Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Supplementary Examination, Dec 2023

Course: Formal Languages & Automata Theory
Semester: III
Program: BCA (All Branches)
Time : 03 hrs.
Course Code: CSEG 2035P **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define a finite automaton. Explain the components and working of a deterministic finite automaton (DFA).	**4**	**CO1**
Q 2	Explain the conversion of a nondeterministic finite automaton (NFA) to a deterministic finite automaton (DFA).	**4**	**CO2**
Q 3	Define context-free grammars and context-free languages.	**4**	**CO1**
Q 4	Discuss closure properties of regular languages.	**4**	**CO2**
Q 5	Give formal definition of a Push Down Automata (PDA).	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Explain the pumping lemma for context-free languages.	**10**	**CO1**
Q 7	Construct a NFA to accept strings of a's and b's having substring aba.	**10**	**CO3**
Q 8	Construct a DFA that recognizes the language of all strings over {0, 1} containing an even number of 1s.	**10**	**CO2**
Q 9	Convert the following context-free grammar to Chomsky Normal Form (CNF): $S \rightarrow aSb \mid \varepsilon$	**10**	**CO1**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Construct PDA accept the language $L=\{a^n b^n n\geq 0\}$. where each 'a' is followed by a 'b'. **OR** Prove that the languages accepted by pushdown automata are equivalent to the class of context-free languages.	**20**	**CO3**

Q 11	**a)** Prove that the halting problem is undecidable. **b)** Design a Turing Machine to accept the strings having equal number of 0's and 1's. **OR** **a)** Provide a high-level description of a Turing machine that accepts the language $\{0^n 1^n \mid n \geq 0\}$. **b)** Compare the computational power of a pushdown automaton and a Turing machine. Discuss their similarities and differences.	**20**	**CO4**