Savitribai Phule Pune University, Pune
Faculty of Science and Technology

Syllabus for

T.E. (Electronics and Computer Engineering)

(Course 2019)

(w.e.f. June 2022)

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

(With effect from Academic Year 2022-23)

Semester V

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
310341	Database Management Systems	03	-	-	30	70	-	-	-	100	03	-	-	03
310342	Advanced Java Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
310343	Data Communication	03	-	-	30	70	-	-	-	100	03	-	-	03
310344	Microcontroller and Applications	03	-	-	30	70	-	-	-	100	03	-	-	03
310345	Elective I	03	-	-	30	70	-	-	-	100	03	-	-	03
310346	Database Management Systems Lab	-	02	-	-	-	25	-	25	50	-	02	-	02
310347	Advanced Java Programming Lab	-	02	-	-	-	-	-	25	25	-	01	-	01
310348	Data Communication Lab	-	02	-	-	-	-	50	-	50	-	01	-	01
310349	Microcontroller and Applications Lab	-	02	-	-	-	-	50	-	50	-	01	-	01
310350	Data Analytics using Python Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
	Total	**15**	**10**	**-**	**150**	**350**	**50**	**100**	**50**	**700**	**15**	**06**	**-**	**21**
310351A	Mandatory Audit Course 5												**Grade**	
										Total Credit	**15**	**06**	**-**	**21**

Elective I

310345A -Distributed Systems
310345B- Block Chain Technology
310345C- Digital Signal Processing
310345D- Sensors and Applications

Audit Course 5 (310351A)

- Cyber Security
- Professional Ethics and Etiquettes
- Engineering Economics
- Foreign Language
- MOOC- Learn New Skills

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

(With effect from Academic Year 2022-23)

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
310352	Software Engineering and Project Management	03	-	-	30	70	-	-	-	100	03	-	-	03
310353	Computer Networks and Security	03	-	-	30	70	-	-	-	100	03	-	-	03
310354	Embedded Processors & Applications	03	-	-	30	70	-	-	-	100	03	-	-	03
310355	Elective II	03	-	-	30	70	-	-	-	100	03	-	-	03
310356	Computer Networks and Security Lab	-	02	-	-	-	25	-	25	50	-	01	-	01
310357	Embedded Processors & Applications Lab	-	02	-	-	-	-	50	-	50	-	01	-	01
310358	Elective-II Lab	-	02	-	-	-		-	50	50	-	01	-	01
310359	Mini Project	-	04	-	-	-	25	-	25	50	-	02	-	02
310360	Internship**	-	**	-	-	-	100 **	-	-	100	-	04 **	-	04
	Total	**12**	**10**	**-**	**120**	**280**	**150**	**50**	**100**	**700**	**12**	**09**	**-**	**21**
310351B	Mandatory Audit Course 6												**Grade**	
										Total Credit	**12**	**09**	**-**	**21**

Elective II

310355A-Software Modeling and Design

310355B-Advanced Database Management Systems

310355C-Power Electronics

310355D-PLC and Automation

Audit Course 6 (310351B)

- Digital and Social Media Marketing
- Sustainable Energy Systems
- Leadership and Personality Development
- Foreign Language
- MOOC-Learn New Skills

Elective-II Lab

Assignments from **Elective-II** selected

****Internship:**

Internship guidelines are provided in course curriculum sheet.

SEMESTER - V

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310341:Database Management System

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Data Structures and Algorithms

Companion Course, if any: Database Management System Lab

Course Objectives:

1. To understand fundamental concepts of database from its design to its implementation.
2. To analyze database requirements and determine the entities involved in the system.
3. To manipulate database using SQL Query to create, update and manage Database.
4. Be familiar with the basic issues of transaction processing and concurrency control.
5. To learn and understand Parallel Databases and its Architectures.
6. To learn and understand Distributed Databases and its applications.

Course Outcomes: On completion of the course, learner will be able to-

CO1: Understand the underlying concepts of database systems.

CO2: Design and implement a database schema for a given problem-domain using data model.

CO3: Solve wide range of query and update problems using SQL/DML/DDL commands.

CO4: Explain transaction Management in relational database System.

CO5: Understand various Database Architectures and its applications.

CO6: Apply NoSQL database concepts for processing unstructured data.

Course Contents

Unit I	Introduction to DBMS	(07 Hrs.)

Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, Data Abstraction and Database System Structure.

Relational Model: Structure of relational databases, Domains, Relations, Keys – Super key, Candidate key, Primary key, Foreign key, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus.

Entity-Relationship model: Basic Concepts, Entity Set, Relationship Sets and Weak Entity Sets, Mapping Cardinalities, E-R diagrams, Extended E-R Features, Converting E-R & EER diagram into tables.

Mapping of Course Outcomes for Unit I	**CO1: Understand the underlying concepts of database systems.**	
Unit II	**Relational Database Design**	**(06 Hrs.)**
Basic concepts, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, 2NF, 3NF, and BCNF.		
Mapping of Course Outcomes for Unit II	**CO2: Design and implement a database schema for a given problem-domain using data model.**	
Unit III	**Basics of SQL**	**(07 Hrs.)**
DDL, DML, DCL, Structure: Creation, Alteration, Defining constraints – Primary key, Foreign key, Unique key, Not null, Check, IN operator, Functions - Aggregate Functions, Built-in Functions –Numeric, Date, String Functions, Set operations, sub-queries, correlated sub queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. **Transaction control commands:** Commit, Rollback, Save-point PL/SQL Concepts: Cursors, Stored Procedures, Stored Function, Database Triggers		
Mapping of Course Outcomes for Unit III	**CO3: Solve wide range of query and update problems using SQL/DML/DDL commands.**	
Unit IV	**Database Transactions Management**	**(07 Hrs.)**
Basic concepts of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, and Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlock handling and Time-stamp based Protocols.		
Mapping of Course Outcomes for Unit IV	**CO4: Explain transaction Management in relational database System.**	
Unit V	**Parallel and Distributed Databases**	**(06 Hrs.)**
Multi-user DBMS Architectures, **Introduction to Parallel Databases**, performance measures-throughput, response time, speed-up, scale-up, Interconnection Network Architectures, Architectures for parallel databases, Evaluating Parallel Query in Parallel Databases, Virtualization on Multicore processors, Parallelizing individual operations, Parallel query optimizations. **Introduction to distributed databases**, Distributed DBMS architectures, storing data in a Distributed, Distributed Query processing, Updating distributed data, Distributed transactions, Distributed Concurrency control and Recovery.		
Mapping of Course Outcomes for Unit V	**CO5: Understand various Database Architectures and its applications.**	
Unit VI	**No SQL Databases**	**(07 Hrs.)**
Types of Data: structured, unstructured and semi structured data. **NoSQL Database:** Introduction, Need, Features. **Types of NoSQL Databases:** Key Value store, Document store,, graph, wide column store, BASE		

properties, DATA consistency model, ACID vs. BASE

MongoDB(with syntax and usage):CRUD operations, Indexing, Aggregation, Map Reduce, Replication, Shading.

Mapping of Course Outcomes for Unit VI	**CO6: Apply NoSQL database concepts for processing unstructured data.**

Learning Resources

Text Books:

1. A. Silberschatz, H.F. Korth and S. Sudarshan , "Database System Concepts", McGraw Hill, 6th Edition.
2. C.J. Date, A. Kannan, S. Swamynathan "An introduction to Database Systems", Pearson, 8th Edition.
3. Pramod Sadalage and Martin Fowler" NoSQL Distilled", Addison-Wesley Professional

Reference Books:

1. Martin Gruber, "Understanding SQL", Sybex Publications.
2. Ivan Bayross, "SQL-PL/SQL", BPB Publications, 4th Edition.
3. S.K. Singh, "Database Systems: Concepts, Design and Application", Pearson, Education, 2nd Edition.

MOOC / NPTEL Courses:

1. NPTEL Course **"Database Management System"**

   Link of the Course: https://nptel.ac.in/courses/106105175
2. NPTEL Course **"Database Management System"**

   https://nptel.ac.in/courses/106104135

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310342:Advanced Java Programming

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Object Oriented Programming

Companion Course, if any: -

Course Objectives:

1. To design and develop basic OOPS concept in Java.
2. To design and develop packages in Java.
3. To design enterprise based applications by encapsulating an application's business logic.
4. To designing applications using pre-built frameworks.

Course Outcomes: On completion of the course, learner will be able to-

CO1: Design and develop GUI applications using Applets.

CO2: Apply relevant AWT/ swing components to handle the given event.

CO3: Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.

CO4: Learn to access database through Java programs, using Java Database Connectivity (JDBC)

CO5: Invoke the remote methods in an application using Remote Method Invocation (RMI)

CO6: Develop program for client /server communication using Java Networking classes.

Course Contents

Unit I	OOPS Concepts	(07 Hrs.)

Inheritance Types Of Inheritance: Introduction, Classes Inheritance, Interface Inheritance, Multilevel Inheritance, Accessing members of other class/interface, Chaining Constructor using this() and Super(), This() constructor call, Super()constructor call, Dynamic method Dispatch, Method Overriding, Modifiers: Java Access Specifies: Public, Protected, Private, Default Other modifiers for members: Static, Final, Abstract, Synchronized, Native, Transient, Volatile, Other modifiers for classes: Abstract classes, Final classes.

Mapping of Course Outcomes for Unit I	CO1: Design and develop GUI applications using Applets.

Unit II	Packages, Interfaces and Fundamental Classes	(07 Hrs.)

String, Introduction to Packages, Types of Fundamental Classes, String Handling: Creating Format String, Exception Handling, Nested Classes, Threads, Collections and Maps, Collections, Networking: Socket Programming, URL class.

Mapping of Course Outcomes for Unit II	**CO2: Apply relevant AWT/ swing components to handle the given event.**	
Unit III	**Applet**	**(07 Hrs.)**

Applet Basics -Introduction, limitations of AWT, Applet architecture – HTML APPLET tag – Passing parameter to Appletget, Japplet: Icons and Labels Text Fields Buttons, Combo Boxes, Checkboxes, Tabbed Panes, Scroll Panes.

Mapping of Course Outcomes for Unit II	**CO3: Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.**	
Unit IV	**Event handling using AWT/Swing components**	**(07 Hrs.)**

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface.

Mapping of Course Outcomes for Unit II	**CO4: Learn to access database through Java programs, using Java Database Connectivity (JDBC)**	
Unit V	**GUI Programming**	**(07 Hrs.)**

Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Java Utilities (java.util Package)

Mapping of Course Outcomes for Unit II	**CO5: Invoke the remote methods in an application using Remote Method Invocation (RMI)**	
Unit VI	**Database Programming using JDBC**	**(07 Hrs.)**

The Concept of JDBC, JDBC Driver Types & Architecture, JDBC Packages, A Brief Overview of the JDBC process, Database Connection, Basic JDBC program Concept, Statement, Result Set, Prepared Statement, Callable Statement, Executing SQL commands, Executing queries

Mapping of Course Outcomes for Unit VI	**CO6: Develop program for client /server communication using Java Networking classes.**

Learning Resources

Text Books:

1. Herbert Schildt, “Java: The complete reference”, Tata McGraw Hill, 7th Edition

2. Jim Keogh, “Complete Reference J2EE” , Enterpr

3. E. Balaguruswamy, “Programming with JAVA: A Primer” McGraw Hill Education, India, 5th Edition.

Reference Books:

1. “Java 6 Programming”, Black Book, Dreamtech

2. “Java Server Programming, Java EE6 (J2EE 1.6)”, Black Book, Dreamtech

3. M.T. Savaliya,“Advanced Java Technology”, Dreamtech

MOOC / NPTEL Courses:

1. NPTEL Course **“Programming in Java”**

   Link of the Course: https://nptel.ac.in/courses/106/105/106105191/

2. Udemy course **“Advanced Java Programming”**

   Link of the Course: https://www.udemy.com/course/advanced-java-programming

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310343:Data Communication

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Principles of Communication System

Companion Course, if any: Data Communication Lab

Course Objectives:

1. To provide an in-depth introduction to all aspects of data communication system.
2. To analyze the noise performance of analog modulation techniques.
3. To introduce various digital band pass modulation schemes.
4. To provide knowledge of various multiplexing schemes.
5. To identify the need of data coding and error detection/correction mechanism.

Course Outcomes: On completion of the course, learner will be able to

CO1: Define & explain terminology of data communications and Apply various network layer Techniques to analyze packet flow on the basis of routing protocols.

CO2: Understand the importance of noise considerations in communication systems.

CO3: Understand and explain various digital modulation techniques used in Digital communication systems and analyze their performance in presence of AWGN noise.

CO4: Understand working of spread spectrum communication system and analyze its performance.

CO5: Identify and explain error detection and correction using appropriate techniques.

CO6: Use error control coding techniques to improve performance of a Digital communication system.

Course Contents

Unit I	Data Transmission Fundamentals	(08 Hrs.)

Data transmission concepts and terminology, analog and digital data transmission, Transmission modes (simplex, half duplex, full duplex), transmission media : Guided (UTP, STP, Optical, coaxial) & wireless(Radio wave, Microwave, Infrared), Data Transmission (parallel and serial synchronous and asynchronous transmission), analog and digital signal properties: Bandwidth, bit rate, baud rate , data rate, Connecting devices: Hubs/Repeaters, Switches, Bridges, Routers, Layered Architecture (OSI Model).

Mapping of Course Outcomes for Unit I	CO1 Define & explain terminology of data communications and Apply various network layer Techniques to analyze packet flow on the basis of

	routing protocols.	
Unit II	**Noise**	**(06 Hrs.)**
Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband systems and Amplitude modulated systems i.e. DSBSC and SSBSC in presence of noise.		
Mapping of Course Outcomes for Unit II	**CO2: Understand the importance of noise considerations in communication systems.**	
Unit III	**Digital Modulation Techniques**	**(08 Hrs.)**
Digital Modulation: Generation, Reception and Signal Space Representation for Binary Amplitude Shift Keying (BASK), Binary Frequency Shift Keying (BFSK), Binary Phase Shift Keying (BPSK), Differential phase shift keying (DPSK), Quadrature Phase Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK),M-ary encoding: Need, M-ary FSK and M-ary PSK, Minimum Shift Keying (MSK).		
Mapping of Course Outcomes for Unit III	**CO3: Understand and explain various digital modulation techniques used in Digital communication systems and analyze their performance in AWGN noise.**	
Unit IV	**Multiple Access Techniques**	**(06 Hrs.)**
Introduction to Multiple Access Techniques – TDMA, FDMA, CDMA, Spread spectrum techniques: Direct Sequence Spread Spectrum (DS-SS) and Frequency Hopping Spread Spectrum (FH-SS), **Pseudorandom (PN) Sequences:** Introduction, Pseudo noise sequences, Generation and Characteristics, Pure and slotted ALOHA, Media access control protocol (CSMA).		
Mapping of Course Outcomes for Unit IV	**CO4: Understand working of spread spectrum communication system and analyze its performance.**	
Unit V	**Information Theory**	**(06 Hrs.)**
The concept of amount of information and its properties, Average information, Information rate, Entropy, mutual information, channel capacity, channel coding theorem, Entropy coding: overview of BSC, Huffman coding, Hartley Shannon's theorem, Shannon-Fano coding, code efficiency.		
Mapping of Course Outcomes for Unit V	**CO5: Identify and explain error detection and correction using appropriate techniques.**	
Unit VI	**Error Control Coding**	**(06 Hrs.)**
Introduction to Error Control Coding, Need of Error control coding, Basic codes definitions , Error Detection, Parity, Checksum for error detection , Linear block codes, Matrix description of Linear Block codes, Parity check matrix, Decoding of Linear block codes , CRC, syndrome detection, Error probability after coding, Error control systems: FEC, ARQ Stop and Wait, Hybrid ARQ, go back N, selective repeat.		

Mapping of Course Outcomes for Unit VI	CO6: Use error control coding techniques to improve performance of a Digital communication system.

Learning Resources

Text Books:

1. Bernard Sklar, Digital Communication,2/E, Pearson Education India, 2009
2. Willam Stallings, Data and Computer Communications,8/E, Pearson, 2007

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 4/E, McGraw-Hill, 2006Leon W. Couch II, Digital and Analog Communication Systems, 6/E, Pearson Education Asia, 2002
2. Taub Schilling, Principals of Communication Systems, 2/E, Tata McGraw Hill, 2004
3. John J Proakis, Digital Communications, 3/E, McGraw-Hill Higher Education, 2001 Computer Networks,A.S.Tanenbaum,4th edition,Pearson education

4) Ranjan Bose, ―Information Theory coding and Cryptography‖, McGraw-Hill, 2nd Ed

5) Murlidhar Kulkarni, K.S.Shivaprakasha, ―Information Theory & Coding‖, Wiley Publications

MOOC / NPTEL Courses:

1. NPTEL Course “Modern Digital Communication Techniques”

Link of the Course: https://nptel.ac.in/courses/117/105/117105144/

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Third Year of Electronics and Computer Engineering (2019 Course)

310344:Microcontroller and Applications

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Digital Electronics, Microprocessors

Companion Course, if any:

Course Objectives:

1. To understand the applications of Microcontrollers.
2. To understand need of microcontrollers in embedded system.
3. To understand architecture and features of Microcontrollers.
4. To learn interfacing of real world input and output devices.
5. To study various hardware & software tools for developing applications.
6. To learn 8051 and MSP430 Microcontrollers.

Course Outcomes: On completion of the course, learner will be able to

CO1: Understand architecture and features of microcontrollers.

CO2: Describe hardware, software tools and interface peripherals with microcontroller.

CO3: Develop an application by interfacing peripherals with microcontroller.

CO4: Understand MSP430 microcontroller architecture and its low power features.

CO5: Explain data communication protocols and develop an application by interfacing peripherals with MSP430 microcontroller.

CO6: Design applications using 8051 and MSP430 microcontrollers.

Course Contents

Unit I	Introduction to microcontroller Architecture	(08 Hrs.)

Microprocessor and microcontroller comparison, Harvard & Von Neumann architecture, RISC & CISC processors. Role of microcontroller in embedded system. Selection criteria of microcontroller. Overview of MCS-51 architecture, Block diagram and explanation of 8051, Port structure, memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Programming of Timer 0&1.

Mapping of Course	CO1: Understand architecture and features of microcontrollers.

Outcomes for Unit I		
Unit II	**Interfacing-I**	**(07 Hrs.)**
Software and Hardware tools for development of microcontroller based systems such as assemblers, compliers, IDE, Emulators, debuggers, programmers, development board, DSO, Logic Analyzer. Interfacing LED with and without interrupt, Keypads, Seven Segment multiplexed Display, LCD, ADC Interfacing. All Programs in embedded c language.		
Mapping of Course Outcomes for Unit II	**CO2: Describe hardware, software tools and interface peripherals with microcontroller.**	
Unit III	**Interfacing-II**	**(06 Hrs.)**
Data transmission and reception using Serial port with PC. Interfacing of DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Opto- isolators, All programs in embedded C language.		
Mapping of Course Outcomes for Unit III	**CO3:Develop an application by interfacing peripherals with microcontroller.**	
Unit IV	**MSP430 Microcontroller Architecture and Low Power Features**	**(07 Hrs.)**
Low Power 16-bit MSP430x5xx microcontroller architecture, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of MSP430 devices; Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power; reliability.		
Mapping of Course Outcomes for Unit IV	**CO4: Understand MSP430 microcontroller architecture and its low power features.**	
Unit V	**Real World Interfacing**	**(06 Hrs.)**
GPIO programming and I/O multiplexing; Interrupts and interrupt programming. Timers and Watchdog timer. PWM control. ADC and DAC in MSP430. Interfacing of LED, IR sensor, Buzzer and Relay. UART protocol, I2C protocol, SPI protocol.		
Mapping of Course Outcomes for Unit V	**CO5: Explain data communication protocols and develop an application by interfacing peripherals with MSP430 microcontroller**	
Unit VI	**Applications using 8051 and MSP430 Microcontrollers**	**(06 Hrs.)**
Data acquisition system, Design of frequency counters with display on LCD, Design of water level monitoring system using 8051 Microcontroller. Design of soil monitoring system for agriculture, Home Automation System, Design of environment monitoring system using MSP430 microcontroller. All programs are in embedded C.		
Mapping of Course	**CO6: Design applications using 8051 and MSP430 microcontrollers.**	

Outcomes for Unit VI	

Learning Resources

Text Books:

1. Mazidi, 8051 microcontroller & embedded system 3rd Edition ,Pearson

2. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newness Publication ISBN-13: 978-0750682763

Reference Books:

1. Getting Started with the MSP430 Launch pad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880 1

2. I2C data sheets from www.ti.comhttps://onlinecourses.nptel.ac.in/noc22_ee12/course

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310345A:Elective I - Distributed Systems

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives:

1. To learn the principles, architectures, algorithms and programming models used in distributed systems.
2. To examine state-of-the-art distributed systems, such as Google File System.
3. To design and implement sample distributed systems
4. To understanding of the principles and techniques behind the design of distributed systems, such as locking, concurrency, scheduling, and communication across networks.
5. To design, implement and debug the Distributed systems.

Course Outcomes: After completion of the course, learner will be able to,

CO1: Demonstrate the basic concepts and elements of distributed system technologies.

CO2: Demonstrate knowledge of the core architectural aspects of distributed systems.

CO3: Design and implement distributed applications.

CO4: Demonstrate knowledge of components of distributed systems

CO5: Use and apply important methods in distributed systems to support scalability and fault tolerance.

CO6: Demonstrate large-scale distributed applications.

Course Contents

Unit I	Introduction to distributed systems	(07Hrs.)

Introduction: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication , Synchronous versus asynchronous executions, Design issues and challenges. A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process

communications. Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.		
Mapping of Course Outcomes for Unit I	**CO1: Demonstrate the basic concepts and elements of distributed system technologies.**	
Unit II	**Communication In Distributed System**	**(07Hrs.)**
System Model, Inter process Communication, the API for internet protocols, External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation And Objects: Remote Invocation–Introduction-Request-reply protocols, Remote procedure call, Remote method invocation. Case study: JavaRMI, Group communication, Publish-subscribe systems, Message queues, Shared memory approaches, Distributed objects, Case study: Enterprise Java Beans, from objects to components.		
Mapping of Course Outcomes for Unit II	**CO2: Demonstrate knowledge of the core architectural aspects of distributed systems.**	
Unit III	**Peer To Peer Services and File System**	**(06Hrs.)**
Peer-to-peer Systems, Introduction, Napster and its legacy, Peer-to-peer Middleware, Routing overlays. Overlay case studies: Pastry, Tapestry, Distributed File Systems, Introduction, File service architecture, Andrew File system. File System: Features, File model, File accessing models, File sharing semantics Naming: Identifiers, Addresses, Name Resolution, Name Space Implementation, Name Caches, LDAP.		
Mapping of Course Outcomes for Unit III	**CO3: Design and implement distributed applications.**	
Unit- IV	**Synchronization and Replication**	**(07Hrs.)**
Introduction, Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks - Global states , Coordination and Agreement, Introduction, Distributed mutual exclusion, Elections Transactions and Concurrency Control, Transactions-Nested transactions , Locks, Optimistic concurrency control, Timestamp ordering, Atomic Commit protocols, Distributed deadlocks, Replication, Case study, Coda.		
Mapping of Course Outcomes for Unit IV	**CO4: Demonstrate knowledge of components of distributed systems**	
Unit-V	**Process & Resource Management**	**(07Hrs.)**
Process Management: Process Migration: Features, Mechanism, Threads: Models, Issues, Implementation. Resource Management: Introduction, Features of Scheduling Algorithms, Task Assignment Approach, Load Balancing Approach, Load Sharing Approach.		
Mapping of Course Outcomes for Unit V	**CO5: Use and apply important methods in distributed systems to support scalability and fault tolerance.**	

Unit- VI	Distributed File Systems	(06Hrs.)
File system, DFS- definition, Characteristics, Goals, SUN NFS, NFS Architecture, NFS Implementation, Protocols, The CODA file system, Design Overview, An Example, Design Rational, Implementation, The GOOGLE files system-Definition, Architectures, GFS Architecture		
Mapping of Course Outcomes for Unit VI	**CO6: Demonstrate large-scale distributed applications.**	

Learning Resources

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2. Andrew S. Tannenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson.
3. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, “Distributed Systems: Concepts and Design”, Addison Wesley.

Reference Books

1. Pradeep K. Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
3. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education,2004.
4. Nancy A Lynch, “Distributed Algorithms” ,Morgan Kaufman Publishers, USA,2003.
5. P. K. Sinha, Distributed Operating Systems: Concepts and Design, IEEE press.
6. M. Singhaland, N. G. Shivaratri, “Advanced Concepts in Operating Systems, McGraw-Hill.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310345B:Elective I - Blockchain Technology

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / Week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Data Structure, OOPs

Companion Course, if any:

Course Objectives:

1. To introduce Blockchain Technology
2. To learn the distributed decentralized system.
3. To learn hashing in cryptography, Ethereum and consensus
4. To learn bitcoin and its process also the blockchain technology in allied technologies.

Course Outcomes: After completion of the course, learner will be able to,

CO1: Understand the basic concepts and architecture of Blockchain Technology

CO2: Demonstrate distributed decentralized system, its applications and regulations

CO3: Demonstrate the application of hashing in cryptography

CO4: Demonstrate the verification process through Ethereum and consensus in blockchain technology.

CO5: Illustrate the concepts of Bitcoin and its process in blockchain technology.

CO6: Understand and illustrate Blockchian with allied technologies such as cloud computing, AI, IoT, Robotics

Course Contents

Unit-I	Basics of Blockchain	(07Hrs.)

Introduction, History and Concept of Blockchain, Definition of Blockchain, Fundamentals of Blockchain, Characteristics of Blockchain, Consensus in Trust-Building Exercise, Public, Private, and Hybrid Blockchains, Architecture of Blockchain, Transactions, Chaining Blocks,

Mapping of Course Outcomes for Unit I	CO1: Understand the basic concepts and architecture of Blockchain Technology

Unit-II	Distributed Decentralized System	(07Hrs.)

Introduction, Distributed Ledger Technologies (DLT), Distributed Decentralized Applications and Databases, Value Proposition of Blockchain Technology, Decentralized Enterprise, Decentralization,

Disintermediation, Decentralized Enterprise Regulation.		
Mapping of Course Outcomes for Unit II	**CO2: Demonstrate distributed decentralized system, its applications and regulations**	
Unit-III	**Cryptography and Hash Functions**	**(06Hrs.)**
Cryptography, Cryptography Primitives, Symmetric Cryptography, Introduction of Hash, Asymmetric Cryptography Hashing, Message Authentication Code, Secure Hash Algorithms (SHA-1), Secure Hash Algorithm Version 3, Distributed Hash Tables, Hashing and Data Structures, Hashing in Blockchain Mining		
Mapping of Course Outcomes for Unit III	**CO3: Demonstrate the application of hashing in cryptography**	
Unit- IV	**Blockchain Components & Consensus**	**(07Hrs.)**
Introduction of Ethereum, History, Ethereum Virtual Machine, Working of Ethereum, Ethereum Clients, Ethereum Key Pairs, Ethereum Addresses, Ethereum Wallets, Ethereum Transactions, Ethereum Languages, Ethereum Development Tools Introduction, Consensus Introduction, Consensus Approach, Consensus Algorithms, Byzantine Agreement Methods		
Mapping of Course Outcomes for Unit IV	**CO4: Demonstrate the verification process through Ethereum and consensus in blockchain technology.**	
Unit-V	**Bitcoins**	**(07Hrs.)**
Introduction, Working of Bitcoin, Merkle Trees, Bitcoin Block Structure, Bitcoin Address, Bitcoin Transactions, Bitcoin Network, Bitcoin Wallets, Bitcoin Payments, Bitcoin Clients, Bitcoin Supply		
Mapping of Course Outcomes for Unit V	**CO5: Illustrate the concepts of Bitcoin and its process in blockchain technology.**	
Unit-VI	**Blockchain and Allied Technologies**	**(06Hrs.)**
Blockchain and Cloud Computing, Characteristics of Blockchain Cloud, Blockchain and Artificial Intelligence, Blockchain and IoT, Blockchain and Machine Learning, Blockchain and Robotic Process Automation		
Mapping of Course Outcomes for Unit IV	**CO6: Understand and illustrate blockchian with allied technologies such as cloud computing, AI, IoT, Robotics**	
Learning Resources		

TEXT Books:

1. Kumar Saurabh and AshutoshSaxena., “Blockchain Technology: Concepts and Applications”, Wliey Publicaions
2. Yathish R , Tejaaswini N,”Blockchain For Beginners”, Publisher:Shroff/X-Team 2019 Edition
3. Don Tapscott, author of Wikinomics, Alex Tapscott, “ Blockchain Revolution: How the technology behind bitcoin and other cryptocurrencies is changing the world”, Penguin Publishing Group

References:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction”, Princeton University Press.
2. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.
3. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing.
4. Merunas Grincalaitis, “Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”, Packt Publishing

NPTEL Link

1. Introduction To Blockchain Technology And Applications Link https://nptel.ac.in/courses/106104220
2. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, “Blockchain Architecture Design And Use Cases”[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310345C:Elective I - Digital Signal Processing

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Signals and Systems

Companion Course, if any:

Course Objectives:

1. To understand DTFT and DFT.
2. To understand, analyze and design FIR and IIR filters.
3. To understand realization of FIR and IIR Filters.
4. To understand its hardware implementation using DSP Processor

Course Outcomes:

After successful completion of this course, the student will be able to:

CO1: Apply DFT as an analytical tool.

CO2: Analyze LTI Systems using FFT algorithms.

CO3: Design FIR and IIR systems.

CO4: Implement FIR and IIR Systems.

CO5: Implement various DSP Systems on DSP Processor

Course Contents

UNIT I	Z-transform and its application to the analysis of LTI systems:	(06Hrs.)

Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Relation between pole locations and time domain behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

Mapping of Course Outcomes for Unit I	CO1: Apply DFT as an analytical tool.

UNIT II	Discrete Fourier Transform	(06Hrs.)

Frequency domain sampling and reconstruction of discrete time signals – DFT, properties of the DFT, use of DFT in linear filtering, filtering of long data sequences, DFT as linear transformation, Efficient

computation of the DFT- FFT Algorithms, Radix 2 DITFFT and DIFFFT, Goertzel Algorithm.

Mapping of Course Outcomes for Unit II	CO2: Analyze LTI Systems using FFT algorithms	
UNIT III	**Design of IIR filters & FIR Filter**	**(06Hrs.)**

IIR:- Classical design by impulse invariance, bilinear transformation and matched Z transform, characteristics and design of commonly used filters – butter worth, Chebyshev and elliptic filters, Spectral transformations, Direct design of IIR filters.

FIR:- General considerations, Linear phase FIR Filters, Symmetric and anti-symmetric impulse response, Design using windows, frequency sampling design, Optimum design.

Mapping of Course Outcomes for Unit III	CO3: Design FIR and IIR systems	
UNIT IV	**Implementation of Discrete time Systems**	**(06Hrs.)**

Structures for FIR systems – Direct form, cascade form, Frequency sampling and lattice structures. Structures for IIR systems – Direct form, cascade and parallel form, lattice ladder structures. Finite word length effects.

Mapping of Course Outcomes for Unit IV	CO4: Implement FIR and IIR Systems.	
UNIT V	**Multi rate Signal processing**	**(06Hrs.)**

Multi rate Signal Processing:-Sampling rate reduction: decimation by integer factors, Sampling rate increase: interpolation by integer factors, sampling rate conversion by non integer factors

Mapping of Course Outcomes for Unit V	CO5: Implement various DSP Systems on DSP Processor	
UNIT VI	**DSP Processors and Application of DSP**	**(06Hrs.)**

DSP Processors: -Need for Special architecture of DSP processor, Difference between DSP processor & microprocessor, a general DSP processor TMS320C54XX series,

Application of DSP: - Case study of Real Time DSP applications to Speech Signal Processing and Biomedical Signal Processing

Mapping of Course Outcomes for Unit VI	CO6:

Learning Resources

TEXTBOOK:

1. Proakis J.G and. Manolakis D.G. Mimitris D. (2003) ―Introduction to Digital Signal Processing‖ Prentice Hall, India

REFERENCES:

1. Oppenheim A. V. and Schafer R.W. (2003) ―Discrete Time Signal Processing‖, Pearson education.

2. Ifeachar and Jervis (2003) ―Digital Signal Processing: A Practical approach‖ Pearson education, Asia

3. Rabiner L.R and Gold D.J (1988) ―Theory and applications of digital signal processing‖ Prentice Hall, India

MOOC / NPTEL Courses:

1. NPTEL Course on "**Digital Signal Processing**"

Link of the Course: https://nptel.ac.in/courses/117/102/117102060/

2. NPTEL Course on "**Digital Signal Processing**"

Link of the Course: https://nptel.ac.in/courses/108/105/108105055/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310345D:Elective I - Sensors and Applications

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Basic Electronics Engineering

Companion Course, if any: -

Course Objectives:

1. Explain the operation/working principle of different sensors.
2. Compare various sensors and select appropriate sensor for a particular application.
3. To impart interdisciplinary knowledge regarding sensors and actuators.
4. Explain the advanced sensor fabrication techniques like MEMS.
5. Explain industrial applications of sensors and transducers.

Course Outcomes: On completion of the course, learner will be able to -

CO1: **Classify** sensors/transducers and **describe** important performance measures, terminology of sensors/instrumentation systems.

CO2: **Compare** various temperature sensors, **design** signal conditioning circuits for temperature sensors and describe working principles of chemical sensors.

CO3: **Compare** various flow and level sensing techniques and **select** appropriate technique for a specific application.

CO4: **Describe** working principles of motion, light and radiation detectors.

CO5: **Describe** construction and working principle of MEMS and SMART sensors.

CO6: **Select** appropriate Switches and final control elements for a specific application

Course Contents

Unit I	Fundamentals of Sensors & Transducer	(06 Hrs.)

Definitions sensors & transducer, Classification of sensors and transducers, Performance and Terminology: Accuracy, precision, resolution, threshold, sensitivity, linearity, hysteresis, drift, range, span, speed of response, measuring lag, fidelity, dynamic error.

Advantages, disadvantages & applications of sensors and transducers, Block diagram and description of Instrumentation system.

Instrument calibration- definition, benefits of calibration, Measurement Standards-International System of

Units (SI), Calibration Chain and Traceability, Calibration procedure.		
Mapping of Course Outcomes for Unit I	**CO1: Classify sensors/transducers and describe important performance measures, terminology of sensors/instrumentation systems.**	
Unit II	**Temperature & Chemical sensors**	**(06 Hrs.)**
Temperature: RTD, thermistors, thermocouples, noncontact temperature measurement- pyrometers. Semiconductor temperature sensing (LM75), Signal conditioning circuit for RTD and Thermocouple, Interfacing technique of Temperature sensors with microcontroller. Acoustics sensors for sound level measurement, Humidity Sensors. Chemical sensors: classes of chemical sensors, Characteristics of chemical sensors, biochemical sensors, electronics noses.		
Mapping of Course Outcomes for Unit II	**CO2: Compare various temperature sensors, design signal conditioning circuits for temperature sensors and describe working principles of chemical sensors.**	
Unit III	**Flow and Level Sensing**	**(07 Hrs.)**
Flow: Bernoulli Equation, Differential head type flow meters (Orifice, Venturi tube and Flow Nozzle), Pitot static tube, Variable area type flow meter – Rotameter, vortex shedding, Electromagnetic, ultrasonic flow meters, hot wire anemometers. **Level:** Float, DP Cell, Ultrasonic, Capacitance probe type, Hydrostatic pressure and Nuclear level detection techniques.		
Mapping of Course Outcomes for Unit III	**CO3: Compare various flow and level sensing techniques and select appropriate technique for a specific application.**	
Unit IV	**Weight, Motion, Light & Radiation Detectors**	**(07 Hrs.)**
Weight- Load Cell and strain gauges, strain gauge signal conditioning. **Displacement-** LVDT ,Ultrasonic, capacitive detectors, Proximity sensors (inductive, optical and capacitive) **Velocity-**Absolute and incremental encoders. **Acceleration–** Accelerometer characteristics, capacitive accelerometers, Piezoelectric Accelerometer, Piezo-resistive accelerometer, thermal accelerometer. **Light & Radiation detectors:** Photo diodes, photo transistor, CCD, CMOS image sensors, gas flame detectors, Radiation detectors.		
Mapping of Course Outcomes for Unit IV	**CO4: Describe working principles of motion, light and radiation detectors.**	
Unit V	**MEMS & Smart sensors**	**(06 Hrs.)**
Magnetic field sensors – Hall effect and magneto-resistive elements (MRE), magneto-transistors, piezoelectric (PZT) sensors and actuators. Microelectromechanical systems (MEMS) – Bulk		

micromachining, micro-machined absolute pressure sensor, Surface Micromachining-Hot wire anemometer micro-miniature temperature sensor, surface micromachined accelerometer and SMART sensors.

Mapping of Course Outcomes for Unit V	**CO5: Describe construction and working principle of MEMS and SMART sensors.**

Unit VI	**Actuators and Final Control Elements**	**(06 Hrs.)**

Pneumatic and hydraulic actuators- Directional control valves, Pressure control valves, Cylinders, Process control valves - Electrical actuators- Mechanical switches, Solid state switches, Solenoids, DC motors, AC motors and Stepper motors.

Mapping of Course Outcomes for Unit VI	**CO6: Select appropriate Switches and final control elements for a specific application.**

Learning Resources

Text Books:

1. W. Bolton; " Mechatronics, Electronic Control Systems in Mechanical and Electrical Engineering"; Pearson Education; 3rd Edition
2. William C. Dunn,"Introduction to Instrumentation, Sensors, and Process Control", Artech House Sensors Library.

Reference Books:

1. Curtis Johnson; " Process Control Instrumentation Technology "; Prentice Hall of India Pvt. Ltd.;7th Edition
2. Ernest O. Doebelin; "Measurement System Application and Design "; Mc-Graw Hill; 5th Edition
3. David G. Alciatore, Michael B Histand; " Introduction to Mechatronics and Measurement System "; Tata McGraw Hill
4. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition.

MOOC / NPTEL Courses:

1. **Industrial Instrumentation, https://nptel.ac.in/courses/108105064**
2. **NOC: Sensors and Actuators, https://nptel.ac.in/courses/108108147**

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310346: Database Management Systems Lab

Teaching Scheme:	Credit: 02	Examination Scheme:
Practical: 02 Hrs. / week		Oral: 25 Marks Termwork: 25 Marks

Prerequisite Courses, if any: -

Companion Course, if any: Database Management System

List of Laboratory Experiments

Group A- Database Programming Languages – SQL

1. Design and develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence and Synonym
2. Design and develop SQL queries for suitable database application using SQL DML statements: Insert, Select, Update and Delete with operators and functions.
3. Design and develop at least 5 SQL queries for suitable database application using SQL DML statements: all types of Join and Sub-Query.

Group B- Database Programming Languages – PL / SQL

4. Write a Stored Procedure namely calculate_fine for the following requirements:-

   Schema:

   Borrower (Roll no., Name, Date of Issue, Name of Book, Status)

   Fine (Roll no, Date, Amt.)

   - Accept roll no. & name of book from user.
   - Check the number of days (from date of issue), if days are between 15 and 30, then fine amount will be Rs 5 per day.
   - If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day.
   - After submitting the book, status will change from I to R.
   - If condition of fine is true, then details will be stored into fine table.

   Write a PL/SQL block for using procedure created with above requirement.
5. Write a PL/SQL block of code using parameterized Cursor that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.
6. **Database Trigger**: Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added

in Library_Audit table.

Group C- Database Programming Languages – No SQL

7. Mongo DB queries: Design and Develop Mango DB Queries using CRUD operations.(use CRUD operations, SAVE Method and logical operators)
8. Mango DB – Aggregation and Indexing: Design and Develop Mango DB Queries using Aggregation and Indexing with suitable example.
9. Mango DB Map reduces operations: Implement Map reduces operation with suitable example using Mango DB

Group D- Mini Project: Database Project Life Cycle

10. Design and develop database application with following details:

- **Requirement Gathering and Scope finalization**
- **Database Analysis and Design:**
  - Design Entity Relationship Model, Relational Model, Database Normalization
  - Implementation :
  - Front End : Java/Perl/PHP/Python/Ruby/.net
  - Backend : MYSQL/Oracle/ MongoDB
  - Database Connectivity : ODBC/JDBC
- **Testing: Data Validation**
- Group of students should submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle: Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling features, Data Dictionary, Relational Database Design, Database Normalization, Graphical User Interface, Source Code, Testing document, Conclusion

Virtual LAB Links:

Link of the Virtual Lab: http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310347:Advanced Java Programming Lab

Teaching Scheme:	Credit: 01	Examination Scheme:
Theory: 02 Hrs. / week		Oral: 25 Marks

List of Laboratory Experiments

Group A (All are Compulsory)

1. Write a program to demonstrate status of key on an Applet window such as KeyPressed, KeyReleased, KeyUp, KeyDown.
2. Write a program to create a frame using AWT. Implement mouseClicked, mouseEntered() and mouseExited() events. Frame should become visible when the mouse enters it.
3. Develop a GUI which accepts the information regarding the marks for all the subjects of a student in the examination. Display the result for a student in a separate window.
4. Write a program to insert and retrieve the data from the database using JDBC.
5. Develop an RMI application which accepts a string or a number and checks that string or number is palindrome or not.
6. Write a program to demonstrate the use of InetAddress class and its factory methods.

Group B (Any Two)

7. A. Write Servlet (procedure for client side) to display the username and password accepted from the client.

   B. Write Servlet (procedure for server side) to display the username and password accepted from the client.
8. Write program with suitable example to develop your remote interface, implement your RMI server, implement application that create your server, also develop security policy file.
9. Write a database application that uses any JDBC driver.

Group C (Any Two)

10. Write a simple JSP page to display a simple message (It may be a simple html page).
11. Create login form and perform state management using Cookies, Http Session and URL Rewriting.
12. Create a simple calculator application using servlet.
13. Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database

Third Year of Electronics and Computer Engineering (2019 Course)

310348:Data Communication Lab

Teaching Scheme:	Credit: 01	Examination Scheme:
Theory: 02 Hrs.. / week		Practical: 50 Marks

Prerequisite Courses, if any: Principles of Communication System

Companion Course, if any: Data Communications

List of Laboratory Experiments

Group A: All experiments are compulsory.

1. Study of Network devices: Hubs/Repeaters, Switches, Bridges, Routers.
2. Experimental study of ASK modulation and demodulation
3. Experimental study of FSK modulation and demodulation
4. Experimental study of PSK modulation and demodulation
5. Experimental study of QPSK and OQPSK modulation and demodulation
6. Design and study of PN sequence generator.
7. Experimental study of generation and detection of Spread Spectrum System (DSSS)

Group B: Software Assignments: (Any Three)

8. Simulation study of Performance of M-aryPSK .
9. Simulation study of Performance of M-ary QAM.
10. Implementation of linear block code by using suitable software.
11. Implementation of Shannon Fano codes using suitable software.
12. Implementation of Huffman codes using suitable software.

Virtual LAB Links:

1. Link: https://www.etti.unibw.de/labalive/index/digitalmodulation/

2. Link: https://vlab.amrita.edu/index.php?sub=59&brch=163&sim=262&cnt=970

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310349:Microcontroller and Applications Lab

Teaching Scheme:	Credit: 01	Examination Scheme:
Theory: 02 Hrs. / week		Practical: 50 Marks

Microcontroller and Application Experiments:

List of Experiments:

Group A (Any 04)

1. Interfacing LED bank to 8051 microcontroller using timer with interrupt.
2. Interfacing Seven Segment Display to 8051 microcontroller
3. Interfacing DAC to 8051 microcontroller for generating various waveforms
4. Interfacing stepper motor to 8051 microcontroller.
5. Interfacing of LCD to 8051 microcontroller.

Group B (Any 04)

6. Learn and understand how to configure MSP-EXP430G2 digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).
   Exercises:
   a) Modify the code to make the green and red LEDs blink.
   b) Modify the delay with which the LED blinks.
7. Implement Pulse Width Modulation to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.
   Exercises: a) Observe the PWM waveform on a particular pin using CRO.
8. Interface IR sensor with MSP430G2553 to detect intruder and turn on buzzer.
9. Interface relay with MSP430G2553 and write embedded C program to turn on and off relay and DC motor.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310350:Data Analytics using Python Lab

Teaching Scheme:	Credit: 01	Examination Scheme:
Theory: 02 Hrs. / week		Termwork: 25 Marks

List of Experiments:

1. **Introduction to data analytics and Python fundamentals:**
   - Understanding the Data.
   - Python Packages for Data Science.
   - Importing and Exporting Data in Python.
   - Getting Started Analyzing Data in Python.
   - Accessing Databases with Python.
2. **Data Visualization in Python:**
   - **Matplotlib, Pandas, Seaborn**: Sactterplot, Barchart, Linechart, Histogram.
   - **Other Graphs**: Boxplot, Heatmap, Faceting, Pairplot.
3. **Data Wrangling:**
   - Pre-processing Data in Python
   - Dealing with Missing Values in Python
   - Data Formatting in Python
   - Data Normalization in Python
   - Binning in Python
   - Turning categorical variables into quantitative variables in Python
4. **Statistical Data Analysis:**
   - Probability.
   - Sampling & Sampling Distributions.
   - Hypothesis Testing.
5. **Exploratory Data Analysis:**
   - Descriptive Statistics.
   - Group By in Python.
   - Correlation.
   - Correlation – Statistics.
   - Analysis of Variance ANOVA.

6. **Model Development:**
    - Linear Regression and Multiple Linear Regression
    - Model Evaluation using Visualization
    - Polynomial Regression and Pipelines
    - Measures for In-Sample Evaluation
    - Prediction and Decision Making

Learning Resources:

Reference Books:

1. Jake Vander Plas and O'Reilly, "Python Data Science Handbook: Essential Tools for Working with Data"
2. Wes McKinney and O'Reilly, "Python for Data Analysis", 2nd Edition.
3. Joel Grus and O'Reilly, "Data Science from Scratch: First Principles with Python".

Web resources:

1. https://swayam.gov.in/nd1_noc20_cs46/

2. https://www.coursera.org/learn/data-analysis-with-python

3. https://www.geeksforgeeks.org/python-for-data-science/

4. https://www.coursera.org/learn/python-data-analysis/home/welcome/

5. https://www.udemy.com/course/data-science-with-python-a-complete-guide-3-in-1/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310351A:Mandatory Audit Course 5

Teaching Scheme:	Credit:	Examination Scheme:
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List of Courses to be opted (Any one) under Mandatory Audit Course 5

- Cyber Security
- Professional Ethic sand Etiquettes
- Engineering Economics
- Foreign Language
- MOOC-Learn New Skills

GUIDELINES FOR CONDUCTION OF AUDIT COURSE

In addition to credits courses, it is mandatory that there should be audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of audit course. The student may opt for two of the audit courses (One in each semester). Such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in the semester is provided in the curriculum. Student can choose one of the audit course from list of courses mentioned. Evaluation of audit course will be done at institute level.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

Selecting an Audit Course:

Using NPTEL Platform:

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of

NPTEL courses are available on its official website www.nptel.ac.in

1. Student can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
2. Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
3. After clearing the examination successfully; student will be awarded with certificate.

Assessment of an Audit Course:

1. The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
2. During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
3. On the satisfactory submission of assignments, the institute can mark as “Present” and the student will be awarded the grade AP on the marksheet.

SEMESTER - VI

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310352:Software Engineering and Project Management

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Principle of programming Language

Companion Course, if any:

Course Objectives: The main objective of this course is to introduce the students to software engineering- the fundaments of software engineering principles and practices, including project management, configurations management, requirements definition, system analysis, design, testing, and deployment with hands-on experience in a group software development project.

1. To learn and understand the principles of Software Engineering.
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply design and testing principles to software project development.
4. To understand project management through life cycle of the project.

Course Outcomes: On completion of the course, learner will be able to -

CO1: **Analyze** software requirements and formulate design solution for a software.

CO2: **Design** applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.

CO3: **Apply** new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.

CO4: **Model** and design User interface and component-level.

CO5: **Identify** and handle risk management and software configuration management.

CO6: **Utilize** knowledge of software testing approaches, approaches to verification and validation.

Course Contents

Unit I	Introduction to Software Engineering and Software Process Models	(06 Hrs.)

Software Engineering Fundamentals: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice. **Software Process:** A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and

Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, A Final Word on Evolutionary Processes. Unified Process, Agile software development: Agile methods, plan driven and agile development.

Mapping of Course Outcomes for Unit I	**CO1: Analyze software requirements and formulate design solution for Fsoftware.**

Unit II	**Software Requirements Engineering and Analysis**	**(07 Hrs.)**

Modeling: Requirements Engineering, Establishing the Groundwork, Identifying Stakeholders, Recognizing Multiple Viewpoints, Working toward Collaboration, Asking the First Questions, Eliciting Requirements, Collaborative Requirements Gathering, Usage Scenarios, Elicitation Work Products, Developing Use Cases, Building the Requirements Model, Elements of the Requirements Model, Negotiating Requirements, Validating Requirements.

Suggested Free Open Source tools: StarUML, Modelio, SmartDraw.

Mapping of Course Outcomes for Unit II	**CO2: Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.**

Unit III	**Estimation and Scheduling**	**(07 Hrs.)**

Estimation for Software Projects: The Project Planning Process, Defining Software Scope and Checking Feasibility, Resources management, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition Techniques, Software Sizing, Problem-Based Estimation, LOC-Based Estimation, FP-Based Estimation, Object Point (OP)-based estimation, Process- Based Estimation, Estimation with Use Cases, Use-Case–Based Estimation, Reconciling Estimates, Empirical Estimation Models, The Structure of Estimation Models

Project Scheduling: Project Scheduling, Defining a Task for the Software Project, Scheduling.

Suggested Free Open Source Tools: Gantt Project, Agantty, Project Libre.

Mapping of Course Outcomes for Unit III	**CO3: Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.**

Unit IV	**Design Engineering**	**(07 Hrs.)**

Design Concepts: Design within the Context of Software Engineering, The Design Process, Software Quality Guidelines and Attributes, Design Concepts - Abstraction, Architecture, design Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object-Oriented Design Concept, Design Classes, The Design Model, Data Design Elements, Architectural Design Elements, Interface Design Elements, Component-Level Design Elements, Component Level Design for Web Apps, Content Design at the Component Level, Functional

Design at the Component Level, Deployment-Level Design Elements.

Architectural Design: Software Architecture, What is Architecture, Why is Architecture Important, Architectural Styles, A brief Taxonomy of Architectural Styles.

Suggested Free Open Source Tool: Smart Draw

Mapping of Course Outcomes for Unit IV	**CO4: Model and design User interface and component-level.**

Unit V	**Risks and Configuration Management**	**(07 Hrs.)**

Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

Software Configuration Management: Software Configuration Management, The SCM Repository The SCM Process, Configuration Management for any suitable software system.

Suggested Free Open Source Tools: CF Engine Configuration Tool, Puppet Configuration Tool.

Mapping of Course Outcomes for Unit V	**CO5: Identify and handle risk management and software configuration management.**

Unit VI	**Software Testing**	**(07 Hrs.)**

Introduction to software testing, Principal of Testing, Testing Life Cycle, Phases of Testing, Types of Testing. Verification & Validation, Defect Management, Defect Life Cycle, Bug Reporting, GUI Testing, Test Management and Automation.

Mapping of Course Outcomes for Unit VI	**CO6: Utilize knowledge of software testing approaches, approaches to verification and validation.**

Learning Resources

Text Books:

1. Roger Pressman, "Software Engineering: A Practitioner's Approach"‖, McGraw Hill, ISBN 0– 07–337597–7
2. Ian Sommerville, "Software Engineering"‖, Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", PHI, ISBN-10: 0133056996
2. Rajib Mall, "Fundamentals of Software Engineering"‖, PHI, ISBN-13: 978-8120348981
3. PankajJalote, "An Integrated Approach to Software Engineering"‖, Springer, ISBN 13: 9788173192715.
4. S K Chang, "Handbook of Software Engineering and Knowledge Engineering"‖, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1
5. Tom Halt, "Handbook of Software Engineering", Clanye International ISBN-10: 1632402939

MOOC / NPTEL Courses:

1. NPTEL Course **"Software Engineering"**
https://onlinecourses.nptel.ac.in/noc19_cs69/preview

2. NPTEL Course on **"Software Engineering"**
https://swayam.gov.in/nd2_cec20_cs07/preview

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310353:Computer Networks and Security

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: -

Companion Course, if any:

Course Objectives:

1. To understand state-of-the-art in network protocols, architectures, and applications
2. To provide students with a theoretical and practical base in computer networks issues
3. To outline the basic network configurations
4. To understand the transmission methods underlying LAN and WAN technologies.
5. To understand security issues involved in LAN and Internet

Course Outcomes:

After successfully completing the course students will be able to

CO1: Understand fundamental principles of computer networking

CO2: Describe and analyze the hardware, software, components of a network and their interrelations.

CO3: Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies

CO4: Have a basic knowledge of installing and configuring networking applications.

CO5: Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols.

CO6: Have a basic knowledge of the use of cryptography and network security.

Unit I	Introduction to Computer Networks	(06 Hrs.)

Definition & Uses of computer Network, Network Hardware-LAN, WAN, MAN & Internet, Network Software-design Issues for layers, Service primitives and relationship of services to Protocols, Reference models-OSI &TCP/IP, network architectures introduction, Addressing types-Physical, Logical & port address, Protocols and Standards.

Mapping of Course Outcomes for Unit I	CO1: Understand fundamental principles of computer networking

Unit II	Physical Layer	(06 Hrs.)

Physical layer-Data rate limits, Transmission media-guided and Unguided, Switching systems- Circuit switching, Datagram Switching & Virtual circuit switching, Example of networks- X.25, Frame Relay & ATM, Structure of circuit and packet switch networks, cable modem and DSL technologies, Communication

satellites (LEO/MEO/GEO), Introduction to physical layer in 802.11 LAN & 802.15 WPAN.

Mapping of Course Outcomes for Unit II	CO2: Describe and analyze the hardware, software, components of a network and their interrelations.	
Unit III	**Data link layer**	**(06 Hrs.)**

Data link layer: Framing, Flow & Error control Protocols, noiseless channels, Noisy channels, HDLC, PPP, Multiple access techniques-random access, controlled access & Channelization, Ethernet types-bridged, Switched, Full duplex, Fast & gigabit Ethernet. Introduction to Data link layer in 802.11 LAN, Connecting devices like passive hubs, repeaters, Active hubs, Bridges, Two-layer Switches, Routers, three layer switches, Gateway etc., Backbone networks, Virtual LANs.

Mapping of Course Outcomes for Unit III	CO3: Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies	
Unit IV	**Network Layer and Transport Layer**	**(06 Hrs.)**

Network Layer: IPv4 address, IPv6 address, Address mapping-ARP, RARP & DHCP, IPv4 datagram detail format, IPv6 datagram detail format, ICMP, IGMP, Network layer issues like Delivery, forwarding, intra domain and Inter domain routing, Routing algorithms like Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Path vector routing etc., Simple Router architecture. Transport layer-Process to process delivery, Connection oriented & Connectionless Transport, UDP, TCP, congestion control and Quality of Service.

Mapping of Course Outcomes for Unit IV	CO4: Have a basic knowledge of installing and configuring networking applications.	
Unit V	**Application Layer**	**(06 Hrs.)**

Application layer protocols and applications like Ping, FTP, telnet, http (www), SMTP, SNMP, Trace route, TFTP, BOOTP, DNS, NFS, RPC, X-server, E-mail, Introduction to streaming Audio/Video,P2P file sharing, Introduction to socket & Socket Interface, Introduction to HTML programming.

Mapping of Course Outcomes for Unit V	CO5: Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols.	
Unit VI	**Basics of Network Security and Network administration**	**(06 Hrs.)**

Network security: Introduction to Cryptography, Secret key algorithm, public key algorithm, Hash Functions, Basics of Security Requirements/Services/Dimensions, Basics of Security attacks, Basics of Security mechanisms / solutions. Network Administration: UTP Cabling for PC to PC communication, Network tester, network monitoring, Protocol Analyzer, Network Simulation, internet access through Dialup/DSL/Leased Line/Mobile handset.

Mapping of Course Outcomes for Unit VI	CO6: Have a basic knowledge of the use of cryptography and network security

Learning Resources

Text Books

1.Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, TATA McGraw Hill

2. Andrew Tenenbaum, Computer Networks, 4th Edition, Pearson Education.

Reference Books

1. William Stallings, Computer Networks and Cryptography, 3rd edition, Pearson Education

2. Behrouz A. Forouzan, TCP/IP protocol Suit, 3rd edition, TATA McGraw Hill

3. Stevens, TCP/IP illustrated Volume - I & II, Pearson education.

4. Feibel Werner, Encyclopaedia of networking, Pearson education.

5. Frank J. Derfler, Practical Networking, 2nd edition, QUE international Publishing.

6. AtulKahate, Cryptography and Network Security, 2nd edition, TATA McGraw Hill

7. Kenneth Mansfield, Computer Networking from LANs to WANs: Hardware, Software & Security, CENGAGE learning.

8. NurulSarkar, Computer Networking & Hardware concepts, Information Science Publisher, USA. 9. Kurose & Ross, Computer Networking: A top Down Approach featuring the Internet. 3rd edition, Pearson Education

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310354:Embedded Processors and Applications

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		Insem (Theory): 30 Marks Endsem (Theory): 70 Marks

Prerequisite Courses, if any: Microcontroller and its Applications

Companion Course, if any:

Course Objectives:

1. To study the architecture of ARM series microprocessor
2. To study LPC2148 ARM7 microcontroller.
3. To study interfacing advanced peripherals to LPC2148 microcontroller
4. Study of ARM cortex architectures and its feature.
5. To learn about Embedded system for IoT application using ARM processors

Course outcomes:

After successful completion of the course students are able to

CO1: Demonstrate the ARM architectures and its feature.

CO2: Understand ARM7 Based Microcontroller LPC 2148 architecture

CO3: Interface the advanced peripherals to ARM based microcontroller

CO4: Demonstrate the ARM cortex M3 architectures and its feature.

CO5: Understand ARM CORTEX M4 based Microcontroller STM32F4xx architecture

CO6: Design simple applications using ARM and IoT

Mapping of Course Outcomes for Unit I	CO1: Demonstrate the ARM architectures and its feature.	
Unit I	**ARM7, ARM9, ARM11 Processors**	**(07Hrs.)**

Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features and applications, advantages & suitability of ARM processors for embedded application, ARM7 TDMI architecture / Core diagram, registers, CPSR, SPSR, Barrel shifter,ARM7 data flow model, programmers model, modes of operations, Addressing mode and instruction set.

Mapping of Course Outcomes for Unit II	CO2: Understand ARM7 Based Microcontroller LPC 2148 architecture	
Unit II	**ARM7 Based Microcontroller LPC 2148**	**(06 Hrs.)**

ARM7 Based Microcontroller LPC2148: Features, Architecture its Description, System Control Block (PLL and VPB divider), GPIO, Pin Connect Block, timer, interfacing with LED, LCD, Relay, Buzzer, Motion sensor, soil moisture sensor..

Mapping of Course Outcomes for Unit III	CO3: Interface the advanced peripherals to ARM based microcontroller	
Unit III	**Real World Interfacing with LPC 2148**	**(06 Hrs.)**
UART of LPC 2148, interfacing of LPC 2148 with PC using UART and embedded C program to send message to PC, interfacing the peripherals to LPC2148: GSM and GPS using UART (only algorithm and flow chart), on-chip ADC, EEPROM interfacing using I2C, on-chip DAC and its applications for waveform generation.		
Mapping of Course Outcomes for Unit IV	**CO4: Demonstrate the ARM cortex M3 architectures and its feature.**	
Unit IV	**ARM CORTEX Processors**	**(06 Hrs.)**
Introduction to ARM CORTEX series, advantages over classical series and for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications, ARM Cortex-M3 architecture, features and its functional description, advantages of ARM Cortex-M3 for embedded application, Comparison of ARM Cortex-M3 and ARM 7, Firmware development using CMSIS standard for ARM Cortex.		
Mapping of Course Outcomes for Unit V	**CO5: Understand ARM CORTEX M4 based Microcontroller STM32F4xx architecture**	
Unit V	**Introduction to ARM CORTEX M4 Based Microcontroller**	**(07Hrs.)**
Introduction to ARM CORTEX M4 microprocessor core, programmer model, Processor Modes, Memory Map, STM32F4xx Architecture, STM32F4xx Clock and SYSCLK, Peripheral Clock, PLL clock, GPIO Programming, Interfacing seven segment LED, LDR and MQ3 sensor with STM32F4xx, STM32F4xx: Counters and Timers: Timer and Delay Generation.		
Mapping of Course Outcomes for Unit VI	**CO6: Design simple applications using ARM and IoT**	
Unit VI	**Embedded System and Internet of Things**	**(06 Hrs.)**
Introduction to Embedded System and its characteristics and architecture, introduction to Internet of Things and its architecture, Sensors and actuators, Basic block diagram of Embedded System with IoT, Case study using IoT: Smart Home automation, Waste Management for Smart City, Smart Car, Parking system, health monitoring system, agriculture automation, Transportation management		

Learning Resources

Text Books:

1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Develops Guide – Designing and Optimizing System Software", ELSEVIER
2. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Develops Guide – Designing and Optimizing
3. Shujen Chen, Muhammad Ali Mazidi, EshraghGhaemi, "STM32 Arm Programming for Embedded Systems: Using C Language with STM32", Nucleo, Micro DigitalEd., Illustrated Edition,2018.

Reference Books

1. LPC214xUser manual(UM10139):-www.nxp.com
2. ARM architecture reference manual:-www.arm.com
3. https://developer.arm.com/ip-products/processors/cortex-m/cortex-m3
4. RM0390 Reference manual, STM32F446xx advanced Arm®-based 32-bit MCUs
5. ARM architecture reference manual : - www.arm.com
6. https://class.ece.uw.edu/474/peckol/doc/StellarisDocumentation/IntroToCortex-M3.pdf

MOOC / NPTEL Courses:

NPTEL Course on " Embedded System Design with ARM "

Link: https://nptel.ac.in/courses/106/105/106105193/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310355A:Elective-II - Software Modeling and Design

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any:

1. Basic Knowledge of Object-oriented Programming
2. Software Engineering
3. Database Management System

Companion Course, if any: Software Modeling and Design Lab

Course Objectives: To make the students understand

1. To understand UML and its use to arrive at a design solution for real world problems.
2. To understand basics of object-oriented Modeling.
3. To learn Design concepts in the development of for real world problems using object modeling.
4. To explore Interaction and behavior modeling.
5. To understand Software design principles and patterns.
6. To explore the architectural design guidelines in various type of application development.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Understand basics of object oriented methodologies and Unified Modeling Language (UML).

CO2: Apply analysis process, use case modeling, domain/class modeling.

CO3: Design and apply interaction and behavior modeling on a given system.

CO4: Comprehend OO design process and business, access and view layer class design.

CO5: Recognize the software design principles and patterns to be applied on system.

CO6: Illustrate architectural design principles and guidelines in the various type of application development.

Course Contents

Unit I	INTRODUCTION TO OOM AND UML	(06 Hrs.)

Introduction to Object Oriented Methodology- Study of various design methodologies like Object Oriented Design by Booch, Object Modelling Techniques by Rumbaugh, Object-Oriented Analysis by Codd Yourdon and Object-Oriented Software Engineering by Ivar Jacobson

Unified Approach – Unification of Booch, Rumbaugh and Jacobson methodologies, Object - Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modelling based on

UML , Layered Approach

Unified Modeling Language – Introduction to Modeling and UML2.0, MDA, UML2.0 Structure, UML Building Blocks, UML common Mechanisms, Introduction to all UML2.0 Diagram notational Techniques, 4+1View

Mapping of Course Outcomes for Unit I	**CO1: Understand basics of object oriented methodologies and Unified Modeling Language (UML).**

Unit II	**OBJECT ORIENTED ANALYSIS**	**(06 Hrs.)**

Object Oriented Analysis Process: Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Case Identification, Uses/Include/Extend Association, Writing a formal use case, Forward Engineering (Use case realization)

Class Modeling: Approach for identifying class, Approaches for identifying classes, Class pattern approach, Class Responsibilities, Collaboration Approach, Naming Classes, Class associations Generalization specialization relationship, Aggregation and Composition Relationships

Mapping of Course Outcomes for Unit II	**CO2: Apply analysis process, use case modeling, domain/class modeling.**

Unit III	**INTERACTION AND BEHAVIOR MODELING**	**(06 Hrs.)**

Activity Diagram: Activity and Actions, Activity Edge, Decision and Merge Points, Fork-Join, Control Flow, Constraints on Action, Swim Lanes.

Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, delete object, Modelling Interactions.

Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram.

State Diagram: State Machine, Triggers and Ports, Transitions and conditions, Initial and Final State, nested state, Composite States, Submachine States.

Mapping of Course Outcomes for Unit III	**CO3: Design and apply interaction and behavior modeling on a given system.**

Unit IV	**OBJECT ORIENTED DESIGN PROCESS**	**(06 Hrs.)**

Object Oriented Design Process: Designing Business Layer: Object Oriented Constraints Language (OCL), **Designing Business Classes:** The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes.

Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table — Inherited Classes Mapping, Designing the Access Layer Classes: create mirror classes, identify access layer class relationships, eliminate redundant classes, create method classes.

Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process – identify view layer objects, and build prototype for view layer Interface.

Test Usability and User satisfaction: Component and Deployment Design using Component and Deployment Diagram.

Mapping of Course Outcomes for Unit IV	**CO4: Comprehend OO design process and business, access and view layer class design.**	
Unit V	**SOFTWARE DESIGN PRINCIPLES AND PATTERNS**	**(06 Hrs.)**
Introduction and need of Design Principles: General Responsibility Assignment Software Patterns (GRASP): Introduction, Creator, Information Expert, Low coupling, Controller, High Cohesion, Polymorphism, Pure fabrication, Indirection, Protected Variations. **Introduction to GOF design patterns :** Types of design patterns: Creational Pattern: Singleton, Factory **Structural Pattern:** Adapter, Façade Behavioral Patterns: Strategy, State		
Mapping of Course Outcomes for Unit V	**CO5: Recognize the software design principles and patterns to be applied on system.**	
Unit VI	**SOFTWARE ARCHITECTURAL DESIGN**	**(06 Hrs.)**
Anatomy of Software Architecture, Quality attributes in architecture design, Designing Object-Oriented Software Architecture, Designing Client/Server Software Architecture, Designing Service-Oriented Architectures, Designing Component-Based Software Architectures, Designing Concurrent and Real-Time Software Architectures. Product Line Architecture design.		
Mapping of Course Outcomes for Unit VI	**CO6: Illustrate architectural design principles and guidelines in the various type of application development.**	

Learning Resources

Text Books:

1. Ali Bahrami, Object Oriented systems Development using Unified Modelling Language McGraw – Hill, International Editions 1999, ISBN: 0-07-1160090-6
2. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition, ISBN: 9789332555402, 9332555400.

Reference Books:

1. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub., ISBN:8184040024, 9788184040029.
2. Object-Oriented Analysis and Design with Applications, Third Edition by Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, and Kelli Houston, 2007.
3. An introduction to Software Architecture by Shaw & Garlan, http://sunnyday.mit.edu/16.355/intro_softarch.pdf
4. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures, Cambridge University Press, ISBN: 978-0-521-76414-8.
5. JIM Arlow, IlaNeustadt, UML 2 and the Unified Process, Pearson, Second Edition, ISBN: 9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN: 9788126504527.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310355B:Elective II - Advanced Database Management System

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any: Database Management System

Companion Course, if any:

Course Objectives:

1. To understand the fundamental concepts of Relational and Object-oriented databases.
2. To learn and understand various Parallel and Distributed Database Architectures and Applications.
3. To understand and apply the basic concepts, categories and tools of NoSQL Database.
4. To learn and understand Data warehouse and OLAP Architectures and Applications.
5. To learn data mining architecture, algorithms, software tools and applications.
6. To learn enhanced data models for advanced database applications.

Course Outcomes: On completion of the course, learner will be able to

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 model for advanced applications.

Course Contents

Unit I	Review Of Relational Data Model and Relational Database Constraints	(06Hrs.)

Relational model concepts, Relational model constraints and relational database schemas, Update operations, anomalies, dealing with constraint violations, Types and violations. **Overview of Object-Oriented Concepts**–Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, Class hierarchies, polymorphism examples.

Mapping of Course Outcomes for Unit I	CO1: Differentiate relational and object-oriented databases.

Unit II	Concepts for Object Databases	(06Hrs.)

Object Identity– Object structure Type Constructors–

Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance. XML Databases: XML - Related Technologies - XML Schema - XML Query Languages - Storing XML in

Databases- XML and SQL.		
Mapping of Course Outcomes for Unit II	**CO2: Illustrate parallel & distributed database architectures.**	
Unit III	**NOSQLDATABASES**	**(06Hrs.)**
Introduction, **Overview, and History of NoSQL Databases**- The definition of Four Types of No SQL Databases. NoSQL Key/Value Database: MongoDB, **Column-Oriented Database:** Apache Cassandra, Comparison of Relational and NoSQL databases, NoSQL database Development Tools(Map Reduce/Hive) and Programming Languages(XML/JSON)		
Mapping of Course Outcomes for Unit III	**CO3: Apply concepts of NoSQL Databases.**	
Unit IV	**DATA WAREHOUSING**	**(06Hrs.)**
Architectures and components of data warehouse, Characteristics and limitations of data warehouse, Data ware house schema(Star, Snow flake), OLAP Architecture (ROLAP/MOLAP/HOLAP), Introduction to decision support system, Views and Decision support		
Mapping of Course Outcomes for Unit IV	**CO4: Explain concepts of data warehouse and OLAP technologies.**	
Unit V	**DATA MINING**	**(06Hrs.)**
Introduction to Data Mining, KDD seven step process, Architecture of data mining, Introduction to Predictive and descriptive algorithms, Data mining software and applications		
Mapping of Course Outcomes for Unit V	**CO5: Apply data mining algorithms and various software tools.**	
Unit VI	**ENHANCED DATA MODELS FOR ADVANCED APPLICATIONS**	**(06Hrs.)**
Active database concepts and triggers; Temporal, Spatial, and Deductive Databases–Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.		
Mapping of Course Outcomes for Unit VI	**CO6: Comprehend emerging and enhanced data model for advanced applications.**	

Learning Resources

Text Books:

1. Silberschatz A.,Korth H., Sudarshan S, Database System Concepts,McGraw Hill Publication,ISBN-0-07-120413-X,SixthEdition.
2. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication,ISBN-978-81-317-6092-5.

Reference Books:

1. Kristina Chodorow, Michael Dirolf,“MongoDB: The Definitive Guide”,O’Reilly Publications
2. Jiawei Han,MichelineKamber,JianPei,“Data Mining: Concepts and Techniques” , Elsevier
3. Mario Piattini ,Oscar Diaz“Advanced Database Technology and Design”-online book.

4. M. Tamer Özsu, Patrick Valduriez, “Principles of Distributed Database Systems” PrenticeHall,1999.

5. Ramez Elmasri and Shamk ant B. Navathe “Fundamentals of Database System”7th Edition

MOOC/NPTEL Courses:

- https://nptel.ac.in/courses/106105175
- https://nptel.ac.in/course/106105174
- Data Mining-Course : (swayam2.ac.in)

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310355C:Elective II - Power Electronics

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any: Power Electronics Lab

Course Objectives: To make the students understand

1. To understand construction, switching characteristics and protection of power devices.
2. To understand protection circuits and triggering circuits for power devices.
3. To give an exposure to students of working & analysis of controlled rectifiers, Inverters, choppers, AC voltage controllers for different loads.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Select power devices for different power conversion applications.

CO2: Design & Implement gate drive circuits for power devices.

CO3: Understand the operation of Controlled rectifiers.

CO4: Understand the operation of Choppers and Single phase AC voltage controller.

CO5: Understand the operation of Inverters.

CO6: Utilize Power Electronics Converters in various industrial applications.

Course Contents

Unit I	Power Devices	(06 Hrs.)

SCR: Construction, Operation & characteristics, different ratings.

Power MOSFET: Construction, Operation, Static characteristics, Switching characteristics, Breakdown voltages, Safe Operating Area.

IGBT: Construction, Operation, Steady state characteristics, Switching characteristics, Safe operating area, applications.

Performance overview of Silicon, Silicon Carbide &GaN based MOSFET and IGBT. Comparison of SCR, Power MOSFET and IGBT.

Mapping of Course Outcomes for Unit I	CO1: Assimilate the physics, characteristics and parameters of SCR, MOSFET and IGBT towards its application as a switch.

Unit II	Gate drive circuits and Protection circuits for Power Devices	(06 Hrs.)

Gate/Base drive circuits: for Power MOSFET, IGBT, SCR, Need & requirements of Isolation of Gate and base drives using pulse transformers and Opto-coupler, Synchronized UJT triggering for SCR,

Microprocessor based triggering circuit. Protection circuits for Power Devices: Cooling and heat sinks. Snubber circuits, Voltage protection by Selenium diodes and MOVs. Current protections using fuse		
Mapping of Course Outcomes for Unit II	**CO2: Design Gate drive circuits and Protection circuits for Power devices for given specifications.**	
Unit III	**Controlled Rectifiers**	**(06 Hrs.)**
Single phase Semi & Full converters for R, R-L load, Performance parameters. Three phase Semi & Full converters, Single Phase PWM Rectifier using IGBT, Three Phase Controlled Rectifier Using IGBT, and Difference between SCR based conventional rectifiers and IGBT based rectifiers. Power factor improvement techniques, Supply side filters for harmonic eliminations, Load side filters for ripple reduction. Overview of applications of Controlled rectifies in DC drives.		
Mapping of Course Outcomes for Unit III	**CO3: Analyze and assess the performance of Controlled Rectifiers with their variants, towards applications in DC drives.**	
Unit IV	**Choppers & AC Voltage Controllers**	**(06 Hrs.)**
Step down chopper for R/RL load, Step up chopper, Control strategies. 2-quadrant & 4 quadrant choppers, Performance parameters, Design of control circuit using PWM IC LM3524. Applications of choppers, SMPS, Overview of applications of Choppers in DC drive. AC Voltage Controllers: Single phase AC Voltage Controller for R load.		
Mapping of Course Outcomes for Unit IV	**CO4: Analyze and assess different types of choppers and its performance Parameters towards applications in SMPS and DC drives.**	
Unit V	**Inverters**	**(06 Hrs.)**
Single phase full bridge inverter for R & R-L loads, performance parameters, three phase voltage source inverter for balanced star R load. Variable frequency and Voltage control of inverters. Need of PWM inverters. Design of control circuit for single phase inverters using PWM IC LM3524, Overview of applications of three phase PWM inverters for three phase variable frequency drives (VFDs)		
Mapping of Course Outcomes for Unit V	**CO5: Analyze and assess different types of Inverters and its performance Parameters towards applications in PWM inverters for three phase variable frequency drives.**	
Unit VI	**Industrial Applications of Power Electronics**	**(06 Hrs.)**
Electric Vehicles & Traction applications, HVDC transmission system, UPS: ON-line and OFF line. Battery Charging Applications, Induction heating applications.		
Mapping of Course Outcomes for Unit VI	**CO6: Understand and explain the various Industrial Applications of Power Electronics**	
Learning Resources		
Text Books: **1. Power Electronics** – M. H. Rashid, Prentice Hall of India Pvt. Ltd. **2. Power Electronics:** Converters, Applications and Design – Ned Mohan, Tore M. Undeland and		

William P. Robbins, 3rd Edition, John Wiley and Sons.

Reference Books:

1. **Power Electronics**- M. D. Singh and Khanchandani K. B., Tata McGraw Hill Publishing Company Limited.
2. **Power Electronics** – Cyril W. Lander.

MOOC / NPTEL Courses:

1. NPTEL Course on **"Power Electronics"**

https://nptel.ac.in/courses/108105066

https://nptel.ac.in/courses/108102145

https://nptel.ac.in/courses/108107128

https://nptel.ac.in/courses/108108077

https://batteryuniversity.com/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310355D:Elective II - PLC and Automation

Teaching Scheme:	Credit: 03	Examination Scheme:
Theory: 03 Hrs. / week		In-Sem (Theory): 30 Marks End-Sem (Theory): 70 Marks

Companion Course, if any: Elective-II Lab

Course Objectives:

1. Discuss importance, purpose, functions and operations of the PLC in industrial application.
2. The ladder diagrams for industrial control applications.
3. Aware how to select the essential elements and practices needed to develop and implement the engineering automation using PLC.

Course Outcomes: On completion of the course, learner will be able to -

CO1: Apply concepts of PLC, its uses for industrial applications.

CO2: Demonstrate Relay logic instructions & PLC ladder programs for industrial applications.

CO3: Demonstrate timer, counter arithmetic, comparison functions & PLC ladder programs for industrial applications.

CO4: Make use of knowledge of Installation, troubleshooting & maintenance of PLC to provide solution for industrial automation problems.

CO5: Describe fundamentals of process control, SCADA & HMI

CO6: Select appropriate interfacing technique & communication protocol to establish communication with field devices, HMI & SCADA.

Course Contents

Unit I	PLC Overview	(06 Hrs.)

Definition & History of PLC, Basic structure & Components of PLC, Principle of Operation, Selection of PLC, Why Use PLC, PLC I/O Modules, Memory & How it is used, PLC advantages &Disadvantages, PLC vs Computers, Overview of Micro PLCs. Conventional ladders vs PLC Ladder logic, What is Logic? Overview of Logic functions, Number systems & Codes, Hardwired Logic vs Programmed logic, Programming word level logic instructions, Relation of digital gate logic to contact/coil logic

Mapping of Course Outcomes for Unit I	CO1: Apply concepts of PLC, its uses for industrial applications.

Unit II	Basics of PLC Programming –I	(06 Hrs.)

Processor memory organization, PLC Programming languages, Ladder diagrams, Relays, contactors, switches, sensors, output control devices, latching relays, ladder diagram elements. Instructions: Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming. Develop a PLC ladder logic diagram for given situation: A railway station has 3 platforms A, B and C. A train is coming into the station. It has to be given entry to platform A if A is empty. If both A and B are occupied then it has to be given entry to platform C. If all the platforms are full then the train has to wait.		
Mapping of Course Outcomes for Unit II	**CO2: Demonstrate Relay logic instructions & PLC ladder programs for industrial applications.**	
Unit III	**Basics of PLC Programming –II**	**(06 Hrs.)**
Basic Functions : PLC Timer & Counter functions, Timer & Counter Industrial applications, Arithmetic functions, Comparison functions, Jump functions, Data handling functions, Digital Bit functions, PLC matrix Functions, Advanced PLC Functions: Analog PLC operation, PID control of Continuous processes. Develop PLC program for following statement: Motor 1 (M1) starts as soon as start switch is ON; after 10 Seconds M1 goes off and Motor 2 (M2) starts. After 5 seconds M2 goes OFF and M3 starts. After 10 Seconds M3 goes off, M1 Starts. and the cycle is repeated. When stop switch is ON, all Motors are stop.		
Mapping of Course Outcomes for Unit III	**CO3: Demonstrate timer, counter arithmetic, comparison functions & PLC ladder programs for industrial applications.**	
Unit IV	**PLC Installation, Troubleshooting & Maintenance**	**(06 Hrs.)**
Installation : Consideration of operating environment, Receiving test, check & assembly, Electrical Noise, Leaky inputs & outputs, Grounding, voltage variations & surges, Circuit protections & wiring, Program Editing& Commissioning. Troubleshooting: Processor module, Input & Output malfunctions, Ladder logic program. PLC Maintenance.		
Mapping of Course Outcomes for Unit IV	**CO4: Make use of knowledge of Installation, troubleshooting & maintenance of PLC to provide solution for industrial automation problems.**	
Unit V	**Process control, HMI & SCADA**	**(06 Hrs.)**
Types of processes, structure of control systems, on/off control, PID Control, Motion control, SCADA (Supervisory control and data acquisition): Block diagram, RTU (Remote terminal unit), Functions of RTU, MTU (Main terminal unit), functions of MTU, operating interfaces& applications, HMI (Human Machine Interface, Interfacing technique of PLC with HMI.		
Mapping of Course Outcomes for Unit V	**CO5: Describe fundamentals of process control, SCADA & HMI.**	
Unit VI	**PLC Networking**	**(06 Hrs.)**
Types of communication interface, Types of networking channels, Advantages of standard		

industrial network, Data Communications, Serial communication, Industrial network : CAN (Controller area network), DeviceNet, ControlNet, EtherNet/IP, Modbus, Fieldbus, Profibus-PA/DP	
Mapping of Course Outcomes for Unit VI	**CO6: Select appropriate interfacing technique & communication protocol to establish communication with field devices, HMI & SCADA.**

Learning Resources

Text Books:

1. Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, Fourth Edition.

Reference Books:

1. Programmable logic controllers & Industrial Automation- Madhuchandra Mitra, Samarjeet Sen Gupta Penram International Pvt. Ltd., Fourth reprint, 2012
2. Programmable Logic Controllers, W. Bolton, Elsevier, Fourth Edition,2015
3. Programmable Logic Controllers, Principles & Applications" John W. Wobb, Ronald, A. Rais, PHI publishing, Fifth Edition
4. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson, Delmar Learning, 3rd Edition.

MOOC / NPTEL Courses:

1. NPTEL Course on "**Industrial Automation and Control**"
   Link: https://nptel.ac.in/courses/108/105/108105062/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310356:Computer Networks & Security Lab

Teaching Scheme:	Credit: 01	Examination Scheme:
Theory: 02 Hrs. / week		Oral: 25 Marks Termwork: 25 Marks

List of Laboratory Experiments

(Perform any 8 experiments)

1. Study of network commands & IP address configurations.
2. Study of Cable tester for fault detection of UTP-CAT5 Cross / Straight LAN cable.
3. Implementation of LAN using star topology and connectivity between two computers using cross over UTP CAT5 cable. (Cisco Packet Tracer)
4. Installation and configuration of Web Server and hosting web page using HTML programming. (Cisco Packet Tracer)
5. Installation and configuration of Proxy Server.
6. Installation and configuration of FTP server for FTP communication.
7. Installation and configuration of Telnet server for Telnet Communication. (Teamviewer)
8. Write a program in „C" for Encryption and Decryption (RSA Algorithm).
9. Write a program in „C" for Shortest Path algorithm.
10. Connectivity of LAN computers to Internet using Dial-Up modem/leased line Modem /Mobile Handset. (Installation and configuration).
11. Installation of Suitable Protocol Analyzing software and Analysis of Intranet activities. (Wireshark)
12. Configure RIP using packet Tracer.
13. Study of any network simulation tools-To create a network with three nodes & establish a TCP connection between node 0 & node 1 such that node 0 will send TCP packet to node 2 via node 1.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310357:Embedded Processor and Applications Lab

Teaching Scheme:	Credit: 01	Examination Scheme:
Theory: 02 Hrs. / week		Practical: 50 Marks

List of Laboratory Experiments:

Conduct any 07 (seven) experiment form (Group A) 01 to 11 and Conduct any 03 (three) experiment form (Group B) 12 to 17.

GROUP A

1. Interfacing LPC2148 to LCD and display message on LCD
2. Interfacing LPC 2148 to seven segment display and display a count form 0 to 9 with suitable delay.
3. Interfacing LPC2148 to RGB LED and display the possible color generated by RGB LED
4. Interfacing LPC2148 for internal ADC and program to display digital value on serial port or on LCD
5. Interfacing LPC2148 for internal DAC and program to generate waveform
6. Interface LM 35 temperature with LPC 2148 and turn on LED if temperature exceeds 50 0C
7. Interface IR sensor and buzzer with LPC2148 and turn on buzzer when intruder detected
8. Interface switch and DC motor with LPC2148. Write embedded C program to turn ON/OFF using switch
9. LPC2148UART Interfacing LPC2148 in embedded system (GSM/GPS)
10. Interfacing EEPROM to LPC2148 using I2C protocol
11. Write embedded C program to use timer block of LPC 2148 to generate suitable delay to toggle LEDs.

Group B:

12. Interfacing Seven Segment LED using STM32F4xx
13. Embedded C program to transmit a character from keyboard using on chip UART for STM32F4xx.
14. Write embedded C program to on chip ADC implementation with STM32F4xx
15. To control speed and direction of DC Motor using PWM Block for STM32F4xx
16. Interfacing Ultrasonic Sensor HC-SR04 with STM32F4xx.
17. Interfacing LDR and MQ3 sensor with STM32F4xx

Virtual LAB Links:

Link of the Virtual Lab: http: // vlabs.iikgp.ernet.in/rtes/

Note: Additional 2 experiments to be performed using the virtual lab

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310358: Elective-II Lab (Software Modeling and Design)

Teaching Scheme:	Credit: 01	Examination Scheme:
Practical: 02 Hrs.. / week		Oral: 50 Marks

Prerequisite Courses, if any: -

1. Problem Solving & Object-Oriented Programming.

2. Software Engineering and Project Management.

Companion Course, if any: Software Modeling and Design

List of Laboratory Experiments: (All Experiments are Compulsory)

1. **Write Problem Statement for System / Project**

   Identify Project of enough complexity, which has at least 4-5 major functionalities.

   Identify stakeholders, actors and write detail problem statement for your system.

2. **Prepare Use Case Model**

   Identify Major Use Cases, Identify actors.

   Write Use Case specification for all major Use Cases.

   Draw detail Use Case Diagram using UML2.0 notations.

3. **Prepare Activity Model**

   Identify Activity states and Action states.

   Draw Activity diagram with Swim lanes using UML2.0 Notations for major Use Cases

4. **Prepare Analysis Model-Class Model**

   Identify Analysis Classes and assign responsibilities.

   Prepare Data Dictionary.

   Draw Analysis class Model using UML2.0 Notations.

   Implement Analysis class Model-class diagram with a suitable object oriented language

5. **Prepare a Design Model from Analysis Model**

   Study in detail working of system/Project.

   Identify Design classes/ Evolve Analysis Model. Use advanced relationships.

   Draw Design class Model using OCL and UML2.0 Notations.

   Implement the design model with a suitable object-oriented language.

6. **Prepare Sequence Model.**

   Identify at least 5 major scenarios (sequence flow) for your system.

   Draw Sequence Diagram for every scenario by using advanced notations using UML2.0

Implement these scenarios by taking reference of design model implementation using suitable object-oriented language.

7. **Prepare a State Model**

Identify States and events for your system.

Study state transitions and identify Guard conditions.

Draw State chart diagram with advanced UML 2 notations.

Implement the state model with a suitable object-oriented language.

Reference Books:

1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011

2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education

3. UML 2 and the Unified Process, Second Edition, JIM Arlow, IlaNeustadt, Pearson

4. Design Patterns: Elements of Reusable Object Oriented Software, Erich Gamma, Pearson

5. Design Patterns in Java Second Edition by Steven John Metsker, Pearson

All the practicals/assignments should be conducted on Latest version of Open Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310358: Elective-II Lab (Advanced Database Management System)

Teaching Scheme:	Credit: 01	Examination Scheme:
Practical: 02 Hrs.. / week		Oral: 50 Marks

Prerequisite Courses, if any: -Database Management System

Companion Course, if any:

List of Laboratory Experiments (All Experiments are Compulsory)

1. Create a database with suitable example using MongoDB and implement • Inserting and saving document(batch insert, insert validation)
   - Removing document
   - Updating document (document replacement, using modifiers, upinserts, updating Multiplied documents, returning updated documents)
   - Execute at least 10 queries on any suitable MongoDB database that demonstrates following:
     - Find and find One(specific values)
     - Query criteria (Queryconditionals,ORqueries,$not, Conditional semantics)Type- specific queries(Null, Regular expression, Querying arrays)
     - $where queries
     - Cursors(Limit, skip, sort, advanced query options)
2. Implement Map-reduce and aggregation, indexing with suitable example in MongoDB. Demonstrate the following:
   - Aggregation framework
   - Create and drop different types of indexes and explain () to show the advantage of the indexes.
3. Case Study: Design conceptual model using Star and Snow flake schema for anyone database.
4. **Mini Project**

   Pre-requisite: Build the mini project based on the requirement document and design prepared as a part of Database Management Lab in second year.
   - Form team so far around 3to 4 people.
   - Develop the application:

     Build a suitable GUI by using forms and placing the controls on it for any application. Proper data entry validations are expected.

     Add the database connection with frontend. Implement the basic CRUD operations.
   - Prepare and submit report to include: Title of the Project, Abstract, List the hardware and software requirements at the backend and at the front end, Source Code, Graphical User Interface, Conclusion.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310358: Elective-II Lab (Power Electronics)

Teaching Scheme:	Credit: 01	Examination Scheme:
Practical: 02 Hrs. / week		Oral: 50 Marks

Prerequisite Courses, if any: -

Companion Course, if any: 204181 - Electronic Circuits

List of Laboratory Experiments:

[Any 8 to be performed]

1. V-I Characteristics of MOSFET / IGBT
2. V-I Characteristics of SCR & measurement of holding & latching current
3. Triggering circuit for MOSFET / IGBT.
4. Triggering circuit for thyristor (Using UJT or specialized IC)
5. Single phase Semi / Full Converter with R & R-L load
6. Three phase Semi / Full Converter with R load
7. Single/Three Phase PWM bridge inverter for R load
8. Load and Line Regulation of SMPS
9. Simulation of Three phase Semi/Full converter for R and RL load.
10. Simulation of Three phase PWM inverters for R and RL load

Virtual LAB Links:

Link of the Virtual Lab:

http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/power_electronics/labs/index.php

Note: Two experiments to be performed using the virtual labs.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310358: Elective-II Lab (PLC and Automation)

Teaching Scheme:	Credit: 01	Examination Scheme:
Practical: 02 Hrs.. / week		Oral: 50 Marks

List of Laboratory Experiments:

[Any 8 to be performed]

1. Simulate & implement basic logic gates ladder logic program.
2. Simulate & implement simple start/stop ladder logic.
3. Simulate & implement single push button on/off ladder logic.
4. Simulate & implement PLC program example with on delay timer.
5. Simulate & implement PLC program example with Off delay timer.
6. Design & simulate PLC program example with Retentive Timer.
7. Design & simulate ladder diagram for DOL Motor Starter.
8. Design & simulate traffic light ladder logic diagram.
9. Star Delta PLC Ladder Diagram.
10. Simulate ladder diagram for Bottle Filling Plant.
11. Simulate PLC ladder diagram for Elevator Control.
12. Implement traffic light ladder logic using PLC hardware.

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310359: Mini Project

Teaching Scheme:	Credit: 02	Examination Scheme:
Theory: 04 Hrs. / week		Oral: 25 marks Termwork: 25 marks

Course Objectives:

1. To understand the "Product Development Process" including budgeting through Mini Project.
2. To plan for various activities of the project and distribute the work amongst team members.
3. To inculcate electronic hardware/software implementation skills by -
4. Learning design and development of software based applications.
5. Imbibing good soldering and effective trouble-shooting practices.
6. To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
7. To understand the importance of document design by compiling Technical Report on the MiniProject work carried out.

Course Outcomes:

On completion of the course, student will be able to

CO1: Understand, plan and execute a Mini Project with team.

CO2: Implement electronic hardware/software by design and development process

CO3: Prepare a technical report based on the Mini project.

CO4: Deliver technical seminar based on the Mini Project work carried out.

a. Execution of Mini Project

- Project group shall consist of not more than 3 students per group.
- Mini Project Work should be carried out in the Projects software and hardware laboratory.
- Project designs ideas can be necessarily adapted from recent issues/innovative ideas
- Mini Project can be either hardware based or software based
- Bare board test report shall be generated in case of hardware based Mini Project
- Assembly of components and enclosure design is mandatory in case of hardware based Mini Project

b. Selection: Domains for projects may be from the following, but not limited to:

1. Hardware based Mini Project (Innovative ideas)

- Instrumentation and Control Systems
- Electronic Communication Systems
- Biomedical Electronics
- Power Electronics
- Audio , Video Systems
- Embedded Systems
- Mechatronic Systems
- Microcontroller based projects should preferably use Microchip PIC controllers / ATmega controller / AVR microcontrollers / Arduino / Raspberry Pi.

2. Software based Mini Project (Innovative ideas)

- C/C++ based software Projects
- Python based software Projects
- Java based software Projects
- Database management based software Projects
- Artificial Intelligence based software Projects
- Machine Learning based software Projects
- Android based software Projects
- Data Analytic based software Projects

  etc.

c. Monitoring: (for students and teachers both): Suggested Plan for various activities to be monitored by the teacher.

- Week 1 & 2: Formation of groups, Finalization of Mini project & Distribution of work.
- Week 3 &4: PCB artwork design using an appropriate EDA tool, Simulation hardware based Mini project
- Week 3 & 4: Development of architectural model or algorithm for software based Mini project
- Week 5 to 8: PCB manufacturing through vendor/at lab, Hardware assembly, programming(if required) Testing, Enclosure Design, Fabrication etc. for hardware based Mini project
- Week 5 to 8: design and testing of modular programs for software based Mini project
- Week 9 & 10: Testing of final product/software, Preparation, Checking & Correcting of the Draft Copy of Report
- Week 11 & 12: Demonstration and Group presentations.

Log book for all these activities shall be maintained and shall be produced at the time of examination.

d. Report writing: A project report with following contents shall be prepared:

A. For Hardware based Mini Project

- Title
- Abstract
- Introduction
- Aim and Objectives
- Specifications
- Block Diagram
- Circuit Diagram
- Selection of components, calculations
- Simulation Results
- PCB Art work
- Testing Procedures
- Enclosure Design
- Test Results
- Conclusion and future work
- References

B. For Software based Mini Project

- Title
- Abstract
- Introduction
- Scope of the Work
- Requirements of software project
- Aim and Objectives
- Proposed architecture/methodology
- Details of Software used
- Algorithm and flow chart
- User Interface
- Experimentation
- Test Results
- Conclusion and Future work
- Project source code & program
- References

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310360:Internship**

Teaching Scheme:	Credit: 04	Examination Scheme:
Theory: Hrs.. / week		Termwork: 100 Marks

Course Objectives:

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real-life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes: On completion of the course, learners should be able to

CO1:Demonstrate professional competence through industry internship.

CO2: Apply knowledge gained through internships to complete academic activities p rofessional manner.

CO3: Choose appropriate technology and tools to solve given problem.

CO4: Demonstrate abilities of a responsible professional and use ethical practices in day day life.

CO5: Creating network, social circle and developing relationships with industry people.

CO6: Analyze various career opportunities and decide carrier goals.

** Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that

influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Duration:

Internship is to be completed after semester 5 and before commencement of semester 6 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 6.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry [1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination and before academic schedule of semester VI.

Student can take internship work in the form of the following but not limited to:

- Working for consultancy/ research project,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks + Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills
- Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work
- Societal Understanding
- Ethics

- Regularity and punctuality
- Attendance record
- Diary/Workbook
- Student's Feedback from External Internship Supervisor

  After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines and other sources)

Feedback from internship supervisor(External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership…..

Reference:

[1] https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

[2] https://internship.aicte-india.org/

Savitribai Phule Pune University

Third Year of Electronics and Computer Engineering (2019 Course)

310351B:Mandatory Audit Course 6

Teaching Scheme:	Credit:	Examination Scheme:
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List of Courses to be opted (Any one) under Mandatory Audit Course 6

- Digital and Social Media Marketing
- Sustainable Energy Systems
- Leadership and Personality Development
- Foreign Language
- MOOC-Learn New Skills

GUIDELINES FOR CONDUCTION OF AUDIT COURSE

In addition to credits courses, it is mandatory that there should be audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of audit course. The student may opt for two of the audit courses (One in each semester). Such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in the semester is provided in the curriculum. Student can choose one of the audit course from list of courses mentioned. Evaluation of audit course will be done at institute level. The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

Selecting an Audit Course:

Using NPTEL Platform:

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of

NPTEL courses are available on its official website www.nptel.ac.in

- Student can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with certificate.

Assessment of an Audit Course:

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as "Present" and the student will be awarded the grade AP on the marksheet.