PAPER ID-421621

**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.<br>  i) Turing Machine as Computer of Integer Functions<br>  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 $\Sigma = \{a, b\}$. | 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**
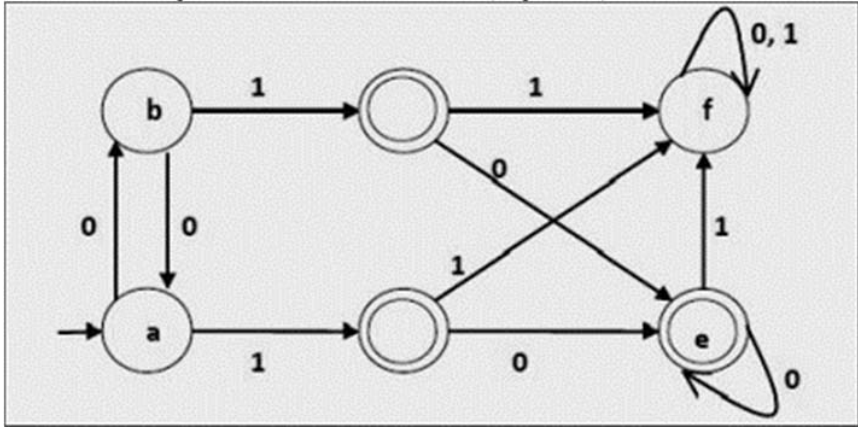
| Q.no | Questions | Marks | CO |
|---|---|---|---|
| (a) | Prove that the Compliment, Homomorphism, Closure and Inverse Homomorphism of a Regular language is also Regular. | 10 | 2 |
| (b) | Minimize the given DFA shown below (Figure A). | 10 | 1 |



Figure A

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

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