Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Formal Languages and Automata Theory **Semester: IV**

Program: B.Tech CSE all specializations **Time : 03 hrs.**

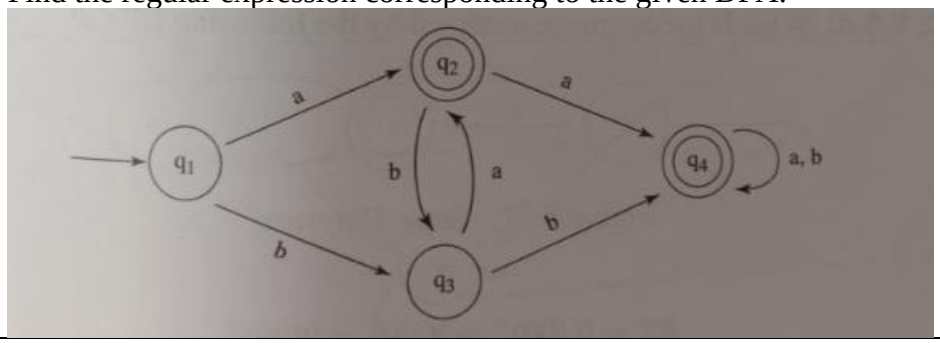
Course Code: CSEG 2035_3 **Max. Marks: 100**

Instructions: Provide sufficient explanation for every answer.

SECTION A

(5Qx4M=20Marks) Attempt any five questions

S. No.		Marks	CO
Q 1	Show that the halting problem of a turing machine is undecidable.	**4**	**CO4**
Q2	Design a CFG to generate the language $L=\{0^n1^n2^m3^m \mid n,m\geq 0\}$.	**4**	**CO2**
Q3	Convert the CFG G({S,A,B}, {0,1},P,S) with its production set P as S→AAA|1B A→0A|B B→ε to CNF	**4**	**CO2**
Q4	Design a CFG to generate the language $L=\{a^nb^nc^m \mid n,m \geq 0\}$.	**4**	**CO3**
Q5	Design a Mealy machine to subtract two binary numbers of the form $X_1X_2X_3\ldots..X_k$ and $Y_1Y_2Y_3\ldots..Y_k$. Assume that X and Y contain the same number of bits and the leftmost bits are zeros.	**4**	**CO1**
Q6	If two languages L_1 and L_2 are recursive then prove that their union $L_1 \cup L_2$ is also recursive.	**4**	**CO2**
	SECTION B **(4Qx10M= 40 Marks) Attempt any four questions**		
Q 7	Design a PDA to accept the language $L=\{0^n1^{n+2} \mid n \geq 1\}$. Justify that the string '00011111' is accepted by null store. OR Design a PDA to accept the language $L=\{ww^R \mid w\ \varepsilon(a,b)^+\}$. Justify that the string 'ababbaba' is accepted by null store.	**10**	**CO3**
Q8	Prove that the language $L= \{a^p \mid p \text{ is prime}\}$ is not a CFL.	**10**	**CO2**
Q9	Design a minimum DFA that accepts even no of 0's and even no of 1's, where $\sum= \{0,1\}$. Find out the equivalent regular expression from that DFA.	**10**	**CO1**

Q10	Construct an NFA with null moves to accept the set of all strings over {0,1} containing an even number of 0's or exactly two 1's. Convert that NFA with null moves into equivalent DFA.	**5+5**	**CO1**
Q11	Find the regular expression corresponding to the given DFA:  	**10**	**CO2**
SECTION-C **(2Qx20M=40 Marks)**			
Q 12	Design a Turing Machine to compute the multiplication of two positive integers. OR Design a Turing machine to divide a positive integer by 3 and to compute the quotient and the remainder.	**20**	**CO4**
Q13	The production system of a CFG, is given below: S→ABC | AaA A→Aa | BaC | aaa | B B→ bBb | a | D C→ CA|AC D→ε Create an equivalent CFG $G_1(V_1,\{a,b\},P_1,S)$ in GNF.	**20**	**CO3**