**ST. JOSEPH’S UNIVERSITY, BENGALURU -27**

Registration Number:

Date & Session

**M.Sc Computer Science – I SEMESTER**

**SEMESTER EXAMINATION: OCTOBER 2023**

**(Examination conducted in November/December 2023)**

**CS7221: Theory of Computation**

**(For Current Batch Students only)**

**Time: 2 Hours Max Marks: 50**

**This paper contains 2 printed pages and 3 parts**

**PART-A**

**Answer all FIVE questions (2 X 5 = 10)**

1. Differentiate between DFA, NFA and ∈ - NFA.
2. Construct a DFA which doesn’t contain the substring 110.
3. Construct a CFG over {a,b} generating a language consisting of equal number of a’s and b’s.
4. For G = ( { S, B }, { c, d }, P, S ) where P = { S → c B S | c B → S d B | S S | d c }

Find the left most derivation and draw the parse tree for the string ccdcddc.

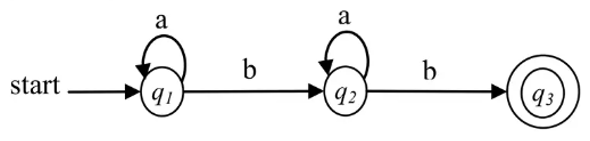
1. What is meant by recursively enumerable language?

**PART- B**

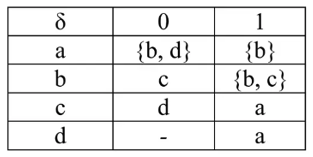
**Answer any FIVE questions (4 X 5 = 20)**

# Construct an ∈-NFA for Regular Language L = (0+1)\*(00+ 11).

1. Obtain the regular expressions for the finite automata



1. Construct a DFA equivalent to the NFA . M =({a,b,c,d),(0,1), δ, a,{b,d} where transition is a defined as



1. Reduce the following grammar to Chomsky normal form.

S → A B

A → a a b

B → a A C

1. Prove by pumping lemma, that the language 0n1n is not regular.
2. Convert the following grammar into GNF.

S → AB1 | 0

A → 00A | B

B → 1A1

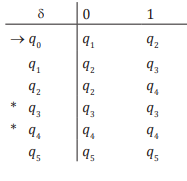
1. Write a short note on different types of Turing Machine.

**PART- C**

**Answer any TWO questions (10 X 2 = 20)**

1. a. Construct a minimized automata for the following automata to define

the same language. [6]



b. Remove the ∈ - production from the following CFG.

S → X Y X X → 0 X | ∈ Y → 1 X | ∈ [4]

1. a. Construct a push down automata for the language L={anbn|≥1} [6]
2. Define Turing Machine, Language Acceptance of TM & Instantaneous

Description of TM. [4]

1. a. Explain Chomsky Hierarchy of generative Grammars with

examples. [6]

b. Define Regular Expressions and write the properties of regular

expressions. [4]