO1 | L2       |
| 3                                                              | Define a Regular Expression                                                                                             | CO2 | L1       |
| 4                                                              | Which of the following is true?<br>a) $(01)^*0 = 0(10)^*$<br>b) $(0+1)^*0(0+1)^*1(0+1) = (0+1)^*01(0+1)^*$              | CO2 | L1       |
| 5                                                              | Define push down automata                                                                                               | CO3 | L1       |
| 6                                                              | For the Grammar $\{S \rightarrow AS/a, A \rightarrow SbA/SS/ba\}$ construct Left most derivation for the string aabbbaa | CO3 | L3       |
| 7                                                              | What is the purpose of studying Turing Machine?                                                                         | CO4 | L1       |
| 8                                                              | Construct CFG to generate string with any numbers of 1's                                                                | CO4 | L3       |
| 9                                                              | Give an example of un decidable problem                                                                                 | CO5 | L2       |
| 10                                                             | Write short note on NP-hard problem                                                                                     | CO5 | L2       |

#### Part-B

| Answer All the following questions. (5X10M=50Marks) |                                                                                                                                                                                                                                                                                   |     |          |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
| 11                                                  | A. Explain in detail about Melay and Moore Machines. (5M)<br>B. Construct a DFA accepting the set of all strings ending with 'bb' over $\Sigma = \{a,b\}$ (5M)                                                                                                                    | CO1 | L5<br>L3 |
| OR                                                  |                                                                                                                                                                                                                                                                                   |     |          |
| 12                                                  | A. Explain briefly about Finite Automata with Epsilon- Transitions. (5M)<br>B. Develop DFA for the following over $\{a, b\}$ (5M)<br>a) All strings containing not more than three a's.<br>b) All strings that has at least two occurrences of b between any two occurrences of a | CO1 | L5<br>L3 |
| 13                                                  | A. Explain about the Closure Properties of Regular sets. (5M)<br>B. Determine the regular expression $01^*+1$ to finite automata. (5M)                                                                                                                                            | CO2 | L5<br>L5 |

|    |                                                                                                                                                                                                                                        |        |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|--------|---|----|----|---|----|---|---|-----|----|---|------|-----|--|--|
|    | OR                                                                                                                                                                                                                                     |        |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 14 | A. Explain the applications of pumping lemma (5M)<br>B. Construct a DFA for the Regular Language consisting of any number of a's and b's. (5M)                                                                                         | CO2    | L5<br>L3 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 15 | A. Identify each PDA with the exists CFG such that $L(G)=N(P)$ (5M)<br>B. Construct a PDA for $L=\{wcw^R/w \in (0+1)^*\}$ (5M)                                                                                                         | CO3    | L3<br>L3 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
|    | OR                                                                                                                                                                                                                                     |        |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 16 | A. Explain in brief about decision properties of context free languages (5M)<br>B. Construct the following grammar into a PDA that accepts the language by empty stack $S \rightarrow 0S1 A, A \rightarrow 1A0 S  \epsilon$ (5M)       | CO3    | L5<br>L3 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 17 | A. Develop a Turing Machine to recognize strings containing equal number of 0's and 1's. (5M)<br>B. Explain in detail about Chomsky Normal Form (CNF). Convert the following grammar to CNF $S \rightarrow 0S0 1S1  \epsilon$ (5M)     | CO4    | L3<br>L5 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
|    | OR                                                                                                                                                                                                                                     |        |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 18 | A. Explain about types of Turing Machine (5M)<br>B. Estimate Turing Machine to accept $L=\{WcW^R   W \text{ is in } (a+b)^*\}$ . (5M)                                                                                                  | CO4    | L5<br>L5 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 19 | A. List in details about P,NP and NP-complete problems. (5M)<br>B. Let $\epsilon =\{0,1\}$ and A,B be the list of 3 strings each. Identify whether the following PCP has a solution or not? (5M)                                       | CO5    | L4<br>L3 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
|    | <table><tr><td></td><td>List A</td><td>List B</td></tr><tr><td>1</td><td>wi</td><td>Xi</td></tr><tr><td>1</td><td>00</td><td>0</td></tr><tr><td>2</td><td>001</td><td>11</td></tr><tr><td>3</td><td>1000</td><td>011</td></tr></table> |        | List A   | List B | 1 | wi | Xi | 1 | 00 | 0 | 2 | 001 | 11 | 3 | 1000 | 011 |  |  |
|    | List A                                                                                                                                                                                                                                 | List B |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 1  | wi                                                                                                                                                                                                                                     | Xi     |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 1  | 00                                                                                                                                                                                                                                     | 0      |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 2  | 001                                                                                                                                                                                                                                    | 11     |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 3  | 1000                                                                                                                                                                                                                                   | 011    |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
|    | OR                                                                                                                                                                                                                                     |        |          |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |
| 20 | A. Explain briefly about undecidable problem. (5M)<br>B. Explain in detail recursively enumerable language. (5M)                                                                                                                       | CO5    | L5<br>L5 |        |   |    |    |   |    |   |   |     |    |   |      |     |  |  |