Faculty of Science & Technology

Savitribai Phule Pune University,Pune,

Maharashtra, India

Curriculum For

Third Year of Information Technology

(2019 Course)

(With effect from AY 2021-22)

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Savitribai Phule Pune University, Pune Bachelor of Information Technology	
Program Educational Objectives	
PEO1	**Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.**
PEO2	**Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.**
PEO3	**Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.**
PEO4	**Have commitment ethical practices, societal contributions through communities and life-long learning.**
PEO5	**Possess better communication, presentation, time management and team work skills leading to responsible & competent professional sand will be able to address challenges in the field of IT at global level.**

Program Outcomes		
Students are expected to know and be able to–		
PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solutionwith the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development ofSolutions	An ability to design, implement, and evaluate software or asoftware /hardware system ,component ,or process to meet desired need switch in realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide essay schematicsolutions to complex engineering /Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints andassumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security andsocial issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or a sate ammember to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies /tools with the help of electives, profession along animations and extra-curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

Program Specific Outcomes(PSO)	
A graduate of the Information Technology Program will demonstrate-	
PSO1	**An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.**
PSO2	**An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.**
PSO3	**An understanding of professional, business and business processes, ethical,legal, security and social issues and responsibilities.**
PSO4	**Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.**

SEMESTER – V

Savitribai Phule Pune University
Third Year of Information Technology (2019 course)
(With effect from Academic Year 2021-22)

Semester-V

Course Code	Course Name	Teaching Scheme (Hours/ week)			Examination Scheme and Marks						Credit Scheme			
		Theory	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
314441	Theory of Computation	03	-	-	30	70	-	-	-	100	3	-	-	3
314442	Operating Systems	03	-	-	30	70	-	-	-	100	3	-	-	3
314443	Machine Learning	03	-	-	30	70	-	-	-	100	3	-	-	3
314444	Human Computer Interaction	03	-	-	30	70	-	-	-	100	3	-	-	3
314445	Elective-I	03	-	-	30	70	-	-	-	100	3	-	-	3
314446	Operating Systems Lab	-	04	-	-	-	25	25	-	50	-	2	-	2
314447	Human Computer Interaction- Lab	-	02	-	-	-		-	50	50	-	1		1
314448	Laboratory Practice-I	-	04	-	-	-	25	25		50	-	2	-	2
314449	Seminar	-	01	-	-	-	50	-	-	50	-	1	-	1
314450	Audit Course 5	-	-	-	-	-	-	-	-	-	-	-	-	-
									Total Credit		15	06	-	21
	Total	15	11	-	150	350	100	50	50	700	15	06	-	21

Abbreviations: TH: Theory, TW: Term Work, PR: Practical , OR: Oral ,TUT: Tutorial

Elective-I:
- 314445A- Design and Analysis of Algorithm
- 314445B- Advanced Database and Management System
- 314445C- Design Thinking
- 314445D- Internet of Things

Audit Course 5:
- 314450A-Banking and Insurance
- 314450B-Startup Ecosystems
- 314450C- Foreign Language–(Japanese Language- III)

Laboratory Practice-I:
Assignment from Machine Learning and Elective I

Note: Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

Savitribai Phule Pune University
Third Year of Information Technology (2019 Course)
(With effect from Academic Year 2021-22)
Semester-VI

Course Code	Course Name	Teaching Scheme (Hours/ week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term Work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
314451	Computer Networks& Security	03	-	-	30	70	-	-	-	100	03			03
314452	Data Science and Big Data Analytics	03	-	-	30	70	-	-	-	100	03			03
314453	Web Application Development	03	-	-	30	70	-	-	-	100	03			03
314454	Elective-II	03	-	-	30	70	-	-	-	100	03			03
314455	Internship	-	04	-	-	-	100	-	-	100		04		04
314456	Computer Networks& Security-Lab	-	04	-	-	-	25	-	50	75		02		02
314457	DS & BDA-Lab	-	02	-	-	-	25	25	-	50		01		01
314458	Laboratory Practice-II	-	04	-	-	-	50	25	-	75		02		02
314459	Audit Course 6	-	-	-	-	-	-	-	-	-	-	-	-	-
										Total	12	09	-	21
	Total	12	14	-	120	280	200	50	50	700	12	09	-	21

Abbreviations: TH: Theory, TW: Term Work, PR: Practical , OR: Oral, TUT: Tutorial

Elective-II:
314454A- Artificial Intelligence
314454B- Cyber Security
314454C -Cloud Computing
314454D- Software Modeling and Design

Audit Course 6:
314459A - Green and Unconventional Energy
314459B - Leadership and Personality Development
314459C- Foreign Language-(Japanese Language- IV)

Laboratory Practice-II:
Assignments from Web Application Development and Elective-II.

Note: Students of T.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

Savitribai Phule Pune University, Pune
Third Year Information Technology (2019 Course)
314441: Theory of Computation

HOME

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 3 hrs/week	03 Credits	Mid_Semester : 30 Marks End_Semester : 70 Marks

Prerequisite Courses:

1. Discrete Structures.
2. Data structures.

Companion Course, if any: NA

Course Objectives:

1. To know the applicability of the model of computation to different problems.
2. To understand in detail the relationship among formal languages, formal grammars and automata.
3. To learn the design of Finite Automata, Pushdown Automata and Turing Machine for processing offormal languages.
4. To study the theory of computability and complexity for algorithm design.

Course Outcomes:

On completion of the course, students will be able to–

CO1: Construct finite automata and its variants to solve computing problems.

CO2: Write regular expressions for the regular languages and finite automata.

CO3: Identify types of grammar, design and simplify Context Free Grammar.

CO4: Construct PushdownAutomata machine for the Context Free Language.

CO5: Design and analyze Turing machines for formallanguages.

CO6: Understand decidable and undecidable problems, analyze complexity classes.

COURSE CONTENTS

Unit I	FINITE AUTOMATA	(06 hrs)

Basic Concepts: Symbols, Strings, Language, Formal Language.

Finite Automata (FA): Formal definition and notations for FSM, Concept of state transition diagram and transition table for FA, Construction of DFA, NFA, NFA with epsilon moves. Conversion of NFA with epsilon moves to NFA, Conversion of NFA to DFA, and Conversion of NFA with epsilon moves to DFA, Minimization of FA, Equivalence of FAs, and Applications of FA.

Finite State Machine with output: Moore and Mealy machines - Definition, Construction, Inter-Conversion.

Mapping of Course Outcomes for Unit I	CO1

Unit II	REGULAR EXPRESSIONS AND LANGUAGES	(06 hrs)

Regular Expressions (RE) : Definition and Identities of RE, Operators of RE, Equivalence of two regular expressions, Equivalence of regular expressions and regular languages (RL), Conversion of RE to FA using direct method, Conversion of FA to RE using Arden's theorem, Pumping lemma for RLs, Closure properties of RLs, Applications of Regular Expressions.

Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**CONTEXT FREE GRAMMAR AND LANGUAGE**	**(06 hrs)**
Grammar: Introduction and representation, Chomsky Hierarchy, Formal definition of Regular **Grammar(RG), Conversions:** LRG to RLG, RLG to LRG, RG to FA, FA to RG. **Context Free Grammar (CFG):** Definition of CFG, Derivation tree, sentential forms, Leftmost and Rightmost derivations, Ambiguous Grammar and unambiguous grammar, Context Free Language (CFL). **Grammar Simplification, Normal forms:** Chomsky Normal Form, Greibach Normal Form. Closure properties of CFL, Pumping lemma for CFL.		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**PUSHDOWN AUTOMATA AND POST MACHINE**	**(06 hrs)**
Pushdown Automata(PDA) : Introduction and formal definition of PDA, Construction of Transition diagram and Transition table for PDA, Instantaneous Description of PDA, Equivalence of Acceptance by Final State & Empty stack, Deterministic PDA and Nondeterministic PDA, Context Free Language and PDA, Conversion of CFG to PDA and PDA to CFG. **Post Machine (PM):** Definition and construction of Post Machine.		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**TURING MACHINE**	**(06 hrs)**
Turing Machine (TM) : Formal definition of a Turing machine, Design of Turing machines, Variants of **Turing Machines:** Deterministic TM, Nondeterministic TM, Multi-tape TM, Universal Turing Machine, Halting problem of TM , Church-Turing thesis, Recursive Languages and Recursively Enumerable Languages, Post Correspondence Problem.		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**COMPUTATIONAL COMPLEXITY**	**(06 hrs)**
Decidability: Decidable problems concerning regular languages, Decidable problems concerning context free languages, Un-decidability. **Computational Complexity:** Measuring Complexity, The Class P, Examples of problems in P, The Class NP, and Examples of problems in NP, Reducibility, Mapping Reducibility, Polynomial Time Reduction and NP Completeness. Satisfiability Problem, NP Completeness of the SAT Problem, Normal Forms for Boolean Expressions, Cook's theorem, Node-C over Problem.		