



**B.Tech III Semester Supplementary Examinations, July 2022**

**FORMAL LANGUAGE & AUTOMATA THEORY**  
(COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE))

**Maximum Marks: 70**

**Date: 23.07.2022 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 Explain about  $\epsilon$ -closure().
- 2 Explain the difference between DFA & NFA
- 3 Give a simple verbal description of the language  $L ((aa)^* b (aa)^* + a (aa)^* ba (aa)^*)$
- 4 Write regular expression for denoting language containing empty string.
- 5 Let  $\Sigma = \{a, b\}$ . For each of the following languages, find a grammar that generates it.  
 $L1 = \{a^n b^m : n \geq 0, m > n\}$ .
- 6 Define Right Linear Grammar.
- 7 Define Greiback Normal form with an example.
- 8 Write a short note on Recursively Enumerable languages.
- 9 Define Instantaneous Description of TM
- 10 Define post correspondence problem

**Part-B**

Answer All the following questions. (10M X 5=50Marks)

- 11 (a) Convert the Moore machine to determine residue mod 3 into Mealy machine. [5M]  
(b) Briefly describe the block diagram of FA with a neat sketch [5M]

OR

- 12 (a) Consider the set of strings on  $\{0,1\}$  such that the leftmost symbol differs from the rightmost one: Construct an accepting dfa for the language of strings as defined. [5M]  
[5M]

- (b) Find an nfa with four states for  $L = \{a^n : n \geq 0\} \cup \{b^n a : n \geq 1\}$ .

- 13 (a) Construct the minimum state automata for the following. [5M]

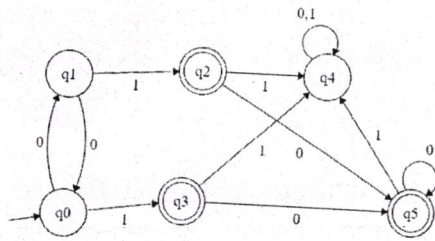
<b>M</b>	<b>0</b>	<b>1</b>
<b>→A</b>	B	C
<b>B</b>	B	C
<b>C</b>	B	C
<b>D</b>	B	E
<b>E</b>	B	C

[5M]

- (b) Show that the language  $L = \{w \in \Sigma^+ : n_a(w) < n_b(w)\}$  is not Regular using Pumping Lemma

OR

- 14 (a) Minimize the following DFA using equivalence theorem. [5M]



[5M]

- (b) Prove or disprove the following for regular expressions  $r$ ,  $s$ , and  $t$ .
- i)  $(r + s)t = rt + st$
  - ii)  $(rs + r)*r = r(sr + r)*$
- 15 (a) Show that the grammar  $G_1 = (\{S\}, \{a, b\}, S, P)$ , with productions  $S \rightarrow SS/SSS/aSb/bSa/\epsilon$  is equivalent to the grammar  $G_2 = (\{S\}, \{a, b\}, S, P)$ , with productions  $S \rightarrow SS/\epsilon/aSb/bSa$  [5M]
- (b) List out the properties of PDA. [5M]
- OR
- 16 (a) Construct the PDA to the following grammar: [5M]  
 $S \rightarrow AB$   
 $A \rightarrow BS/b$   
 $B \rightarrow SA/a$  [5M]
- (b) Explain the difference between DPDA and NPDA.
- 17 (a) Construct PDA for the given CFG:  $S \rightarrow aSb, S \rightarrow ab$ , Where  $S$  is the only variable and  $\{a, b\}$  are terminals. [5M]
- (b) Construct a Turing machine to compute the function  $f(w) = w^R$ , where  $w \in (0, 1)^+$  [5M]
- OR
- 18 (a) Write properties of recursive and recursively enumerable languages. [5M]
- (b) Design TM for performing proper subtraction of two numbers. [5M]
- 19 Define the following and give examples [5M]  
 a) NP Problem [5M]  
 b) NP - Complete Problem [5M]
- OR
- 20 (a) Write briefly about the following: [5M]  
 i. Decidability of Problems [5M]  
 ii. Define PCP. [5M]
- (b) Give the solution of PCP  $A = \{ba, ab, a, baa, b\}$  and  $B = \{bab, baa, ba, a, aba\}$