CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR
(Deemed to be University)
KOKRAJHAR :: BTR :: ASSAM :: 783370

END – SEMESTER EXAMINATION
Diploma

Session: **Janu-June 2025** Semester: **VI** Time: **3Hrs**. Full Marks: **100**
Course Code: **DCSE613** Title: **Formal Language & Automata Theory**

Answer Question 1 and any *four* of the remaining questions

1. (a) Regular language is correspond to ...
(i) DFA (ii) NFA (iii) Regular expression (iv) All the above

(b) Most powerful machine is ... (i) DFA (ii) NFA (iii) PDA (iv) TM

(c) Which one is more powerful? (i) DPDA (ii) NPDA

(d) Write a grammar for $L = \{aw : w \in \{a, b\}^*\}$

(e) Write a regular expression for $L = \{wa : w \in \{a, b\}^*\}$

(f) Design an NFA for $L = \{awa : w \in \{a, b\}^*\}$

(g) Design an DFA for $L = \{bw : w \in \{a, b\}^*\}$

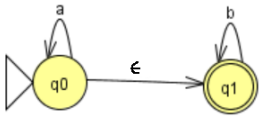
(h) Null string is
(i) Empty string (ii) String without any symbol (iii) String of zero length
(iv) All the above

(i) The Pumping Lemma is used to prove that a language is not regular.
(i) True (ii) False

(j) $L = \{a^m b^n\}$ is regular when (i) $m, n \geq 0$ (ii) $m = n$ (iii) $m \neq n$

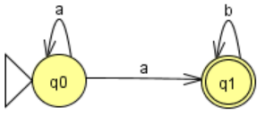
2 x 10

2. (a) Define the DFA. Design a DFA for the language
L = $\{w \in \{0, 1\}^*$: where binary representation of w is divisible by 3$\}$.
(b) Transform the ϵ-NFA to its equivalent ϵ-free NFA. Also find the regular expression corresponding to that NFA



4 + 6 + 6 + 4

3. (a) Convert the following NFA to its equivalent DFA.



(b) Design an NFA for the regular expression:
r = (a + a(ab + ba)*)*
(c) State the Chomsky hierarchy of the language.
(d) State the pumping lemma for the regular language.

5 + 5 + 5 + 5

4. Define the PDA. Design a PDA for the language $L = \{a^n b^n : n \geq 0\}$. Write a context-free grammar for this language.

5 + 10 + 5

5. Define the TM. Design a TM for the language $L = \{a^{2n} b^n : n > 0\}$. Define the recursive language.

5 + 12 + 3

6. Answer any four:
(a) Ambiguous grammar.
(b) Parse tree
(c) Pigeonhole principle
(d) Chomsky's Normal Form (CNF)
(e) Church–Turing thesis
(f) Multi Tape TM

4 x 5

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