Programme	
Course Code and Course Name	: CBS2002: Formal Languages and Automata Theory
Faculty Name(s)	: Dr. Lakshmanan K
Class Number(s)	: VL2024250104089
Date of Examination	: Oct-2024
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions. **Write legibly and only to the point.** Draw diagrams/tables wherever necessary.
- If any notation is not explained, it is the standard notation used in the book and in the class. If you are using new notations not discussed in the referenced book/class, you need to explain them.

Q. No	Question	M
1.	a) Show that Union of two non-regular languages can be regular. (4 marks) b) Prove or disprove that $L_1 = \{a^i b^{j^2} \mid i, j \geq 1\}$ is regular. (6 marks)	10
2.	Consider the context-free grammar G_2 with the rules S → YA | XB, A → XS | a, B → b, X →a, Y →b, Z →YA. Given the string w=bbaaba, check w in L(G_2) by CYK.	10
3.	Consider the context-free grammar G with the rules S → AB|BC, A → ab|Aa, C → c. B → b|SB|bc, Convert to equivalent grammar in GNF (Greibach Normal form).	10
4.	a) Show that the grammar G_3 is ambiguous. (4 marks) S → B | AbB, A → a |AA, B → Aba | AdA | Bda | b. b) For the following grammar G_4, remove λ, unit production and useless rules and identify equivalent grammar whose Language is L(G_4)-{λ} (6 marks) S → B | AB | CD | DDE, A → a | ab | λ, B → b | CC, C → c | λ, D → dD|B, E → eE.	10
5.	a) Construct a PDA that accepts the language $L_a = \{0^{(i+2)} 1^i \mid i \geq 1\}$ (4marks) b) Consider the language $L_b = \{a^{2n} c^m b^n \mid n, m \geq 1\}$. The objective is to construct a (pushdown automata) pda for this language and below are the partial transition rules. The main idea is to push a 0 in the stack whenever a is read and when bs are read, they need to be cancelled against 0s such a way that for every 1 b is read, two 0s need to be cancelled out in the stack. You are expected to fill-in the remaining rules which are left unattempted (denoted with - in the rules) and complete the rules such that the constructed pda will accept the given language L_b. FYI, the transition function δ of the PDA is defined as: $\delta : Q \times \Sigma \cup \{\lambda\} \times \Gamma \longrightarrow$ finite subset of $Q \times \Gamma^*$. You are allowed to use only one (new) additional state which is q_f, the final state. **Write only incomplete rules 2,4,6,7,8 for answering the question.** 1. $\delta(q_0, a, z) = (q_1, 0z)$ 2. $\delta(q_1, a, -) = (q_1, 00)$ 3. $\delta(q_1, c, 0) = (q_2, 0)$ 4. $\delta(q_2, c, -) = (-, -)$ 5. $\delta(q_2, b, 0) = (q_3, \lambda)$ 6. $\delta(q_3, -, -) = (-, \lambda)$ 7. $\delta(q_4, b, -) = (-, -)$ 8. $\delta(q_4, \lambda, -) = (-, -)$ (6 marks)	10

****** ALL THE BEST ******