| ADAMAS UNIVERSITY PURSUE EXCELLENCE | **ADAMAS UNIVERSITY**<br>**END-SEMESTER EXAMINATION : JANUARY 2021**<br>(Academic Session: 2020 – 21) | | |
|---|---|---|---|
| **Name of the Program:**<br>(Example: B. Sc./BBA/MA/B.Tech.) | B.Tech | **Semester:**<br>(I/III/ V/ VII/IX) | V |
| **Paper Title :** | Theory of Computation | **Paper Code:** | ECS43101 |
| **Maximum Marks :** | 40 | **Time duration:** | 3 hours |
| **Total No of questions:** | 8 | **Total No of Pages:** | 2 |
| *(Any other information for the student may be mentioned here)* | | | |

***Answer all the Groups***

**Group A**

Answer all the questions of the following $5 \times 1 = 5$

**1.** **a)** Which of these are more powerful than a powerful than a single-tape infinite Turing machine?
A) Multi-tape Turing Machine, B) Multi-track Turing Machine, C) Both A&B, D) None of these

**b)** Match the following:

| | | |
|---|---|---|
| A) | Finite State Automata | I) Context Free Language |
| B) | Push Down Automata | II) Recursive Language |
| C) | Linear Bounded Automata | III) Regular Language |
| D) | Turing Machines | IV) Context Sensitive Language |

**c)** Distinguish between total recursive functions and partial recursive functions with example.

**d)** Match the following:

| | | |
|---|---|---|
| A) | Finite State Automata | I) Stack |
| B) | Push Down Automata | II) Finite Tape |
| C) | Linear Bounded Automata | III) Infinite Tape |
| D) | Turing Machines | IV) No Memory |

**e)** How many types of basic functions are there? Define them.

**GROUP –B**

Answer *any three* of the following $3 \times 5 = 15$

**2.** What are the differences between Mealy Machine and Moore Machine. Explain with example

**3.** Explain the Chomsky hierarch of formal grammars. Demonstrate the type of language, the corresponding grammar, memory constraints and accepting machines.

**4.** Define finite state automata? Design the FSA for the language L = (a*(ab)*b*) | (a*(ba)*b*).

5. Show that add(x,y)=x+y as a primitive recursive function.

## GROUP –C

Answer *any two* of the following $2 \times 10 = 20$

6. Design a PDA for the language $a^n b^m c^n$. Show the ID for the input "aaabbccc"

7. Distinguish between P, NP, NP-Hard, and NP-Complete. Show that Knapsack Problem can be reduced to the 3-SAT problem.

8. Design a Turing Machine to multiply two numbers represented in the tally notation. For example. For 3*2 input would be 111 and 11 separated by a marker as shown in the tape below.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| b | 1 | 1 | 1 | x | 1 | 1 | = | b |

Print the resultant number in the tally notation on the right of the equals sign. Output should look like,

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b | 1 | 1 | 1 | x | 1 | 1 | = | 1 | 1 | 1 | 1 | 1 | 1 | b |

Show the ID for the multiplication of (2*2).