III Semester M.C.A. Examination, April/May 2022
(CBCS Scheme)
COMPUTER SCIENCE
MCA 303 : Theory of Computation

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **any five** from Part – **A** and **any four** from
Part – B.

PART – A

Answer **any five** of the following. **Each** question carries **6** marks.   (5×6=30)

1. Define Regular Expressions. Design ϵ-NFA for regular expression $(a+b)^*a^*b^*c^*$.

2. Define Pumping Lemma for Regular languages.

3. Enumerate the limitations of a Deterministic Finite Automaton (DFA).

4. Define CFG. Show that $L = \{a^n b^n c^n, n \geq 1\}$ is not context free.

5. Show that the grammar $E \rightarrow E + T / T$, $T \rightarrow T \times F/F$, $F \rightarrow a$ is ambiguous.

6. Construct a PDA to accept $L = \{0^n 1^n, n \geq 1\}$ and show the computation for input sequence $w = 000111$.

7. Define Turing Machine (TM). Explain the Turing Machine model and give any 2 of its variants.

8. Enumerate any five closure properties of Context free languages.

PART – B

Answer **any four** of the following. **Each** question carries **10** marks.   (4×10=40)

9. Construct DFA to accept strings for $\Sigma = \{a, b\}$.

   a) Strings not containing the substring aba

   b) Strings with length divisible by 3.

10. Design NFA to accept strings of 0's and 1's ending with 10 or 01. Convert the NFA to its equivalent DFA.

11. a) Given CFG G

S → aB / bA

A → a / aS / bAA

B → b / bS / aBB

For the string bbaabbaa find LMD, RMD and Parse Tree.

b) Simplify the given CFG.

S → ABCa / bD

A → BC / b

B → b / ∈

C → d / ∈

D → d.

12. Define CNF. Convert to CNF where P = {S → 0A/1B, A → 0AA/1S/1, B → 1BB/0S/0}.

13. Construct a TM as a transducer to determine sum of 2 integers represented as zeroes and separated by a #.

14. Explain the following :

a) ID of a TM

b) Language accepted by a PDA

c) Halting problem of TM

d) Chomsky's Hierarchy.

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