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Roll No:

Subject Code: ACSE0404

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to Dr. A.P. J Abdul Kalam Technical University, Uttar Pradesh, Lucknow

Course: B. Tech. Branch: CSE/IT/AIML/IOT/CS/AI/DS

Semester: IV Examination: PUT Year – (2021-22)

Subject Name: **Theory of Automata and Formal Languages**

Time: 2.00 Hrs Max. Marks:60

General Instructions:

- This Question paper consists of...2.... pages & ...4... questions. It comprises of three Sections -A, B, & C.
- Section A –Q.No- 1 is Very short answer type questions carrying 1 mark each, Q. No- 2 is Short Answer Type-I Question carrying 2 mark each. You are expected to answer them as directed.
- Section B- Q. No-3 is Short Answer type-II questions carrying 5 marks each. Attempt any four out of five questions given.
- Section C - Q. No-4 is Long Answer type questions carrying 6 marks each. Attempt any four out of six questions given.

SECTION – A

1. Attempt all parts [8x1=08]

1-a	Define GNF.	(1) CO3
1-b	Write any two closure properties of CFL.	(1) CO3
1-c	Explain the condition of acceptance by a PDA using empty stack.	(1) CO4
1-d	Why Context free language is so called?	(1) CO3
1-e	Give Tuple representation of Turing Machine.	(1) CO5
1-f	Explain Church Thesis.	(1) CO5
1-g	Define ID of PDA.	(1) CO4
1-h	Define Language of PDA.	(1) CO4

2. Attempt all parts [4x2=08]

2-a	Differentiate between NPDA and DPDA.	(2) CO4

2-b Design CFG for $L = \{a^n b^m : n \neq m\}$. (2) CO3

2-c Prove that the following Grammar is ambiguous: (2) CO3

$E \rightarrow E + E / E - E / id$

2-d Discuss Universal Turing Machine. (2) CO5

SECTION – B

3. Attempt any four out of five questions- [4×5=20]

3-a. Define CNF. Find the equivalent CNF of following CFG: (5) CO3

$E \rightarrow E+T / T$

$T \rightarrow T*F / F$

$F \rightarrow (E) / a$

3-b. Consider the following Context Free Grammar: (5) CO3

$E \rightarrow T \# E / T, \quad T \rightarrow T \$ F / F, \quad F \rightarrow a / b / c / d / e / f$

Show the steps of derivation of string a # b # c $ d # e $ f

3-c. Find the Solution of PCP problem for following Lists: (5) CO4

A = {a, ab, bba}, B = {baa, aa, bb}

3-d. Design a pda for the Language $L = \{WW^R \mid W \in \{0,1\}^*\}$. (5) CO4

3-e. Construct a Turing Machine for Language $L = \{0^k 1^k 2^k 3^k, k>0\}$. (5) CO5

SECTION – C

4 Attempt any four out of six questions- [4×6=24]

4-a Using Pumping lemma for CFL's prove that Language $L = \{a^k$, where $k=i^2\}$ is not context free. (6) CO3

4-b Find the equivalent PDA for the following context free grammar: (6) CO4

$S \rightarrow 0S1 \mid 0S \mid 0$

4-c Eliminate Useless, Null and Unit productions from the following grammar in the given order: (6) CO3

$S \rightarrow AB \mid b$, $A \rightarrow a \mid \epsilon$, $B \rightarrow bB \mid aB$, $E \rightarrow aA \mid a$

4-d Design a Turing Machine that computes $f(n) = 2^n$, $n>=0$ (6) CO5

4-e Write Short note on: (6) CO5

(i) Closure properties of recursive and recursive enumerable languages

(ii) Variants of Turing Machine

4-f Define 2-Stack PDA. Design a 2-Stack PDA for language $L = \{a^n b^n c^n d^n\}$ (6) CO4

--------THE END --------