

Section-C

6. (a) Design a Turing Machine to recognize the language $\{a^n b^n c^m \mid n, m \geq 1\}$.
(b) Explain halting problem of Turing machine. 15,5
7. (a) Discuss Decidable problems concerning Context free languages in detail.
(b) Explain the various variants of Turing Machine briefly with example. 12,8

Section-D

8. (a) What is a primitive recursive function ? Show that the following function is primitive recursive :
 $r(x, y) =$ the remainder obtained when x is divided by y .
(b) What is PCP problem ? Explain with the help of example. 10,10
9. Write short notes on the following :
(a) Church-Turing Thesis
(b) Tractable decision problems
(c) Partial Recursive Function 20

Roll No. :

Total No. of Questions : 9] [Total No. of Pages : 4

22642

M.Tech. (CSE) 1st Semester
Examination, March-2021

MATHEMATICAL FOUNDATION OF COMPUTER
SCIENCE

Paper-MTCSE21C5

Time : **Three Hours**]

[**Maximum Marks : 100**

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note :- Attempt *five* questions in all, selecting *one* question from each Section. Question No. 1 is compulsory.

1. Write short notes on the following :
- Halting problem is undecidable.
 - Explain Left most derivation and Right most derivation in CFG.
 - A simple undecidable problem (PCP).

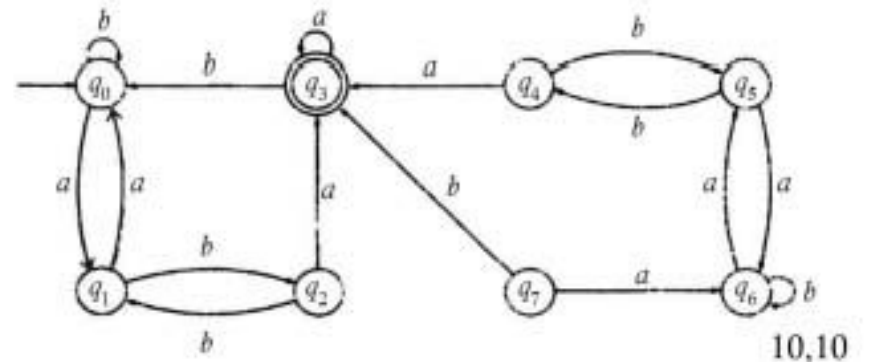
- (d) Explain context free grammar and its applications. 5×4=20

Section-A

2. (a) What is the difference between Mealy and Moore machine ? What is the procedure for transforming a Moore machine into Mealy machine ?
- (b) Construct a Mealy machine equivalent to given Moore machine : 10,10

Present State	Next State		Output
	a = 0	a = 1	
→q0	q1	q2	1
q1	q3	q2	0
q2	q2	q1	1
q3	q0	q3	1

3. (a) Let G be $S \rightarrow AB$, $A \rightarrow a$, $B \rightarrow C/b$, $C \rightarrow D$, $D \rightarrow E$ and $E \rightarrow a$. Eliminate unit productions and get an equivalent grammar.
- (b) Write the algorithm to minimize the number of states of DFA. Apply this to minimize the states of the following DFA :



Section-B

4. (a) What do you mean by Push Down Automata (PDA) ? How PDA are different from Finite Automata (FA) ? Also discuss some applications of PDA.
- (b) Explain the relation between PDA and CFL briefly. 10,10
5. (a) Design a PDA for the language $L = \{ w \in (a, b)^* \mid w \text{ has equal numbers of } a\text{'s and } b\text{'s} \}$
Also show the acceptance of string $abab$ with the help of designed PDA.
- (b) Explain the relation between PDA and Context Free Grammar (CFG). 10,10