U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**
Course Code: 22AM3PCTFC **Max Marks: 100**
Course: Theoretical Foundations of Computations

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

B.M.S.C.E. - ODD SEM 2023-24

UNIT - I

1 a) Design a DFA to accepting the following strings over the alphabet{a,b} **6**

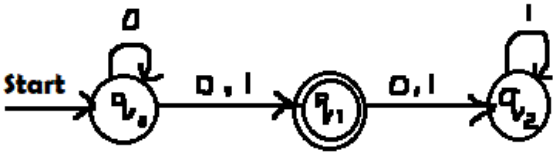
i. The set of strings with odd number of '**a**' and even number of '**b**'
ii. The set of strings which either start or end with **ba**

b) Consider the given language L = {w, w mod 5=0, ∑ = {0, 1} and Construct a DFA which accepts strings of 0's & 1's where each string is represented as binary number. **8**

c) Obtain an NFA to accept the language L={abab^n or aba^n, n >=0} **6**

OR

2 a) Convert the following NFA to its equivalent DFA and Elaborate the conversion of steps in detail. **10**



b) Obtain the NFA to accept strings of a's and b's ending with ab or ba. Using the resultant NFA obtain an equivalent DFA. **10**

UNIT - II

3 a) Write the equivalent regular expression for the language **8**

L ={ a^{2n}b^{2m} , n, m >=0}

b) Derive the regular expression to accept the string of a's and b's having total length less than or equal to 0. **6**

c) Construct a ε-NFA to accept the regular language: $(0+1)^*+1$ **6**

UNIT - III

4 a) If L1 & L2 are two Context Free Languages, then show that the L1UL2, L1.L2, $L1^*$ are also Context Free and are closed. **6**

b) Convert the given Context Free Grammar (CFG) to Chomsky Normal Form (CNF) **8**

S →ASB

A→aAS | a | ε

B → SbS | A | bb

c) Show that the given grammar is ambiguous **6**

S →A|B

A → aAb | ε

B → abB | ε

UNIT - IV

5 a) Construct a Push Down Automata (PDA) that accepts the language **10**

L={ $a^n b^m c^{n+m}$ | n, m>=1}

b) Convert the given CFG: S → aSa | bSb | c to an equivalent PDA and show the instantaneous descriptions for the input string "abbccbba" when applied on the resultant PDA. **10**

OR

6 a) Design Non-Deterministic Pushdown Automata (NPDA) to accept the language L={ WW^R over the alphabets ∑ ={a,b}} **8**

b) Convert the given PDA transitions to its equivalent CFG representation: **6**

f(q0, a, Z) = (q0, AZ)

f(q0, a, A) = (q0, A)

f(q0,b,A) = (q0, ε)

f(q1, ε, Z)= (q2, ε)

c) Differentiate between Deterministic PDA and NPDA. **6**

UNIT - V

7 a) Design a Turing machine to accept the language L = {0^n 1^n where n >=1} **10**

b) Obtain Turing machine to accept strings of a's and b's on the string w having $N_a(w)$ equal to $N_b(w)$ **10**

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