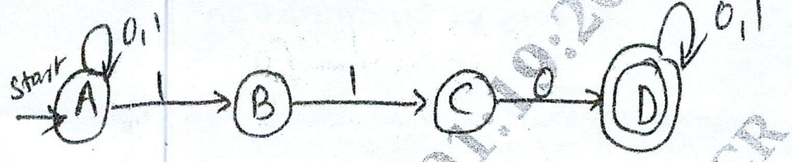
		OR			
Q.4	**a.**	State and prove pumping theorem for regular languages. Show that the language $L = \{a^n b^n \mid n \geq o\}$ is not regular.	**06**	**L3**	**CO2**
	b.	Convert the following FA to RE using state elimination method. 	**06**	**L3**	**CO2**
	c.	Prove that the Regular Languages are closed under : i) Union ii) Complementation iii) Intersection iv) Difference	**08**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Design CFG for the following Languages. i) $L = \{ ww^R$ where $W \in \{a, b\}^* \}$ ii) $L = \{ 0^m 1^m 2^n \mid m \geq 1$ and $n \geq 0 \}$ iii) $L = \{ a^n b^{n+3} \mid n \geq 0 \}$	**10**	**L3**	**CO3**
	b.	Consider the grammar G with productions $S \rightarrow aSbS \mid bSaS \mid \in$ Obtain LMD, RMD and parse tree for the string aababb. Is the grammar ambiguous.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Obtain PDA to accept the language $L = \{ wCw^R \mid W \in (a + b)^* \}$ and show the moves made by the PDA for the string aabCbaa.	**10**	**L3**	**CO3**
	b.	Convert the following CFG to PDA $S \rightarrow aABC$ $A \rightarrow aB \mid a$ $B \rightarrow bA \mid b$ $C \rightarrow a$	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Define CNF. Convert the following CFG to CNF $E \rightarrow E + T/T$ $T \rightarrow T * F/F$ $F \rightarrow (E) / I$ $I \rightarrow Ia / Ib \mid a \mid b$	**10**	**L3**	**CO4**
	b.	State and prove pumping lemma for context Free Grammars. Show that $L = \{ 0^n 1^n 2^n \mid n \geq 1 \}$ is not content free.	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Define CNF convert the following CFG to CNF $S \rightarrow AB$ $A \rightarrow aA \mid bB \mid b$ $B \rightarrow b$	**10**	**L3**	**CO4**
	b.	Prove that the content free languages are closed under i) Union ii) Concatenation iii) Homomorphism	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define a Turing Machine. Explain the working of a basic Turing machine with neat diagram.	**08**	**L2**	**CO5**
	b.	Design a Turing Machine to accept the language $L = \{ a^n b^n c^n \mid n \geq 1 \}$. Draw the transition diagram and show the moves made by TM for the string : aabbcc.	**12**	**L3**	**CO5**
		OR			
Q.10	**a.**	What are the programming Techniques for Turing Machine. Explain.	**10**	**L2**	**CO5**
	b.	Write short notes on : i) Multi Tape Turing Machine ii) Non Deterministic Turing Machine	**10**	**L2**	**CO5**

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CBCS SCHEME

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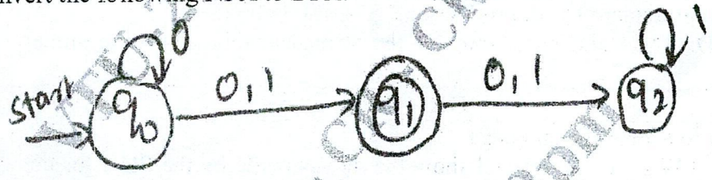
BCS503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Theory of Computation

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	**a.**	Define the following with example. i) Alphabet ii) String iii) Power of an Alphabet iv) Language v) Problem	**05**	**L2**	**CO1**
	b.	Design DFA for the following languages. i) DFA to accept string of 0's, 1's and 2's beginning with a '0' followed by odd number of 1's and ending with a '2'. ii) $L = \{ W \in \{0,1\}^* : w$ does not have 001 as a substring$\}$	**08**	**L3**	**CO1**
	c.	Convert the following NFA to DFA. 	**07**	**L3**	**CO1**
		OR			
Q.2	**a.**	Design an NFA to recognize the following set of strings 0101, 101 and 011.	**05**	**L2**	**CO1**
	b.	Design an DFA to accept binary numbers divisible by 5.	**08**	**L3**	**CO1**
	c.	Obtain DFA for the following $\in$ – NFA δ | $\in$ | a | b | c $\rightarrow p$ | ϕ | {p} | {q} | {r} q | {p} | {q} | {r} | ϕ *r | {q} | {r} | ϕ | {p}	**07**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Write the Regular Expression for the following languages. i) $L = \{a^n b^m \mid n >= 4, m <= 3\}$ ii) RE to accept words with two or more letters but beginning and ending with the same letter where $\sum = \{a, b\}$	**06**	**L3**	**CO2**
	b.	Obtain $\in$ – NFA for given Regular Expression $(a + b)^* aa (a + b)^*$	**06**	**L3**	**CO2**
	c.	Find the minimized DFA of the following δ | a | b $\rightarrow A$ | B | F B | G | C *C | A | C D | C | G E | H | F F | C | G G | G | E H | G | C	**08**	**L3**	**CO2**