JHARKHAND Rai University
RANCHI

End Semester/Reappear (Semester II) Examination May 2025

Programme: MCA
Course: Theory of Computation **Full Marks: 70**
Course Code:3CIT107 **Time: 3 Hrs.**
Enrolment no. _____

Q.No.	Questions	CO	Bloom Taxonomy Category	Marks
	Section I			
1	**Short Answer type questions.**			**4 x 5 = 20**
a	"Define the concept of a relation in the context of databases. Describe its key properties with an appropriate example to illustrate the explanation."	CO1	Understand	
	or			
	Explain the concept of a function in programming. Define a recursive function and illustrate its usage with a suitable example."	CO1	Understand	
b	Define NFA? Design a NFA with ∑ = {0, 1} accepts all strings starting with 1.	CO2	Understand	
	or			
	Differentiate between Mealy Machine and Moore Machine.	CO2	Understand	
c	Describe Type-0, Type-1, Type-2, Type-3 grammar?	CO3	Understand	
	or			
	Describe Greibach's Normal Form in formal language theory. Explain its significance and transformation process within context-free grammars.	CO3	Understand	
d	Provide a structured yet concise explanation of the formal definition of a Pushdown Automaton (PDA). Highlight its key components, including states, transitions, and the stack mechanism. Discuss the operational process of a PDA on input strings and its computational significance.	CO4	Understand	
	or			
	Explain one advantage of using a multi-tape Turing Machine over a single-tape Turing Machine.	CO4	Understand	
	Section II			
	Long Answer type questions.			**3 x 10 = 30**
2	Produce a DFA which accept the language of all string 'w' over {0,1} such that if 'w' start with '0' then it must be ended by '1' and if it start with '1' then it must be ended by '0'.	CO2	Apply	
	or			
	Compare NFA and DFA? Also mention the application of FA.	CO2	Analyze	
3	Write down the closure properties of Context Free Languages.	CO3	Understand	
	or			
	Explain Chomsky Hierarchy of Grammar.	CO3	Understand	
4	Define the complexity classes P, NP, NP-C, and NP-Hard. Explain the basic characteristics that distinguish each class from the others.	CO5	Understand	
	or			
	Explain the concept Halting Problem, Post Correspondence Problem.	CO5	Understand	
	Section III			
	Application based questions			**1 x 20 = 20**
5	Elucidate the fundamental components and operational principles of a Turing Machine. Discuss its role in language recognition and provide a basic example illustrating how a Turing Machine processes strings to determine acceptance or rejection	CO4	Apply	
	or			
	Construct a Turing Machine that recognizes the languages L1 = $\{a^n b^n d^n\}$ and L2 = $\{a^n b^n\}$. Define the formal tuples of the Turing Machine and describe its transition functions for processing strings within these languages."	CO4	Create	

COURSE OUTCOME
CO1 Relate formal languages and mathematical models of computation.
CO2 Analyse different types of languages and the corresponding machines.
CO3 Analyse the Pushdown machine and its role in compiler construction.
CO4 Find the capability of real computers and learn examples of unsolvable problems.
CO5 Analyse classes of P, NP, NP-C and NP-Hard problems.