NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - CARRY OVER THEORY EXAMINATION - APRIL 2023

Subject: Theory of Automata and Formal Languages

Time: 3 Hours   **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

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SECTION A   **20**

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1. Attempt all parts:-

1-a.   Which of the following is not a part of 5-tuple finite automata?   (CO1)   1

             (a) Input alphabet

             (b) Transition function

             (c) Initial State

             (d) Output Alphabet

1-b.   In mealy machine, the O/P depends upon?   (CO1)   1

             (a) State

             (b) Previous State

             (c) State and Input

             (d) Only Input

1-c.   RR* can be expressed in which of the forms: (CO2)   1

             (a) R^+

             (b) R^-

             (c) $R^+ \cup R^-$

(d) R

1-d.   ------------ denotes all strings of 0's and 1's.   (CO2)   1

      (a) 0 1

      (b) (0 + 1) *

      (c) (0 + 1)

      (d) 0 * 1

1-e.   Grammar is defined by number of _____ tuples.   (CO3)   1

      (a) 4

      (b) 5

      (c) 3

      (d) 2

1-f.   The Grammar can be defined as: $G=(V, \sum, p, S)$ 1
In the given definition, what does S represents?   (CO3)

      (a) Accepting State

      (b) Starting Variable

      (c) Sensitive Grammar

      (d) None of these

1-g.   A pushdown automata can be defined as: $(Q, \sum, G, q_0, z_0, A, d)$ 1
What does the symbol z_0 represents?   (CO4)

      (a) an element of G

      (b) initial stack symbol

      (c) top stack alphabet

      (d) all of the mentioned

1-h.   Push down automata accepts _____ languages. (CO4)   1

      (a) Type 3

      (b) Type 2

      (c) Type 1

      (d) Type 0

1-i.   In an standard turing machine$(Q,\Sigma,T,\delta,q_0,b,F)$ the blank symbol b is   1
(CO5)

      (a) in Σ-T

      (b) in T-Σ

      (c) T$\cap\Sigma$

(d) none of the above

1-j.   If Turing machine accepts all the words of the language L and rejects or loops   1
for other words, which are not in L, then L is said to be ___ (CO5)

    (a) recursively enumerable

    (b) recursive

    (c) context free language (cfl)

    (d) none of them

2. Attempt all parts:-

2.a.   Differentiate between NFA and DFA.   (CO1)   2

2.b.   Define alphabet, language and strings. (CO2)   2

2.c.   Define CNF and GNF .   (CO3)   2

2.d.   Distinguish between DPDA & NPDA.   (CO4)   2

2.e.   Explain Universal Turing Machine.   (CO5)   2

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SECTION B   **30**

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3. Answer any <u>five</u> of the following:-

3-a.   Draw a DFA to accept string of 0's and 1's ending with the string 011.   (CO1)   6

3-b.   What are various points of difference between Moore & Mealy Machine?   6
Explain the procedure to convert a moore machine into Mealy machine.   (CO1)

3-c.   Explain Left Linear Grammar and Right Linear Grammar with the help of   6
suitable examples. (CO2)

3-d.   Draw NFA with ε transition for the R.E. 10 + (0 + 11) 0* 1 .   (CO2)   6

3.e.   Discuss the procedure to eliminate Null Productions and Unit Productions with   6
help of an example.   (CO3)

3.f.   Construct a PDA for { $a^n b^n$ / n>=1}.   (CO4)   6

3.g.   Design a TM that recognizes the languages of all strings of even length over   6
alphabet {a,b}.   (CO5)

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SECTION C   **50**

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4. Answer any <u>one</u> of the following:-

4-a.   Explain Chomsky Classification of Grammars in detail.   (CO1)   10

4-b.   Draw an NFA that accepts a language L over an input alphabet ∑ = {a, b} such   10
that L is the set of all strings where 3rd symbol from the right end is **'b'**. Also
convert the same to DFA. (CO1)

5. Answer any <u>one</u> of the following:-

5-a. State Pumping Lemma for Non-Regular languages. Prove that the language L= 10 (a^nb^n where n >= 0} is not regular. (CO2)

5-b. What is the relationship between Finite automata and regular expressions. 10 Discuss its applications also. (CO2)

6. Answer any <u>one</u> of the following:-

6-a. What is meant by ambiguous grammar? Test whether the grammar is 10 ambiguous or not. (CO3)

S → AB

A → aAb / ab / B

B → abB / ε

6-b. Convert the following grammar in GNF: S → AB , A → BS / a , B → SA / b 10 (CO3)

7. Answer any <u>one</u> of the following:-

7-a. Design PDA for Language W c W^R , W ∈ (a , b) * (CO4) 10

7-b. Compare FM and PDA. Construct a PDA accepting all palindromes over {a, b}. 10 (CO4)

8. Answer any <u>one</u> of the following:-

8-a. Explain various types of Turing Machines with example (CO5) 10

8-b. Show that the PCP with two lists x = (b, bab^3, ba) and y = (b^3, ba, a) has a 10 solution. Give the solution sequence. (CO5)