COURSE MODULE FOR THE SESSION 2025-26(ODD SEMESTER)

Course Syllabi with CO's

Academic Year: 2025 - 2026

Department: Computer Science & Engineering -Data science

Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BCS503	**Theory of Computation**	Core	**Sets. Relations. Functions. Modular arithmetic.**	3	2	0	52

Objectives:

CLO 1. Introduce core concepts in Automata and Theory of Computation.
CLO 2. Identify different Formal Language Classes and their Relationships
CLO 3. Learn concepts of Grammars and Recognizers for different formal languages.
CLO 4.Prove or disprove theorems in automata theory using their properties
CLO 5. Determine the decidability and intractability of Computational problems.

Topics Covered as per Syllabus

Module -1

Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions.

Module -2

Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, Applications of Regular Expressions

Module -3

Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.

Module -4

Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages.

Module -5

Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Undecidability: A Language That Is Not Recursively Enumerable

TextBooks:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Second Edition, Pearson.

Reference Books

1. Elain Rich, "Automata,Computability and complexity", 1st Edition, Pearson Education,2018.
2. K.L.P Mishra, N Chandrashekaran , 3rd Edition , 'Theory of Computer Science",PHI,2012.
3. Peter Linz, "An introduction to Formal Languages and Automata ", 3rd Edition, Narosa Publishers,1998.
4. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013.
5. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013.

List of URL's

- https://archive.nptel.ac.in/courses/106/105/106105196/
- https://archive.nptel.ac.in/courses/106/106/106106049/
- https://nptelvideos.com/course.php?id=717

Course outcomes: The students should be able to:

CO 1. Apply the fundamentals of automata theory to write DFA, NFA, Epsilon-NFA and conversion between them

CO 2. Prove the properties of regular languages using regular expressions.

CO 3. Design context-free grammars (CFGs) and pushdown automata (PDAs) for formal languages.

CO 4. Design Turing machines to solve the computational problems

CO 5. Explain the concepts of decidability and undecidability

Continuous Internal Evaluation (CIE): The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code	BCS503			Title: Theory of Computation								
List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO 11	PO1 2	Total
CO-1	2	2	1	1	-	-	-	1	-	1	-	2	10
CO-2	2	2	1	1	-	-	-	1	-	-	-	2	09
	3	2	1	2	-	-	-	1	-	-	-	2	11
CO-4	3	2	1	2	-	-	-	1	-	-	-	2	11
CO-5	3	2	1	2	-	-	-	1	-	-	-	2	11
Total	**12**	**10**	**05**	**08**		**-**	**-**	**5**	**-**	**1**	**-**	**10**	**51**

The Correlation of Program Specific Outcome's (PS0's) and Course Outcome (CO's)

Subject Code	BCS503	Title: Theory of Computation	
List of Course Outcome's	PSO1	PSO2	Total
CO-1	3	-	3
CO-2	3	-	3

CO-3	3	-	**3**
CO-4	3	-	**3**
CO-5	3	-	**3**
Total	**15**	**-**	**15**

Note: 3 = Strong Contribution 2 = Average Contribution 1= Weak Contribution - = No Contribution