



Dr. Vishwanath Karad

MIT WORLD PEACE UNIVERSITY | PUNE

TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

School of Computer science and Engineering

Department of Computer Engineering and Technology

TY BTech (AIDS) (Academic Year 2025-26)

Mid Term Exam – Semester V

Course Name: - Theory of Computation

Course Code: - AID3PM04A

Maximum Marks: 30

Time: 1 Hr

Date: 06/10/2025

Instructions:-

1. Attempt any 3 questions from Q. 1 to Q. 4 AND Attempt any 3 questions from Q. 5 to Q. 8
2. Figure to the right indicates full marks.
3. Use of cell phone is prohibited in the examination hall.
4. Neat diagrams must be drawn wherever necessary.
5. Assume suitable data, if necessary and clearly state.
6. Use of scientific calculator is allowed

Attempt any 3 questions from Q. 1 to Q. 4			
Q.1	CO2	Construct the Regular Expression for the following: 1. Set of strings that begins with the substring 101 over the $\Sigma = \{0,1\}$ 2. Set of strings that either contains all 1's or else, contains 0 followed by some 1's over the $\Sigma = \{0,1\}$. The string also contains ϵ .	[5 Marks]
Q.2	CO2	Convert the given regular expression into equivalent Deterministic Finite Automata(DFA) $r = 0^* 1^* 2^*$	[5 Marks]
Q.3	CO2	Find the Regular expression for given Finite Automata(FA) by using Arden's Theorem. <pre> graph LR start(()) --> q0((q0)) q0 -- 0 --> q0 q0 -- 1 --> q1((q1)) q1 -- 1 --> q1 q1 -- 0 --> q0 q0 ==> end((())) </pre>	[5 Marks]

Q.4	CO2	Prove that the given language is not regular $L = \{a^n b^n c^n : n \geq 1\}$	[5 Marks]
Attempt any 3 questions from Q. 5 to Q. 8			
Q.5	CO3	Define the Context Free Grammar and Generate the input string "001100" with the help of left most derivation and rightmost derivation, where $G = (\{S, A\}, \{0,1\}, P, S)$ and P is $S \rightarrow 0A \mid 0 \mid \epsilon$ $A \rightarrow S1A \mid SS \mid 10$	[5 Marks]
Q.6	CO3	Construct the Context Free Grammar(CFG), for the following language: 1. $L = \{0^i 1^j 2^k \mid \text{where } i = j + k\}$ 2. $L = \{\text{Set of odd length strings in } \{0,1\}^* \text{ having 0 as the middle symbol}\}$	[5 Marks]
Q.7	CO3	Simplify the grammar, by eliminating ϵ - Productions Consider the following grammar, $S \rightarrow ABC$ $A \rightarrow Aba \mid a \mid \epsilon$ $B \rightarrow BCb \mid b \mid \epsilon$ $C \rightarrow Cc \mid c \mid \epsilon$	[5 Marks]
Q.8	CO3	Construct the PDA for Language $L = \{0^n 1^n : n \geq 1\}$ using final state	[5 Marks]



Term End Examinations December 2025
AID3PM04A - Theory of Computation

Question Paper ID: 066710

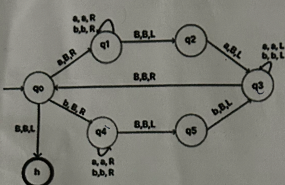
Faculty/School	School of Computer Science and Engineering	Term	Semester V
Program	TY B.Tech AIDS	Duration	1 hour 30 minutes
Specialization	-	Max. Marks	40

Section - 1 (8 X 5 Marks)

Answer any 8 questions

1 ✓	Consider the following Moore Machine described by the transition table given here. Construct the corresponding Mealy machine.	5 marks	CO1	Applying																		
	<table><tr><th rowspan="2">Current State</th><th colspan="2">Next State</th><th rowspan="2">Output</th></tr><tr><th>a = 0</th><th>a = 1</th></tr><tr><td>→ q1</td><td>q1</td><td>q2</td><td>0</td></tr><tr><td>q2</td><td>q1</td><td>q3</td><td>0</td></tr><tr><td>q3</td><td>q1</td><td>q3</td><td>1</td></tr></table>	Current State	Next State		Output	a = 0	a = 1	→ q1	q1	q2	0	q2	q1	q3	0	q3	q1	q3	1			
Current State	Next State		Output																			
	a = 0	a = 1																				
→ q1	q1	q2	0																			
q2	q1	q3	0																			
q3	q1	q3	1																			
2	State the Closure properties of Regular Languages. Consider the following two Regular Expressions: $R1 = a^* + b^*$ $R2 = ab^* + ba^* + b^*a + (a^*b)^*$ 1. Find a string corresponding to R1 but not to R2 2. Find a string corresponding to R2 but not to R1 3. Find a string corresponding to both R1 and R2	5 marks	CO2	Remembering																		
3 ✓	Construct a PDA for $L = \{a^n b^n c^n \mid n > 0\}$	5 marks	CO3	Remembering																		
4 ✓	Convert the grammar $S \rightarrow aSb \mid A$ $A \rightarrow bSa \mid S \mid \epsilon$ to a PDA that accepts the same language by empty stack	5 marks	CO3	Applying																		
5 ✓	Compare Recursive and Recursively enumerable Languages with appropriate examples	5 marks	CO3	Remembering																		
6 ✓	Construct a Turing Machine, which compares two positive integers (unary format) m and n and produces output Gt, if $m > n$, Lt if $m < n$ and Eq if $m = n$.	5 marks	CO3, CO4	Evaluating																		

270

7	Explain a Multitape Turing Machine with a diagram.	5 marks	CO4	Remembering
8	Identify the language accepted by the following TM. With appropriate Instantaneous Description show the derivation of the string: <i>aabbaabbaa</i>  <pre> graph LR q0((q0)) -- "a,a,R / b,b,R" --> q1((q1)) q0 -- "B,B,L" --> h((h)) q1 -- "a,a,R / b,b,R" --> q1 q1 -- "B,B,L" --> q2((q2)) q2 -- "a,B,L" --> q3((q3)) q3 -- "a,a,L / b,b,L" --> q3 q3 -- "B,B,R" --> q0 q3 -- "B,B,L" --> q5((q5)) q5 -- "B,B,L" --> q4((q4)) q4 -- "a,a,R / b,b,R" --> q4 q4 -- "B,B,R" --> q0 </pre>	5 marks	CO4	Applying
9	Explain the halting problem of the Turing Machine with proof.	5 marks	CO4	Remembering
10	Explain, NP (Nondeterministic Polynomial-time) Class Problems Let $A = \{001, 0011, 11, 101\}$, $B = \{01, 111, 111, 010\}$, Similarly let $C = \{00, 001, 1000\}$, $D = \{0, 11, 011\}$. Which of the following pairs have the Post-Correspondence Solution?	5 marks	CO4	Applying

END OF QUESTION PAPER