Course Outcomes

Second Year Information Technology (2019 Course)

SEM-III

Savitribai Phule Pune University
Second Year of Information Technology Engineering(2019 Course)
(With effect from Academic Year 2020-21)
Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
214441	Discrete Mathematics	03	-	01	30	70	25	-	-	125	03	--	01	04
214442	Logic Design and Computer Organization	03	-	-	30	70	-	-	-	100	03	-	-	03
214443	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
214444	Object Oriented Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
214445	Basics of Computer Network	03	-	-	30	70	-	-	-	100	03	-	-	03
214446	Logic Design Computer Organization Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214447	Data Structures and Algorithms Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214448	Object Oriented Programming Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214449	Soft Skill Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
214450	Mandatory Audit Course 3	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	--	700	15	06	01	22

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

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

#Mandatory Audit Course 3:
214450A- Ethics and values in IT
214450B - Quantitative Aptitude and Logical Reasoning
214450C- Language Study- Japanese- Module
214450D-Cyber Security and Law

214441: Discrete Mathematics

CO1: Formulate and apply formal proof techniques and solve the problems with logical reasoning.
CO2: Analyze and evaluate the combinatorial problems by using probability theory.
CO3: Apply the concepts of graph theory to devise mathematical models.
CO4: Analyze types of relations and functions to provide solution to computational problems.
CO5: Identify techniques of number theory and its application.
CO6: Identify fundamental algebraic structures.

214442:Logic Design & Computer Organization

CO1: Perform basic binary arithmetic & simplify logic expressions.

CO2: Grasp the operations of logic ICs and Implement combinational logic functions using ICs.
CO3: Comprehend the operations of basic memory cell types and Implement sequential logic functions using ICs.
CO4: Elucidate the functions & organization of various blocks of CPU.
CO5: Understand CPU instruction characteristics, enhancement features of CPU.
CO6: Describe an assortment of memory types (with their characteristics)used in computer systems and basic principle of interfacing input, output devices.

214443:Data Structure & Algorithms

CO1: Perform basic analysis of algorithms with respect to time and space complexity.
CO2: Select appropriate searching and/or sorting techniques in the application development.
CO3: Implement abstract data type (ADT) and data structures for given application.
CO4: Design algorithms based on techniques like brute -force, divide and conquer, greedy, etc.
CO5: Apply implement learned algorithm design techniques and data structures to solve
problems.
CO6: Design different hashing functions and use files organizations.

214444: Object-Oriented Programming

CO1: Differentiate various programming paradigms.
CO2: Identify classes, objects, methods, and handle object creation, initialization, and Destruction to model real-world problems.
CO3: Identify relationship among objects using inheritance and polymorphism principles.
CO4: Handle different types of exceptions and perform generic programming.
CO5: Use of files for persistent data storage for real world application.
CO6: Apply appropriate design patterns to provide object-oriented solutions.

214445: Basics of Computer Network

CO1: Understand and explain the concepts of communication theory and compare functions of OSI and TCP/IP model.
CO2: Analyze data link layer services, error detection and correction, linear block codes, cyclic Codes, framing and flow control protocols.
CO3: Compare different access techniques, channelization and IEEE standards.
CO4: Apply the skills of subnetting, supernetting and routing mechanisms.
CO5: Differentiate IPv4 and IPv6.
CO6: Illustrate services and protocols used at transport layer.

Savitribai Phule Pune University, Pune
Second Year of Information Technology Engineering (2019 Course)
(With effect from Academic Year 2020-21)

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
207003	Engineering Mathematics- III	03	-	01	30	70	25	-	-	125	03	--	01	04
214451	Processor Architecture	03	-	-	30	70	-	-	-	100	03	-	-	03
214452	Database Management System	03	-	-	30	70	-	-	-	100	03	-	-	03
214453	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
214454	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
214455	Programming Skill Development Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214456	Database Management System Lab	-	04	-	-	-	25	25		50	-	02	-	02
214457	Computer Graphics Lab	-	02	-	-	-	-	25	-	25	-	01	-	01
214458	Project Based Learning	-	04	-	-	-	50	-	-	50	-	02	-	02
214459	Mandatory Audit Course 4	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	-	700	15	06	01	22

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#Mandatory Audit Course 4:
214459A - Water Supply and Treatment
214459B - Language Study- Japanese- Module II
214459C - Waste Management and Pollution Control
214459D - Intellectual Property Rights

SEM-IV

207003: Engineering Mathematics III

CO1: Solve Linear differential equations, essential in modelling and design of computer-based systems.

CO2: Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.

CO3: Apply Statistical methods like correlation& regression analysis and probability theory for data analysis and predictions in machine learning.

CO4: Solve Algebraic &Transcendental equations and System of linear equations using numerical techniques.

CO5: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

214451: Processor Architecture

CO1: Apprehend architecture and memory organization of PIC 18 microcontroller.

CO2: Implement embedded C programming for PIC 18.

CO3: Use concepts of timers and interrupts of PIC 18.
CO4: Demonstrate real life applications using PIC 18. **CO5:** Analyze architectural details of ARM processor.

214452: Database Management System

CO1: Apply fundamental elements of database management systems.
CO2: Design ER-models to represent simple database application scenarios.
CO3: Formulate SQL queries on data for relational databases.
CO4: Improve the database design by normalization & to incorporate query processing.
CO5: Apply ACID properties for transaction management and concurrency control.
CO6: Analyze various database architectures and technologies.

214453: Computer Graphics

CO1: Apply mathematical and logical aspects for developing elementary graphics operations like scan conversion of points, lines, circle, and apply it for problem solving.
CO2: Employ techniques of geometrical transforms to produce, position and manipulate Objects in 2 dimensional and 3-dimensional space respectively.
CO3: Describe mapping from a world coordinates to device coordinates, clipping, and projections in order to produce 3D images on 2D output device.
CO4: Apply concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.
CO5: Perceive the concepts of virtual reality.

214454: Software Engineering

CO1: Classify various software application domains.
CO2: Analyze software requirements by using various modeling techniques.
CO3: Translate the requirement models into design models.
CO4: Apply planning and estimation to any project.
CO5: Use quality attributes and testing principles in software development life cycle.
CO6: Discuss recent trends in Software engineering by using CASE and agile tools.

Third Year of Information Technology (2019 course)
SEM-V

Curriculum for Third Year of Information Technology (2019 Course), Savitribai Phule Pune University

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)

314441: Theory of Computation

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 Pushdown Automata machine for the Context Free Language.
CO5: Design and analyze Turing machines for formal languages.
CO6: Understand decidable and undecidable problems, analyze complexity classes.

314442: Operating Systems

CO1: Explain the role of Modern Operating Systems.
CO2: Apply the concepts of process and thread scheduling.
CO3: Illustrate the concept of process synchronization, mutual exclusion and the deadlock.
CO4: Implement the concepts of various memory management techniques.

CO5: Make use of concept of I/O management and File system.
CO6: Understand Importance of System software.

314443: Machine Learning

CO1: Apply basic concepts of machine learning and different types of machine learning algorithms.
CO2: Differentiate various regression techniques and evaluate their performance.
CO3: Compare different types of classification models and their relevant application.
CO4: Illustrate the tree-based and probabilistic machine learning algorithms.
CO5: Identify different unsupervised learning algorithms for the related real-world problems.
CO6: Apply fundamental concepts of ANN.

314444: Human Computer Interaction

CO1: Explain importance of HCI study and principles of user-centered design (UCD) approach.
CO2: Develop understanding of human factors in HCI design.
CO3: Develop understanding of models, paradigms, and context of interactions.
CO4: Design effective user-interfaces following a structured and organized UCD process.
CO5: Evaluate usability of a user-interface design.
CO6: Apply cognitive models for predicting human-computer-interactions.

314445(B): Elective -I : Advanced Database Management System

CO1: Differentiate relational and object-oriented databases.
CO2: Illustrate parallel & distributed database architectures.
CO3: Apply concepts of NoSQL Databases.
CO4: Explain concepts of data warehouse and OLAP technologies.
CO5: Apply data mining algorithms and various software tools.
CO6: Comprehend emerging and enhanced data models for advanced applications.

SEM-VI

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)

314451: Computer Network and Security

CO1: Explain Responsibilities, services offered and protocol used at application layer of network
CO2: Apply concepts of wireless network and different wireless standards.
CO3: Recognize the Adhoc Network's MAC layer, routing protocol and Sensor network architecture.
CO4: Implement the principal concepts of network security and Understand network security threats, security services, and countermeasures
CO5: Apply basic cryptographic techniques in application development.
CO6: Gain a good comprehension of the landscape of cyber security Vulnerabilities & describe typical threats to modern digital systems.

314452: Data Science and Big Data Analytics

CO1: Understand Big Data primitives.
CO2: Learn and apply different mathematical models for Big Data.
CO3: Demonstrate Big Data learning skills by developing industry or research applications.

CO4: Analyze and apply each learning model comes from a different algorithmic approach and it will perform differently under different datasets.
CO5: Understand, apply and analyze needs, challenges and techniques for big data visualization.
CO6: Learn different programming platforms for big data analytics.

314453: Web Application Development

CO1: Develop Static and Dynamic website using technologies like HTML, CSS, Bootstrap.
CO2: Demonstrate the use of web scripting languages.
CO3: Develop web application with Front End & Back End Technologies.
CO4: Develop mobile website using JQuery Mobile.
CO5: Deploy web application on cloud using AWS.

314454 (C): Elective-II- (Cloud Computing)

CO1: Articulate the main concepts, key technologies and fundamentals of cloud computing.
CO2: Understand cloud enabling technologies and virtualization.
CO3: Analyze various cloud programming models and apply them to solve problems on the cloud.
CO4: Explain data storage and major security issues in the cloud.
CO5: Understand trends in ubiquitous cloud and internet of things.
CO6: Explore future trends of cloud computing.

314455: Internship

CO1: Develop professional competence through industry internship.
CO2: Apply academic knowledge in a personal and professional environment
CO3: Build the professional network and expose students to future employees.
CO4: Apply professional and societal ethics in their day-to-day life.
CO5: Become a responsible professional having social, economic and administrative considerations.
CO6: Make own career goals and personal aspirations.

Final Year of Information Technology (2019 Course)
SEM-VII

Savitribai Phule Pune University
Final Year of Information Technology (2019 Course)
(With effect from Academic Year 2022-23)

Semester VII

Course Code	Course Name	Teaching Scheme(Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Termwork	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
414441	Information and Storage Retrieval	03	-	-	30	70	-	-	-	100	3	-	-	3
414442	Software Project Management	03	-	-	30	70	-	-	-	100	3	-	-	3
414443	Deep Learning	03	-	-	30	70	-	-	-	100	3	-	-	3
414444	Elective III	03	-	-	30	70	-	-	-	100	3	-	-	3
414445	Elective IV	03	-	-	30	70	-	-	-	100	3	-	-	3
414446	Lab Practice III	-	04	-	-	-	25	-	25	50	-	2	-	2
414447	Lab Practice IV	-	02	-	-	-	25	25	-	50	-	1	-	1
414448	Project Stage-I	-	-	02	-	-	50	-	-	50	-	-	2	2
414449	Audit Course7													
										Total Credit	15	03	02	20
	Total	15	06	02	150	350	100	25	25	650	15	03	02	20

Elective III:

- Mobile Computing
- High Performance Computing
- Multimedia Technology
- Smart Computing

Elective IV:

- Bioinformatics
- Introduction to DevOps
- Computer Vision
- Wireless Communications

Lab Practice-III:

It is based on subjects:

- Information and Storage Retrieval

Lab Practice-IV:

It is based on subjects:

- Deep Learning

Audit Courses 7:

- 414449A: Copyrights and Patents
- 414449B: Stress Management by Yoga
- 414449C: English for Research Paper Writing

414441: Information Storage and Retrieval

CO1. Understand the concept of Information retrieval and to apply clustering in information retrieval.

CO2. Use an indexing approach for retrieval of text and multimedia data.

CO3. Evaluate performance of information retrieval systems.
CO4. Apply the concepts of multimedia and distributed information retrieval.
CO5. Use appropriate tools in analyzing the web information
CO6. Simulate the working of a search engine and recommender system.

414442: Software Project Management

CO1. Apply the practices and methods for successful Software Project Management
CO2. Create Design and Evaluate Project
CO3. Analyze Project Schedule and calculate Risk Management with help of tools.
CO4. Demonstrate different tools used for Project Tracking, Monitoring & Control.
CO5. Identify Staff Selection Process and the issues related to Staff Management.
CO6. Discuss and use modern tools for Software Project Management.

414443: Deep Learning

CO1. Understand the theoretical foundations, algorithms, and methodologies of Deep Learning.
CO2. Apply the concepts of Convolution Neural Networks and use of popular CNN architectures.
CO3. Compare Feed Forward Neural Network and Recurrent Neural Network and learn modeling the time dimension using RNN and LSTM.
CO4. Elaborate unsupervised deep learning algorithms like Autoencoders.
CO5. Explore Representation Learning and Transfer Learning techniques using variants of CNN architecture.
CO6. Evaluate the performance of deep learning algorithms and to provide solution for various real-world applications.

414444: Elective – III (Multimedia Technology)

CO1. Understand basic building block and applications of Multimedia.
CO2. Solve and analyze different algorithms for text and image compression.
CO3. Classify different audio and video file formats of Multimedia.
CO4. Apply open-source authoring tools of animation.
CO5. List various devices used in virtual reality and its use in daily life.
CO6. Recognize emerging trends in Multimedia.

414445: Elective – IV (Wireless Communication)

CO1: Articulate the fundamental concept of cellular system.
CO2: Analyse the fundamentals of cellular systems.
CO3: Illustrate multiple access technique for effective utilization of spectrum.

CO4: Design and analyse the WAP Programming Model in networking environment.
CO5: Learn and understand security issues, challenges and tools in wireless communication.
CO6: Explore the emerging trends and applications in wireless communication.

414448: Project Stage I

CO1. To apply knowledge of mathematics, science, and engineering to formulate the Problem statement.
CO2. To design and conduct experiments, as well as to analyze and interpret data.
CO3. Understand the professional and ethical responsibility.
CO4. To communicate effectively.
CO5. Get broad education which is necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
CO6. Recognition of the need for, and an ability to engage in life-long learning.
CO7. To use the techniques, skills, and modern engineering tools necessary for engineering practices.
CO8. To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

SEM-VIII

Curriculum for Final Year of Information Technology (2019 Course), Savitribai Phule Pune University

Savitribai Phule Pune University Final Year of Information Technology (2019Course) (With effect from Academic Year2022-23)														
Semester VIII														
Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Teamwork	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
414450	Distributed Systems	03	-	-	30	70	-	-	-	100	03			03
414451	Elective V	03	-	-	30	70	-	-	-	100	03			03
414452	Elective VI	03	-	-	30	70	-	-	-	100	03			03
414453	Startup and Entrepreneurship	-	-	03	-	-	50	-	-	50	-	-	03	03
414454	Lab Practice V	-	04	-	-	-	50	25	-	75		02		02
414455	Lab Practice VI	-	02	-	-	-	25	-	50	75		01		01
414456	Project Stage II	-	10	-	-	-	100	-	50	150		05		05
414457	AuditCourse8													
										Total Credit	09	08	03	20
	Total	09	16	03	90	210	225	50	75	650	09	08	03	20

Elective V:
- Software Defined Networks
- Social Computing
- Natural Language Processing
- Soft Computing
- Game Engineering

Elective VI:
- Ethical Hacking and Security
- Augmented and Virtual Reality
- Business Analytics and Intelligence
- Blockchain Technology

Lab Practice V:
It is based on subjects:
- Distributed Systems

Lab Practice VI:
It is based on subjects:
- Elective VI

Audit Courses 8:
- 414457A: Functional Programming in Haskell
- 414457B: Cyber Laws and Use of Social Media
- 414457C: Constitution of India

414450: Distributed Systems

CO1. Demonstrate the core concepts of distributed systems.
CO2. Understand the concept of middleware of distributed systems.
CO3. Understand Inter-process communication methods and analyze different coordination algorithms.
CO4. Comprehend the importance of replication to achieve fault tolerance in distributed systems.
CO5. Analyze the design and functioning of existing distributed file systems, distributed multimedia, and distributed web-based systems.
CO6. Understand various Recent Trends in distributed systems.

414451: Elective-V (Software Defined Network)

CO1. Acquire fundamental knowledge of SDN exploring the need, characteristics, and architecture of SDN and methods of API's in SDN.
CO2. Recognize Open Flow protocols and its forwarding, pipeline model and use cases of SDN controller.

CO3. Demonstrate virtualization and Cloud computing services of SDN.
CO4. Comprehend IT Infrastructure and understand the data center in SDN.
CO5. Analyse various security issues and challenges in SDN.
CO6. Comprehend SDN application areas and future.

414452: Elective VI (Business Analytics and Intelligence)

CO1. Apply conceptual knowledge on how Business Intelligence is used in decision making process
CO2. Use modelling concepts in Business Intelligence
CO3. Understand and apply the concepts of business reports and analytics with the help of visualization for business performance management
CO4. Comprehend the model-based decision making using prescriptive analytics
CO5. Analyze the role of analytics and intelligence in Business
CO6. Comprehend different Business Intelligence trends and its future impacts

414453: Startup and Entrepreneurship

1. able to understand key concepts and framework of innovation and start-up ecosystem.
2. gain knowledge of how to develop start up ecosystem, its key components and how to influence and manage
dynamics between them and increase the productivity of ecosystem.
3. understand the role of different stakeholders in ecosystem in building and supporting growth of start-ups.
4. have insight into global trend in start-up ecosystem and product development.
5. mapping different start-up ecosystems and developing performance indicators.

414456 : Project-II

1. To apply engineering and mathematical knowledge to investigate / select proper technology / Algorithm suitable to solve the problem in hand.
2. To apply knowledge of statistics for analysis of results and express conclusion and justification for the same.
3. To design and conduct experiments, as well as to analyze and interpret data or develop prototype model of the application.
4. To communicate effectively.
5. Get broad education which is necessary to understand the impact of engineering solutions in a global, economic, environmental, ethically and societal context.
6. Recognition of the need for, and an ability to engage in life-long learning.