Roll No: ☐☐☐☐☐☐☐☐☐☐☐☐☐

BTECH
(SEM IV) THEORY EXAMINATION 2021-22
THEORY OF AUTOMATA AND FORMAL LANGUAGES

Time: 3 Hours   *Total Marks: 100*
Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.**   **2x10 = 20**

Q.no	Questions	Marks	CO
(a)	Define Alphabet and String in Automata Theory.	2	2
(b)	Give the definition of Deterministic Finite Automaton (DFA).	2	1
(c)	Explain in brief about the Kleen's Theorem.	2	2
(d)	Define Context Free Grammar (CFG).	2	1
(e)	Write the Context Free Grammar (CFG) for regular expression (0+1)*	2	3
(f)	What are Right Linear grammar and Left Linear grammars?	2	3
(g)	Discuss briefly about the Push Down Automata (PDA).	2	4
(h)	What do you mean by Two stack Pushdown Automata?	2	4
(i)	What do you mean by basic Turing Machine Model?	2	5
(j)	What do you understand by the Halting Problem?	2	5

SECTION B

2. **Attempt any *three* of the following:**   **10x3 = 30**

Q.no	Questions	Marks	CO
(a)	Explain in detail about the Turing Church's Thesis and Recursively Enumerable languages.	10	5
(b)	Prove that the Compliment, Homomorphism, Inverse Homomorphism, and Closure of a Regular Language is also Regular.	10	2
(c)	Give the Complete description about the Chomsky Hierarchy.	10	3
(d)	Convert the grammar S → aAA, A → a |aS| bS to a PDA that accepts the same language by Empty stack.	10	4
(e)	Grammar G is given with the production S->aSS A->b. Compute the string w= aababbb with the Left most and Right most derivation Tree.	10	1

SECTION C

3. **Attempt any *one* part of the following:**   **10x1 = 10**

Q.no	Questions	Marks	CO
(a)	Write short notes on following. i) Turing Machine as Computer of Integer Functions ii) Universal Turing machine	10	5
(b)	Explain in detail about the Pumping Lemma and application of Pumping Lemma for Regular Languages.	10	2

4. **Attempt any *one* part of the following:**   **10x1 = 10**

Q.no	Questions	Marks	CO
(a)	Construct a Non Deterministic Finite Automation (NFA) for the language L which accepts all the strings in which the third symbol from right end is always 'a' over Σ = {a, b}.	10	1
(b)	Explain in detail about the Myhill-Nerode theorem using suitable example.	10	3

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5. **Attempt any *one* part of the following:**   **10x1 = 10**

Q.no	Questions	Marks	CO
(a)	Prove that the following Language $L = \{a^n b^n : n >= 0\}$ is not a regular language.	10	4
(b)	Design a Turing Machine for the language L. Where, $L=\{a^n b^n c^n \mid n \geq 1\}$	10	5

6. **Attempt any *one* part of the following:**   **10x1 = 10**

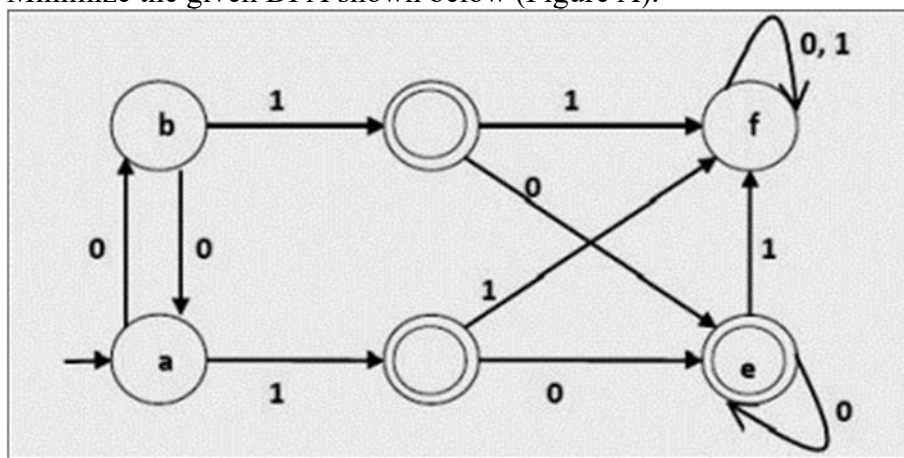| Q.no	Questions	Marks	CO
(a)	Prove that the Compliment, Homomorphism, Closure and Inverse Homomorphism of a Regular language is also Regular.	10	2
(b)	Minimize the given DFA shown below (Figure A). Figure A	10	1

7. **Attempt any *one* part of the following:**   **10x1 = 10**

Q.no	Questions	Marks	CO
(a)	Explain in detail about the following. i) Closure properties of Regular Languages ii) Decidability- Decision properties of Regular Languages	10	4
(b)	Check whether the grammar is ambiguous or not. R-> R+R/ RR/ R*/ a / b / c. Obtain the string w = a+b*c	10	3