Seat. No. _____

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BE SEMESTER-V (New) Examination APRIL-2025

Subject Name: THEORY OF COMPUTATION **Subject Code: CE503-N**

Date: 11/04/2025 **Time: 12:30pm – 03:30pm** **Total Marks: 70**

Instructions:

1. Answer each section in separate answer sheet.
2. Use of scientific calculator is permitted.
3. All questions are Compulsory.
4. Indicate clearly, the option you attempt along with its respective question number.
5. Use the last page of main supplementary of rough work.

Section-I

Q-1 (A) What is set? Explain various operations on set. [5]

(B) What is rational number? Prove that $\sqrt{2}$ is irrational. [5]

(C) Prove that $1 + 3 + 5 + \text{-----} + 2n-1 = n^2$ using PMI, n>=1 [5]

OR

(C) Prove that $7 + 13 + 19 + \text{----} + (6n+1) = n(3n+4)$ using PMI, n>=1 [5]

Q-2 (A) Find the regular expression of the following subset of {a,b}* : [5]

1. Accept all string containing any no of a's and b's
2. Starting and Ending with 'a' and having any combination of b's in between
3. Starting with 'a' but not having consecutive b's
4. Any no of a's is followed by any no of b's is followed by any no of c's
5. String in which 0 is immediately followed by 11

(B) Explain Chomsky Hierarchy of Language. [5]

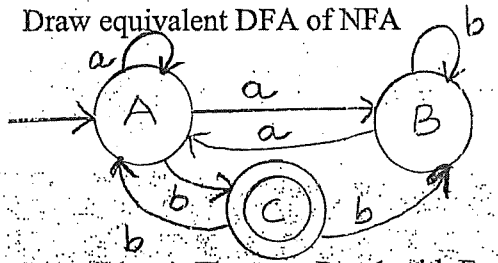
OR

Q-2 (A) Compare DFA, NFA and NFA^ [5]

(B) Draw DFA of the following [5]

1. Language having all the string ending with 'a' over $\sum$={a,b}
2. Language having all string starting with 'a' and ending with 'b' over $\sum$ = {a,b}

Q-3 (A) Draw equivalent DFA of NFA [5]

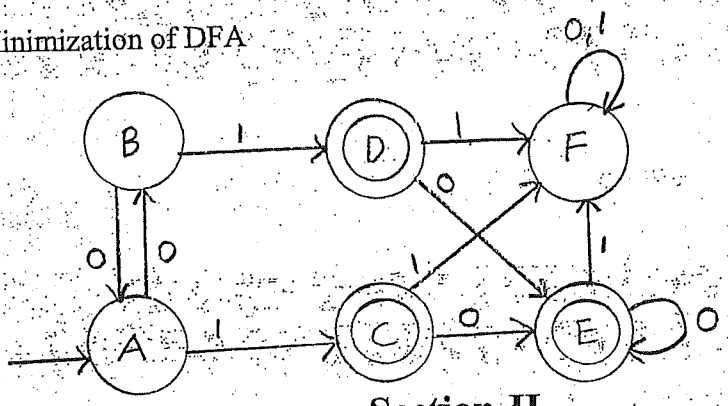


(B) Prove kleen's Theorem Part 1 with Example [5]

OR

Q-3 (A) Prove kleen's Theorem Part II with Example [5]

(B) Minimization of DFA [5]



Section-II

Q-4 (A) Define CFG. Construction of CFG of the following statement [5]
1. Language having any no of a's
2. Language having any no of a's and b's

(B) Difference between Ambiguous and Unambiguous Grammar with example [5]

(C) Construct CFG of the following [5]
$L = \{ a^i b^j c^k \mid i=j \text{ or } j=k\}$

OR

(C) Convert the following CFG into CNF [5]

$S \rightarrow AAC$

$A \rightarrow aAb \mid \wedge$

$C \rightarrow aC \mid a$

Q-5 (A) What is PDA? Give difference between deterministic and non-deterministic PDA [5]

(B) Derive PDA for the following [5]

$L = \{ 0^n 1^{2n}, n > 0\}$

OR

Q-5 (A) Derive PDA for the following [5]

$L = \{ a^n b^n \mid n>=1\}$

(B) Convert the following CFG into CNF [5]

$S \rightarrow aAbB$

$A \rightarrow Ab \mid b$

$B \rightarrow Ba \mid a$

Q-6 (A) Write a short note on Tuning Machine and its Type. [5]

(B) Design a TM for language which has even length palindrome strings over the alphabet. {a,b} [5]

OR

Q-6 (A) Define and explain Context Sensitive Language and Linear Bounded Automata [5]

(B) Design a TM for same number of 0's and 1's. [5]

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