

**Faculty of Science and Technology
Savitribai Phule Pune University
Maharashtra, India**



<http://unipune.ac.in>

**Curriculum
for
Third Year of Computer Engineering
(2019 Course)
(With effect from 2021-22)**

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
(With effect from Academic Year 2021-22)

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Savitribai Phule Pune University															
Third Year of Computer Engineering (2019 Course)															
(With effect from Academic Year 2021-22)															
Semester V															
Course Code	Course Name	Teaching Scheme (Hours/ week)			Examination Scheme and Marks						Credit Scheme				
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total	
310241	Database Management Systems	03	-	-	30	70	-	-	-	100	03	-	-	03	
310242	Theory of Computation	03	-	-	30	70	-	-	-	100	03	-	-	03	
310243	Systems Programming and Operating System	03	-	-	30	70	-	-	-	100	03	-	-	03	
310244	Computer Networks and Security	03	-	-	30	70	-	-	-	100	03	-	-	03	
310245	Elective I	03	-	-	30	70	-	-	-	100	03	-	-	03	
310246	Database Management Systems Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02	
310247	Computer Networks and Security Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01	
310248	Laboratory Practice I	-	04	-	-	-	25	25	-	50	-	02	-	02	
310249	Seminar and Technical Communication	-	01	-	-	-	50	-	-	50	-	01	-	01	
Total		15	11	-	150	350	125	50	25	700	15	06	-	21	
310250	Audit Course 5											Grade			
Total Credit											15	06	-	21	
Elective I						Audit Course 5									
Internet of Things and Embedded Systems Human Computer Interface Distributed Systems Software Project Management						- Cyber Security - Professional Ethics and Etiquettes - MOOC- Learn New Skills - Engineering Economics - Foreign Language									
Laboratory Practice I															
Assignments from Systems Programming and Operating System and Elective I															

Semester V

Savitribai Phule Pune University Third Year of Computer Engineering (2019 Course) 310241: Database Management Systems		
Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
Prerequisites Courses: Discrete Mathematics (210241), Data Structures and Algorithms (210252)		
Companion Course: Database Management Systems Laboratory (310246)		
Course Objectives: - To understand the fundamental concepts of Database Management Systems - To acquire the knowledge of database query languages and transaction processing - To understand systematic database design approaches - To acquire the skills to use a powerful, flexible, and scalable general-purpose databases to handle Big Data - To be familiar with advances in databases and applications		
Course Outcomes: On completion of the course, learners should be able to CO1: Analyze and design Database Management System using ER model CO2: Implement database queries using database languages CO3: Normalize the database design using normal forms CO4: Apply Transaction Management concepts in real-time situations CO5: Use NoSQL databases for processing unstructured data CO6: Differentiate between Complex Data Types and analyze the use of appropriate data types		
Course Contents		
Unit I	Introduction to Database Management Systems and ER Model	06 Hours
Introduction, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models. Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity-Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting ER and EER diagram into tables.		
#Exemplar/Case Studies	Analyze and design database using ER Model for any real-time application and convert the same into tables.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	SQL and PL/SQL	07 Hours
SQL: Characteristics and Advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators. Tables: Creating, Modifying, Deleting, Updating. SQL DML Queries: SELECT Query and clauses, Index and Sequence in SQL. Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries. PL/SQL: Concept of Stored Procedures and Functions, Cursors, Triggers, Assertions, Roles and Privileges.		
#Exemplar/Case Studies	Implementation of Unit 1 case study using SQL and PL/SQL.	
*Mapping of Course Outcomes for Unit II	CO1, CO2	

Unit III	Relational Database Design	06 Hours
Relational Model: Basic concepts, Attributes and Domains, 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, Algorithms for Decomposition, 2NF, 3NF, BCNF.		
#Exemplar/Case Studies	Normalize relational database designed in Unit I.	
*Mapping of Course Outcomes for Unit III	CO1, CO3	
Unit IV	Database Transaction Management	07 Hours
Introduction to Database Transaction, Transaction states, ACID properties, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Lock-based, Time-stamp based Deadlock handling. Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints. Log-Based Recovery: Deferred Database Modifications and Immediate Database Modifications.		
#Exemplar/Case Studies	Study of Transaction Management in PostgreSQL	
*Mapping of Course Outcomes for Unit IV	CO3, CO4	
Unit V	NoSQL Databases	07 Hours
Introduction to Distributed Database System, Advantages, disadvantages, CAP Theorem. Types of Data: Structured, Unstructured Data and Semi-Structured Data. NoSQL Database: Introduction, Need, Features. Types of NoSQL Databases: Key-value store, document store, graph, wide column stores, BASE Properties, Data Consistency model, ACID Vs BASE, Comparative study of RDBMS and NoSQL. MongoDB (with syntax and usage): CRUD Operations, Indexing, Aggregation, MapReduce, Replication, Sharding.		
#Exemplar/Case Studies	Use of NoSQL databases for processing unstructured data from social media.	
*Mapping of Course Outcomes for Unit V	CO5, CO6	
Unit VI	Advances in Databases	07 Hours
Emerging Databases: Active and Deductive Databases, Main Memory Databases, Semantic Databases. Complex Data Types: Semi-Structured Data, Features of Semi-Structured Data Models. Nested Data Types: JSON, XML. Object Orientation: Object-Relational Database System, Table Inheritance, Object-Relational Mapping. Spatial Data: Geographic Data, Geometric Data.		
#Exemplar/Case Studies	Applications of advanced databases in real time environment.	
*Mapping of Course Outcomes for Unit VI	CO5, CO6	

Learning Resources

Text Books :

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled, Addison Wesley", ISBN-10: 0321826620, ISBN-13: 978-0321826626

Reference Books :

1. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
2. S.K.Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9
4. Adam Fowler, "NoSQL For Dummies", John Wiley & Sons, ISBN-1118905628
5. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereooty Limited, ISBN: 1743045743, 9781743045749
6. Joy A. Kreibich, "Using SQLite", O'REILLY, ISBN: 13:978-93-5110-934-1
7. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications ISBN: 9788176569644, 9788176569644

e-Books :

- SQL and Relational Theory
(How to Write Accurate SQL code), C.J. Date, O'REILLY Publication
- SQL A Beginner's Guide, Andy Oppel, Robert Sheldon, McGraw Hill Publication

MOOCs Courses Links:

- <http://www.nptelvideos.com/lecture.php?id=6518>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	-	-	-	1	-	-	-	3
CO2	-	2	3	-	-	2	-	-	-	-	-	3
CO3	-	2	3	-	1	-	-	-	-	-	-	3
CO4	2	2	2	2	-	-	-	-	-	1	-	3
CO5	-	2	3	-	-	-	-	-	-	-	1	3
CO6	2	2	-	-	-	-	1	-	2	-	1	1

Savitribai Phule Pune University Third Year of Computer Engineering (2019 Course) 310242: Theory of Computation			
Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks	
Prerequisites Courses: Discrete Mathematics (210241)			
Companion Course: --			
Course Objectives: - To introduce the students to basics of Theory of Computation - To study abstract computing models to provide a formal connection between algorithmic problem solving and the theory of languages - To learn Grammar, Pushdown Automata and Turing Machine for language processing and algorithm design - To learn about the theory of computability and complexity for algorithm design			
Course Outcomes: After completion of the course, learners should be able to CO1: Understand formal language, translation logic, essentials of translation, alphabets, language representation and apply it to design Finite Automata and its variants CO2: Construct regular expression to present regular language and understand pumping lemma for RE CO3: Design Context Free Grammars and learn to simplify the grammar CO4: Construct Pushdown Automaton model for the Context Free Language CO5: Design Turing Machine for the different requirements outlined by theoretical computer science CO6: Understand different classes of problems, classify and analyze them and study concepts of NP completeness			
Course Contents			
Unit I	Formal Language Theory and Finite Automata	07 Hours	
Finite Automata (FA): An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language. FA without output: Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion. Minimization of DFAs. FA with output: Moore and Mealy machines -Definition, models, inter-conversion.			
#Exemplar/Case Studies	FSM for vending machine, spell checker		
*Mapping of Course Outcomes for Unit I	CO1		
Unit II	Regular Expressions (RE)	07 Hours	
Introduction, Operators of RE, Precedence of operators, Algebraic laws for RE, Language to Regular Expressions, Equivalence of two REs. Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages. Myhill-Nerode theorem.			

#Exemplar/Case Studies	RE in text search and replace	
*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Context Free Grammar (CFG) and Context Free Language (CFL)	07 Hours
Basic Elements of Grammar, Formal Definition of Context Free Grammar, Sentential form, Derivation and Derivation Tree/ Parse Tree, Context Free Language (CFL), Ambiguous Grammar, writing grammar for language. Simplification of CFG: Eliminating ϵ -productions, unit productions, useless production, useless symbols. Normal Forms: Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for CFG, Closure properties of CFL, Decision properties of CFL, Chomsky Hierarchy, Cock-Younger-Kasami Algorithm.		
#Exemplar/Case Studies	Parser, CFG for Palindromes, Parenthesis Match	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Pushdown Automata (PDA)	07 Hours
Introduction, Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs CFLs. Deterministic CFLs.		
#Exemplar/Case Studies	Parsing and PDA: Top-Down Parsing, Bottom-up Parsing simulation showing use of PDA	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Turing Machines (TM)	07 Hours
Turing Machine Model, Formal definition of Turing Machines, Language Acceptability by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction, Computing function with Turing Machine, Variants of Turing Machines, Halting Problem of TM, Halting vs Looping, A Turing-unrecognizable language, Reducibility, Recursion Theorem. The Model of Linear Bounded Automata.		
#Exemplar/Case Studies	Algorithms using Turing Machine	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Computability and Complexity Theory	07 Hours
Computability Theory: Decidable Problems and Un-decidable Problems, Church-Turing Thesis. Reducibility: Undecidable Problems that is recursively enumerable, A Simple Un-decidable. Complexity Classes: Time and Space Measures, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and hard Problems.		
#Exemplar/Case Studies	Traveling salesman problem, Post Correspondence Problem (PCP)	
*Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1
2. John Martin, "Introduction to Languages and The Theory of Computation", 2nd Edition, McGrawHill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5

Reference Books:

1. Sanjeev Arora and Boaz Barak, "Computational Complexity: A Modern Approach", Cambridge University Press, ISBN: 0521424267 97805214242643.
2. Daniel Cohen, "Introduction to Computer Theory", Wiley & Sons, ISBN 97881265133454.
3. J. Carroll & D Long, "Theory of Finite Automata", Prentice Hall, ISBN 0-13-913708-45.
4. Kavi Mahesh, "Theory of Computation: A Problem-Solving Approach", Wiley India, ISBN1081265331106.
5. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, ISBN-13: 97811331878137.
6. Vivek Kulkarni, "Theory of Computation", Oxford University Press, ISBN 0-19-808458

e-Books :

- <https://cglab.ca/~michieli/TheoryOfComputation/TheoryOfComputation.pdf>
- https://www.cs.virginia.edu/~robins/Sipser_2006_Second_Edition_Problems.pdf
- [http://ce.sharif.edu/courses/94-95/1/ce414-2/resources/root/Text%20Books/Automata/John%20E.%20Hopcroft,%20Rajeev%20Motwani,%20Jeffrey%20D.%20Ullman-Introduction%20to%20Automata%20Theory,%20Languages,%20and%20Computations-Prentice%20Hall%20\(2006\).pdf](http://ce.sharif.edu/courses/94-95/1/ce414-2/resources/root/Text%20Books/Automata/John%20E.%20Hopcroft,%20Rajeev%20Motwani,%20Jeffrey%20D.%20Ullman-Introduction%20to%20Automata%20Theory,%20Languages,%20and%20Computations-Prentice%20Hall%20(2006).pdf)

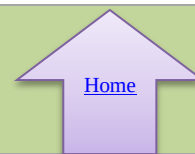
MOOCs Courses Links:

- <https://nptel.ac.in/courses/106/104/106104148/>
- <https://nptel.ac.in/courses/106/104/106104028/>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	2
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	2	1	-	-	-	-	-	-	2
CO6	3	3	3	3	1	-	-	-	-	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310243: Systems Programming and Operating System



Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
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Prerequisites Courses: Programming and Problem solving (110005), Data Structures and Algorithms (210252), Principles of Programming Languages (210255), Microprocessor (210254)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To get acquainted with the basics of System Programming
- To acquire knowledge of data structures used in the design of System Software
- To be familiar with the format of object modules, the functions of linking, relocation, and loading
- To comprehend the structures and functions of Operating Systems and process management.
- To deal with concurrency and deadlock in the Operating System
- To learn and understand memory management of Operating System

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Analyze and synthesize basic System Software and its functionality.
CO2: Identify suitable data structures and Design & Implement various System Software
CO3: Compare different loading schemes and analyze the performance of linker and loader
CO4: Implement and Analyze the performance of process scheduling algorithms
CO5: Identify the mechanism to deal with deadlock and concurrency issues
CO6: Demonstrate memory organization and memory management policies

Course Contents

Unit I	Introduction	08 Hours
Introduction to Systems Programming, Need of systems programming, Software Hierarchy, Types of software: system software and application software, Machine structure. Evolution of components of systems programming: Text Editors, Assembler, Macros, Compiler, Interpreter, Loader, Linker, Debugger, Device Drivers, Operating System. Elements of Assembly Language Programming: Assembly Language statements, Benefits of Assembly Language, A simple Assembly scheme, Pass Structure of Assembler. Design of two pass assembler: Processing of declaration statements, Assembler Directives and imperative statements, Advanced Assembler Directives, Intermediate code forms, Pass I and Pass II of two pass Assembler.		
#Exemplar/Case Studies	Study of Debugging tools like GDB	
*Mapping of Course Outcomes for Unit I	CO1, CO2, CO3	
Unit II	Macro Processor and Compilers	06 Hours
Introduction, Features of a Macro facility: Macro instruction arguments, Conditional Macro expansion, Macro calls within Macros, Macro instructions, Defining Macro, Design of two pass Macro processor, Concept of single pass Macro processor. Introduction to Compilers: Phases of Compiler with one example, Comparison of compiler and Interpreter.		

#Exemplar/Case Studies	GNU M4 Macro Processor	
*Mapping of Course Outcomes for Unit II	CO1, CO2, CO3	
Unit III	Linkers and Loaders	07 Hours
Introduction, Loader schemes: Compile and Go, General Loader Scheme, Absolute Loaders, Subroutine Linkages, Relocating Loaders, Direct linking Loaders, Overlay structure, Design of an Absolute Loader, Design of Direct linking Loader, Self-relocating programs, Static and Dynamic linking.		
#Exemplar/Case Studies	Study the concepts of Class loading in Java.	
*Mapping of Course Outcomes for Unit III	CO1, CO2, CO3	
Unit IV	Operating System	07 Hours
Introduction: Evolution of OS, Operating System Services, Functions of Operating System. Process Management: Process, Process States: 5 and 7 state model, process control block, Threads, Thread lifecycle, Multithreading Model, process control system calls. Process Scheduling: Uni-processor Scheduling, Scheduling: Preemptive, Non-preemptive, Long-term, Medium-term, Short term scheduling. Scheduling Algorithms: FCFS, SJF, RR, and Priority.		
#Exemplar/Case Studies	Process management in Linux /Windows/Android Readers-Writers problem/Producer Consumer problem/Dining Philosopher problem.	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Synchronization and Concurrency Control	07 Hours
Concurrency: principle and issues with concurrency, Mutual Exclusion, Hardware approach, Software approach, Semaphore, Mutex and monitor, Reader writer problem, producer Consumer problem, Dining Philosopher problem. Deadlocks: Principle of deadlock, Deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery.		
#Exemplar/Case Studies	Concurrency Mechanism: Unix/Linux/Windows.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Memory Management	07 Hours
Introduction: Memory Management concepts, Memory Management requirements. Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy Systems Fragmentation, Paging, Segmentation, Address translation. Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit. Virtual Memory (VM): Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Lookaside Buffer, Page Size, VM with Segmentation, VM with Combined paging and segmentation. Page Replacement Policies: First In First Out (FIFO), Last Recently Used (LRU), Optimal, Thrashing.		
#Exemplar/Case Studies	Memory management in Linux /Windows/Android	
*Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources

Text Books:

1. John Donovan, "System Programming", McGraw Hill, ISBN 978-0-07-460482-3.
2. Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4
3. Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN 978-1-118-06333-0

Reference Books:

1. Leland Beck, "System Software: An Introduction to systems programming", Pearson
2. John R. Levine, Tony Mason, Doug Brown, "Lex & Yacc", 1st Edition, O'REILLY, ISBN 81-7366-062-X.
3. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers Principles, Techniques, and Tools", Addison Wesley, ISBN 981-235-885-4

e-Books :

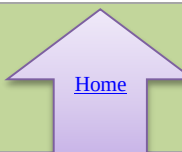
- <https://www.elsevier.com/books/systems-programming/anthony/978-0-12-800729-7>
- <https://www.kobo.com/us/en/ebook/linux-system-programming-1>
- <https://www.ebooks.com/en-us/subjects/computers-operating-systems-ebooks/279/>
- <https://www.e-booksdirectory.com/details.php?ebook=9907>

MOOCs Courses Links:

- <https://www.udacity.com/course/introduction-to-operating-systems--ud923>
- Nptel video lecture link: <https://nptel.ac.in/courses/106/105/106105214/>
- <https://www.edx.org/course/computer-hardware-and-operating-systems>
- https://onlinecourses.nptel.ac.in/noc19_cs50/preview
- <https://www.udemy.com/course/system-programming/>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	-	-	-	-	-	-	-	-
CO2	2	2	1	2	-	-	-	-	-	-	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	-
CO4	2	1	2	1	-	-	-	-	-	-	-	1
CO5	2	2	1	2	-	-	-	-	-	-	-	1
CO6	2	1	2	1	-	-	-	-	-	-	-	1

Savitribai Phule Pune University			
Third Year of Computer Engineering (2019 Course)			
310244: Computer Networks and Security			
Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks	
Prerequisites Courses: --			
Companion Course: Computer Networks and Security Laboratory (310247)			
Course Objectives:			
• To understand the fundamental concepts of networking standards, protocols and technologies • To learn different techniques for framing, error control, flow control and routing • To learn different layer protocols in the protocol stacks • To understand modern network architectures with respect to design and performance • To learn the fundamental concepts of Information Security			
Course Outcomes:			
On completion of the course, learners should be able to			
CO1: Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies			
CO2: Illustrate the working and functions of data link layer			
CO3: Analyze the working of different routing protocols and mechanisms			
CO4: Implement client-server applications using sockets			
CO5: Illustrate role of application layer with its protocols, client-server architectures			
CO6: Comprehend the basics of Network Security			
Course Contents			
Unit I	Introduction To Computer Networks	06 Hours	
Definition, Types of Networks: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Wireless networks, Networks Software, Protocol, Design issues for the Network layers. Network Models: The OSI Reference Model, TCP/IP Model, Network Topologies, Types of Transmission Medium. Network Architectures: Client-Server, Peer To Peer, Hybrid. Network Devices: Bridge, Switch, Router, Gateway, Access Point. Line Coding Schemes: Manchester and Differential Manchester Encodings, Frequency Hopping (FHSS) and Direct Sequence Spread Spectrum (DSSS).			
#Exemplar/Case Studies	Study of Campus wide networking.		
*Mapping of Course Outcomes for Unit I	CO1		
Unit II	Data Link Layer	08 Hours	
Introduction, functions. Design Issues: Services to Network Layer, Framing. ARQ strategies: Error Detection and correction, Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol. WAN Connectivity: PPP and HDLC. MAC Sub layer: Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, CSMA/CD, CSMA/CA, Binary Exponential Back-off algorithm, Introduction to Ethernet IEEE 802.3, IEEE 802.11 a/b/g/n, IEEE 802.15 and IEEE 802.16 Standards.			
#Exemplar/Case Studies	Demonstration of DLL protocols on Simulator		

*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Network Layer	08 Hours
Introduction: Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: Classes of IP (Network addressing), IPv4, IPv6, Network Address Translation, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, MPLS. Routing in MANET: AODV, DSR, Mobile IP.		
#Exemplar/Case Studies	Demonstration of Routing Protocols on simulator.	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Transport Layer	07 Hours
Process to Process Delivery, Services, Socket Programming. Elements of Transport Layer Protocols: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Congestion Control. Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless networks.		
#Exemplar/Case Studies	Demonstration of Transport layer protocols on Simulator.	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Application Layer	06 Hours
Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, DHCP, SNMP.		
#Exemplar/Case Studies	Study of Application Layer protocols using network protocol analyzer. e.g. Wireshark	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Security	07 Hours
Introduction, Security services, Need of Security, Key Principles of Security, Threats and Vulnerabilities, Types of Attacks, ITU-T X.800 Security Architecture for OSI, Security Policy and mechanisms, Operational Model of Network Security, Symmetric and Asymmetric Key Cryptography. Security in Network, Transport and Application: Introduction of IPSec, SSL, HTTPS, S/MIME, Overview of IDS and Firewalls.		
#Exemplar/Case Studies	Study of security protocols in Network, Transport and Application Layer using network protocol analyzer. e.g. Wireshark	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		
Text Books : 1. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw-Hill, Publications, ISBN:0-07 – 058408 – 7 2. Andrew S. Tanenbaum, Computer Networks, 5th Edition, Pearson India, 2012.		

Reference Books :

1. Kurose, Ross, "Computer Networking a Top Down Approach Featuring the Internet", Pearson, ISBN-10: 0132856204
2. L. Peterson and B. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan-Kaufmann, 2012.
3. Douglas E. Comer & M.S Narayanan, "Computer Network & Internet", Pearson Education
4. William Stallings, "Cryptography and Network Security: Principles and Practice", 4th Edition
5. Pachghare V. K., "Cryptography and Information Security", 3rd Edition, PHI,

e-Books :

- <https://people.cs.clemson.edu/~jmarty/courses/kurose/KuroseCh1-2.pdf>
- <http://eti2506.elimu.net/Introduction/Books/Data Communications and Networking By Behrouz A.Forouzan.pdf>
- <http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf>
- https://www.tutorialspoint.com/data_communication_computer_network/data_communication_on_computer_network_tutorial.pdf

Case Study:

- <https://slideplayer.com/slide/6106945>
- <http://www.worldcolleges.info/sites/default/files/Cisco - Ccie Fundamental - Network Design And Case Studies.PDF>
- http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

MOOCs Courses link:

- nptel.ac.in/courses/106/105/106105183
- nptel.ac.in/courses/106/105/106105080
- nptel.ac.in/courses/106/105/106105081
- nptel.ac.in/courses/106/106/106106091
- nptel.ac.in/courses/106/105/106105031
- <https://www.mooc-list.com/tags/computer-networking>
- <https://www.coursera.org/courses?query=computer%20network>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	2	2	1	-	-	-	-	1	1
CO2	1	1	1	1	1	-	1	-	-	1	-	-
CO3	3	1	2	1	2	-	-	-	-	-	-	1
CO4	1	2	1	2	2	-	-	-	1	-	1	1
CO5	1	3	-	-	1	-	1	1	-	-	-	-
CO6	1	-	2	1	-	1	-	-	-	-	-	1

Savitribai Phule Pune University

Third Year of Computer Engineering (2019 Course)

Elective I

310245(A): Internet of Things and Embedded Systems

Home

Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
Prerequisites Courses: Computer Networks and Security (310244)		
Companion Course: Laboratory Practice I (310248)		
Course Objectives: - To understand fundamentals of Internet of Things (IoT) and Embedded Systems - To learn advances in Embedded Systems and IoT - To learn methodologies for IoT application development - To learn the IoT protocols, cloud platforms and security issues in IoT - To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples		
Course Outcomes: On completion of the course, learners should be able to CO1: Understand the fundamentals and need of Embedded Systems for the Internet of Things CO2: Apply IoT enabling technologies for developing IoT systems CO3: Apply design methodology for designing and implementing IoT applications CO4: Analyze IoT protocols for making IoT devices communication CO5: Design cloud based IoT systems CO6: Design and Develop secured IoT applications		
Course Contents		
Unit I	Introduction to Embedded Systems	07 Hours
Definition, Characteristics of Embedded System, Real time systems, Real time tasks. Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.		
#Exemplar/Case Studies	Installation of Real Time Operating System	
*Mapping of Course Outcomes for Unit I	CO1,CO2	
Unit II	Internet of Things : Concepts	07 Hours
Introduction to Internet of Things (IoT): Definition, Characteristics of IoT, Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks. Physical Design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion. Logical Design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT.		
#Exemplar/Case Studies	Exemplary device: Raspberry Pi / Arduino: Programming: Arduino IDE/ Python, Interfacing. Other IoT Devices.	
*Mapping of Course Outcomes for Unit II	CO1,CO2	

Unit III	IoT: Design Methodology	07 Hours
IoT Design Methodology: Steps, Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT Communication Models and IoT Communication APIs, Sensor Networks, Four pillars of IoT: M2M, SCADA, WSN, RFID.		
#Exemplar/Case Studies	Home Automation using IoT communication models and IoT Communication APIs.	
*Mapping of Course Outcomes for Unit III	CO3,CO4	
Unit IV	IoT Protocols	07 Hours
Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa.		
#Exemplar/Case Studies	LoRa based Smart Irrigation System.	
*Mapping of Course Outcomes for Unit IV	CO4,CO5	
Unit V	Cloud Platforms for IoT	07 Hours
Software Defined Networking, Introduction to Cloud Storage Models, Communication API. WAMP: AutoBahn for IoT, Xively Cloud for IoT. Python Web Application Framework: Django Architecture and application development with Django, Amazon Web Services for IoT, SkyNet IoT Messaging Platform, RESTful Web Service, GRPC,SOAP.		
#Exemplar/Case Studies	Smart parking, Forest Fire Detection	
*Mapping of Course Outcomes for Unit V	CO4, CO5	
Unit VI	Security in IoT	07 Hours
Introduction, Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling. Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, lightweight cryptography.		
#Exemplar/Case Studies	Home Intrusion Detection	
*Mapping of Course Outcomes for Unit VI	CO2, CO6	
Learning Resources		
Text Books: 1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515 2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition,Wiley Publication, ISBN: 978-1-119-99435-0		
Reference Books: 1. Dawoud Shenouda Dawoud, Peter Dawoud, “Microcontroller and Smart Home Networks”, ISBN: 9788770221566, e-ISBN: 9788770221559 2. Charles Crowell, “IoT-Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT”,ISBN-13 : 979-8613100194 3. David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5		

4. David Etter, “IoT Security: Practical guide book”, amazon kindle Page numbers, source ISBN : 1540335011.
5. Brian Russell, Drew Van Duren, “Practical Internet of Things Security”, Second Edition, Packt Publishing, ISBN: 9781788625821

e-Books :

- <https://www.iotforall.com/ebooks/an-introduction-to-iot>
- <https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies>

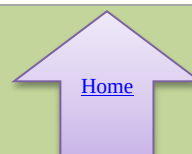
MOOCs Courses link

- <https://nptel.ac.in/courses/106/105/106105166/>
- <https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-development/>
- <https://www.coursera.org/learn/iot>
- <https://nptel.ac.in/courses/108/108/108108098/>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	-	-	-	-	1	-	1	-
CO2	3	2	1	2	1	-	-	-	-	-	-	-
CO3	2	3	3	3	2	3	-	-	2	-	1	-
CO4	1	2	2	2	3	3	-	-	2	1	2	2
CO5	2	2	2	3	3	3	-	-	2	1	2	2
CO6	2	2	1	2	2	2	-	1	1	-	1	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective I



310245(B): Human Computer Interface

Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
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Prerequisites Courses: Computer Graphics (210244), Software Engineering (210253)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To understand the importance of HCI design process in software development
- To learn fundamental aspects of designing and implementing user interfaces
- To study HCI with technical, cognitive and functional perspectives
- To acquire knowledge about variety of effective human-computer-interactions
- To co-evaluate the technology with respect to adapting changing user requirements in interacting with computer

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** To design effective Human-Computer-Interfaces for all kinds of users
CO2: To apply and analyze the user-interface with respect to golden rules of interface
CO3: To analyze and evaluate the effectiveness of a user-interface design
CO4: To implement the interactive designs for feasible data search and retrieval
CO5: To analyze the scope of HCI in various paradigms like ubiquitous computing, virtual reality, multi-media, World wide web related environments
CO6: To analyze and identify user models, user support, and stakeholder requirements of HCI systems

Course Contents

Unit I	Introduction and Foundation of HCI	07 Hours
Foundation: Human Memory. Thinking: reasoning and problem solving, Emotion, Individual Difference, Psychology and design of Interactive systems, The Computer-Text Entry Device, Positioning, Pointing, Display devices, Devices for virtual reality and 3D Interaction, The Interactions-Models of Interaction, Frameworks and HCI, Ergonomics, Interaction styles, Ergonomics, Elements of WIMP Interface, Interactivity, Measurable Human Factors, The context of Interaction. Importance of User Interface: Defining user Interface, Brief History of Human-Computer Interface, Good and Poor Design- Importance of good design.		
#Exemplar/Case Studies	Paper prototype – Design elements of GUI	
*Mapping of Course Outcomes for Unit I	CO1, CO6	
Unit II	Human Perspective in Interaction Design Process	07 Hours
Know your user/client: Understanding how people interact with computers, Important human characteristics in Design, Human considerations in design of Business systems, Human Interaction speeds, Performance versus Preference, Methods of gaining an understanding of users, Miller's Law. Design Guidelines: Navigating the interface, Organizing the display, Getting user's attention, Facilitating data entry. Principles: Determine user's skill level, Identify the tasks, Choose an		

interaction style, Natural Language, Eight Golden rules of Interface design, Prevent errors, Ensuring Human control while increasing automation. Theories: Design-by-level, Stages of action, Consistency, Contextual Theories, Dynamic theories.		
#Exemplar/Case Studies	Registration form design.	
*Mapping of Course Outcomes for Unit II	CO1,CO2	
Unit III	Interaction Styles and HCI in Software Process	07 Hours
Design, Process of Interaction Design. Interaction styles: Command line, Menu Selection, Form fill-in, Direct Manipulation. Graphical User Interface: Popularity of Graphics, Concept of direct manipulation, Advantages, Disadvantages and characteristics of Graphical user interface. Web User Interface: Popularity and Characteristics, Merging of Graphical business systems and the Web-Characteristics of Intranet versus Internet, Web page versus application design, Principles for user interface design, Software life cycle, Usability Engineering, Iterative design and prototyping, Design Rationale.		
#Exemplar/Case Studies	Comparison - GUI and Web design with a real time example.	
*Mapping of Course Outcomes for Unit III	CO1,CO3,CO5	
Unit IV	Usability Evaluation and Universal Design	07 Hours
User interface design process: Designing for People: Seven commandments, Usability Assessment in the Design process, Common Usability problems, Practical and Objective measures of Usability, Formative and Summative evaluation, Usability specifications for evaluation, Analytic methods, Model based analysis, GOMS model, Empirical methods, Field studies, Usability testing in Laboratory, Controlled experiments, Heuristic Evaluation, Cognitive Walkthrough. Evaluation framework: Paradigms and techniques, DECIDE: a framework to guide evaluation, Universal design principles, Multi-modal interaction, Designing for diversity.		
#Exemplar/Case Studies	GOMS model - Adding items to a cart of e-shopping website.	
*Mapping of Course Outcomes for Unit IV	CO1,CO3	
Unit V	HCI Paradigms	07 Hours
Paradigms for Interaction: Time sharing, Video display units, Programming toolkits, Personal computing, The metaphor, Direct manipulation, Hypertext, Computer-supported cooperative work, Agent based interfaces. Ubiquitous Computing: Sensor-based and context-aware interaction, Data Integrity versus Data immunity, Handling missing data, Data entry and fudgeability, Auditing versus Editing, Retrieval in Physical World, Retrieval in Digital world, Constrained Natural Language output, Five stage search framework, Dynamic queries and faceted search, The social aspects of search. Pattern Recognition: Introduction, Examples, Role of Machine Learning, Pattern Recognition Process, Pattern Recognition in HCI.		
#Exemplar/Case Studies	Interface Design- Pattern gesture recognition	
*Mapping of Course Outcomes for Unit V	CO1,CO3,CO4	
Unit VI	HCI for Mobile and Handheld devices	07 Hours
Designing for Mobile and other devices: Anatomy of a Mobile app, Mobile form factors, Handheld		

format apps, Tablet format apps, Mini-tablet format apps, Mobile Navigation, Content, and control idioms- browse controls, Navigation and toolbars, Drawers, Tap-to-reveal and direct manipulation, Searching, Sorting and Filtering, Welcome and help screens, Multi-touch gestures, Inter-app integration, Android Accessibility Guidelines.

Other devices: Designing for kiosks, Designing for 10-foot interfaces, Designing for automotive interfaces, Designing for audible interfaces.

#Exemplar/Case Studies	GUI in Python Enlist and evaluate handled devices
*Mapping of Course Outcomes for Unit VI	CO3,CO5,CO6

Learning Resources

Text Books:

1. Alan J, Dix, Janet Finlay, Russell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004, ISBN 81-297-0409-9.
2. Jenny Preece, Rogers, Sharp, "Interaction Design-beyond human-computer interaction", WILEY-INDIA, ISBN 81-265-0393-9.
3. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, "Designing the User Interface: Strategies for Effective Human- Computer Interaction", 6th Edition, Pearson Education Limited. ISBN 987-1-292-03701-1.

Reference Books :

1. Alan Cooper, Robert Reiman, David Cronin, Christopher Noessel, "About Face: The Essentials of Interaction Design", 4th edition, WILEY, ISBN 978-1-118-76658-3
2. Mary Beth Rosson and John M. Carroll, "Usability Engineering: Scenario-Based Development of Human-Computer Interaction", Morgan Kaufmann Publishers, ISBN 978-1-558-60712-5
3. Wibert O. Galitz, "The Essential Guide to user Interface Design", WILEY India, ISBN: 978-1-265-0280-6.
4. Jenifer Tidwell, "Designing Interfaces", O'REILLY, ISBN: 978-1-449-37970-4.
5. Julie A. Jacko (Ed), "The Human-Computer Interaction Handbook", 3rd edition, CRC Press, 2012.
6. Zou J., Nagy G. (2006) "Human-Computer Interaction for Complex Pattern Recognition Problems".
7. Basu M., Ho T.K. (eds) "Data Complexity in Pattern Recognition. Advanced Information and Knowledge Processing", Springer, London.

e-Books :

- http://www.37steps.com/data/pdf/PRIntro_medium.pdf
- https://www.ecse.rpi.edu/~nagy/PDF_chrono/2005_Zou_Nagy_complexity_05.pdf
- <https://www.raywenderlich.com/240-android-accessibility-tutorial-getting-started>

MOOCs Courses link

- <https://www.edx.org/course/human-computer-interaction-i-fundamentals-design-p>
- <https://www.edx.org/course/human-computer-interaction-ii-cognition-context-cu>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	1	1	1	1	-	-	-	1	1	1
CO2	2	2	-	-	-	-	-	2	1	-	-	-
CO3	-	-	2	-	-	-	-	1	-	-	1	-
CO4	-	-	-	2	3	1	-	-	1	-	-	-
CO5	-	2	2	-	2	2	2	-	-	2	2	3
CO6	-	-	2	1	2	3	-	1	-	-	-	2

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
Elective I
310245(C): Distributed Systems



Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
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Prerequisites Courses: Computer Networks and Security(310244)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To learn the fundamentals of Distributed Systems
- To learn types of communication and synchronization in Distributed Systems
- To acquaint with the Distributed File Systems
- To understand consistency and replication in Distributed Systems
- To understand the fault tolerance based Distributed Systems

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Analyze Distributed Systems types and architectural styles
CO2: Implement communication mechanism in Distributed Systems
CO3: Implement the synchronization algorithms in Distributed System applications
CO4: Develop the components of Distributed File System
CO5: Apply replication techniques and consistency model in Distributed Systems
CO6: Build fault tolerant Distributed Systems

Course Contents

Unit I	Introduction	07 Hours
Defining Distributed Systems, Characteristics, Middleware and Distributed Systems. Design goals: Supporting resource sharing, Making distribution transparent, Open, Scalable, Pitfalls. Types of Distributed Systems: High Performance Distributed Computing, Distributed Information Systems, Pervasive Systems. Architectural styles: Layered architectures, Object based architectures, Publish Subscribe architectures. Middleware organization: Wrappers, Interceptors, Modifiable middleware. System architecture: Centralized, Decentralized, Hybrid, Example architectures – Network File System, Web.		
#Exemplar/Case Studies	Case Study of Middleware System that includes Design, Architecture and Application.	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Communication	07 Hours
Introduction: Layered Protocols, Types of Communication, Remote Procedural Call- Basic RPC Operation, Parameter Passing, RPC-based application support, Variations on RPC, Example: DCE RPC, Remote Method Invocation. Message Oriented Communication: Simple Transient Messaging with Sockets, Advanced Transient Messaging, Message Oriented Persistent Communication, Examples. Multicast Communication: Application Level Tree-Based Multicasting, Flooding-Based Multicasting, Gossip-Based Data Dissemination.		
#Exemplar/Case Studies	Apache Kafka Distributed Event Streaming Platform, gRPC Open Source RPC Framework	

*Mapping of Course Outcomes for Unit II	CO2	
Unit III	Synchronization	07 Hours
Clock Synchronization: Physical Clocks, Clock Synchronization Algorithms. Logical Clocks – Lamport’s Logical clocks, Vector Clocks. Mutual Exclusion: Overview, Centralized Algorithm, Distributed Algorithm, Token-Ring Algorithm, Decentralized Algorithm. Election Algorithms: Bully Algorithm, Ring Algorithm. Location Systems: GPS, Logical Positioning of nodes, Distributed Event Matching. Gossip-Based Contribution: Aggregation, A Peer-Sampling Service, Gossip-Based Overlay Construction.		
#Exemplar/Case Studies	Design Time Synchronization Mechanism in Distributed Gaming	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Naming and Distributed File Systems	07 Hours
Names, Identifiers, Addresses, Flat Naming, Structured Naming, Attributed Based Naming, Introduction to Distributed File Systems, File Service Architecture. Case study: Suns Network file System, Andrew File System.		
#Exemplar/Case Studies	Study of Google File System	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Consistency and Replication	07 Hours
Introduction: Reasons for Replication, Replication as Scaling Technique. Data-Centric Consistency Models: Continuous Consistency, Consistent Ordering of Operations. Client-Centric Consistency Models: Eventual Consistency, Monotonic Reads, Monotonic Writes, Read Your Writes, Writes Follow Reads. Replica Management: Finding the best server location, Content Replication and Placement, Content Distribution, Managing Replicated Objects. Consistency Protocols: Continuous Consistency, Sequential Consistency, Cache Coherence Protocols, Example: Caching, and Replication in the web.		
#Exemplar/Case Studies	Study of HDFS Architecture for Data Replication	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Fault Tolerance	07 Hours
Introduction to Fault Tolerance: Basic Concepts, Failure Models, Failure Masking by Redundancy. Process Resilience: Resilience by Process Groups, Failure Masking and Replication, Example: Paxos, Consensus in faulty systems with crash failures, some limitations on realizing Fault Tolerant tolerance, Failure Detection. Reliable Client Server Communication: Point to Point Communication, RPC Semantics in the Presence of Failures. Reliable Group Communication: Atomic multicast, Distributed commit. Recovery: Introduction, Checkpointing, Message Logging, Recovery Oriented Computing.		
#Exemplar/Case Studies	Study of any Open Source Tool for Building Fault-Tolerant System such as Circuit Breaker/Nginx/HaProxy/Akka	
*Mapping of Course Outcomes for Unit VI	CO6	

Learning Resources

Text Books:

1. Maarten van Steen, Andrew S. Tanenbaum, “Distributed System”, Third edition, version 3
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth edition

Reference Books:

1. P.K.Sinha, “Distributed Operating System”, Wiley, IEEE Press
2. Singhal and Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
3. Vijay K.Garg, “Elements of Distributed Computing”, Wiley

e-Books :

- Martin Kleppmann, “Designing Data-Intensive Applications”, Oreilly

MOOC Courses links:

- Prof. Rajiv Misra, Distributed System, <https://nptel.ac.in/courses/106/106/106106168/#>
- Prof. Rajiv Misra, Cloud computing and Distributed System
- Prof. Rajiv Misra, Distributed System, <https://nptel.ac.in/courses/106/104/106104182/>

@TheCO-POMappingMatrix

CO/ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	1	-	-	-	-	-	1
CO2	3	2	2	2	1	-	-	-	-	1	-	1
CO3	3	2	2	2	1	-	-	-	-	1	-	1
CO4	3	1	2	2	1	-	-	-	-	1	-	1
CO5	3	1	1	1	-	-	-	-	-	-	-	1
CO6	1	1	1	1	1	-	-	-	-	-	-	1

Savitribai Phule Pune University Third Year of Computer Engineering (2019 Course) Elective I 310245(D): Software Project Management			
Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Semester (TH) : 30 Marks End-Sem (paper): 70 Marks	
Prerequisites Courses: Software Engineering (210253)			
Companion Course: Laboratory Practice I (310248)			
Course Objectives: - To understand the fundamentals of Software Project Management - To investigate software project planning and management tools - To learn software project scheduling and tracking - To discuss about the agile project management - To know people management in software project			
Course Outcomes: On completion of the course, learners should be able to CO1: Comprehend Project Management Concepts CO2: Use various tools of Software Project Management CO3: Schedule various activities in software projects CO4: Track a project and manage changes CO5: Apply Agile Project Management CO6: Analyse staffing process for team building and decision making in Software Projects and Management			
Course Contents			
Unit I	Introduction to Software Project Management	07 Hours	
Project Definition, Project versus Flow type work, Project Lifecycle, Processes and Knowledge Areas in Project Management (PM), Build or Buy decision, Work Breakdown Structure (WBS) and its types, Introduction to PMBOK, Program and Portfolio Management.			
#Exemplar/Case Studies	Analysis of a project using PMBOK concepts		
*Mapping of Course Outcomes for Unit I	CO1		
Unit II	Project Planning and Project Management Tools	07 Hours	
Project Planning: Steps for Project Planning, PERT and Gantt Charts, Gantt Project, Microsoft Project and Primavera Project Management Software, Objectives of Activity planning, Project Schedules, Activities, Sequencing and Scheduling, Network Planning Models, Formulating Network Model.			
#Exemplar/Case Studies	Create software project plan using any tool.		
*Mapping of Course Outcomes for Unit II	CO2		
Unit III	Activity based Scheduling	07 Hours	
Introduction, Objectives of Activity Planning, Project Schedules. Activities: Sequencing and Scheduling, Network Planning Models, Formulating Network Model, Activity relationships (FS,SF,SS,FF), Forward Pass and Backward Pass techniques, Critical Path concept and remedies.			

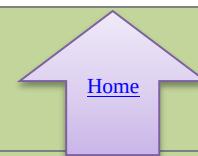
#Exemplar/Case Studies	Apply the critical path technique to the project	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Project Tracking and Control	07 Hours
Introduction, Collection of Project data, Visualizing progress, Cost monitoring, Earned Value Analysis, Project tracking, Change Control, Software Configuration Management, Managing contracts, Contract Management.		
#Exemplar/Case Studies	Analyze the effect of a major requirement change on the schedule	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Agile Project Management	07 Hours
Predictive versus Empirical Management, Comparison between Non-Agile and Agile Project, Three stages of Agile Project, Estimation, Scope Management, Roles and Responsibilities, Scheduling and Tracking.		
#Exemplar/Case Studies	Analyse the same project using Agile. Create the three stages of the project.	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Staffing in Software Projects	07 Hours
Managing People, Organizational behaviour, Best methods of Staff Selection, Motivation, The Oldham, Hackman job characteristic Model, Stress, Health and Safety, Ethical and Professional concerns, Working in Teams, Decision Making, Organizational structures, Dispersed and Virtual Teams, Communications Genres, Communication Plans.		
#Exemplar/Case Studies	Analyse a case study for a distributed team and comment	
*Mapping of Course Outcomes for Unit VI	CO6	
Learning Resources		
Text Books:		
1. Bob Hughes, Mike Cotterell and Rajib Mall, “Software Project Management”, Sixth Edition, Tata McGraw Hill, New Delhi, 2017. 2. Robert K. Wysocki, “Effective Software Project Management”, Wiley Publication, 2011.		
Reference Books :		
1. Ken Schwaber, “Agile Project Management”, Microsoft Press, 2004 2. Walker Royce, “Software Project Management”, Addison-Wesley, 1998. 3. Jalote Pankaj, “Software Project Management in Practice”, Addison-Wesley Professional, 2002 4. PMBOK Guide		
e-Books :		
• https://www.kornev-online.net/ITIL/Mcgraw.Hill.Software_Project_Management_2nd_Edition.pdf • http://library.lol/main/B96E3B122326F8D2C6FBD35A5E978422		
MOOCs Courses Links:		
• https://onlinecourses.nptel.ac.in/noc19_cs70/preview • Software Project Management By Prof. Rajib Mall & Prof. Durga Prasad Mohapatra IIT Kharagpur		

- [Agilealliance.org](https://www.agilealliance.org)
- [Scrum.org](https://www.scrum.org)
- [Scrumalliance.org](https://www.scrumalliance.org)

@The CO-PO Mapping Matrix

CO/ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	1	-	-	-	-	-	1	-	3	-
CO2	-	-	-	2	2	-	-	-	1	-	3	-
CO3	-	-	-	-	-	-	-	-	2	-	3	-
CO4	-	-	-	-	-	-	-	-	1	-	3	-
CO5	-	-	2	1	1	-	-	1	2	-	3	-
CO6	-	-	-	-	1	-	-	-	3	1	3	-

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310246:Database Management Systems Laboratory



Teaching Scheme
Practical: 04 Hours/Week

Credit Scheme: 02

Examination Scheme and Marks
Term work: 25 Marks
Practical: 25 Marks

Companion Course: Database Management Systems (310241)

Course Objectives:

- To develop Database programming skills
- To develop basic Database administration skills
- To develop skills to handle NoSQL database
- To learn, understand and execute process of software application development

Course Outcomes:

On completion of the course, learners will be able to

- CO1:** Design E-R Model for given requirements and convert the same into database tables
- CO2:** Design schema in appropriate normal form considering actual requirements
- CO3:** Implement SQL queries for given requirements , using different SQL concepts
- CO4:** Implement PL/SQL Code block for given requirements
- CO5:** Implement NoSQL queries using MongoDB
- CO6:** Design and develop application considering actual requirements and using database concepts

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, and punctuality.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming tools recommended: - MYSQL/Oracle, MongoDB, ERD plus, ER Win

Virtual Laboratory:

- <http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/labs/index.php>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A, B, C) are compulsory

Sr. No.	Group A: SQL and PL/SQL
1.	ER Modeling and Normalization: Decide a case study related to real time application in group of 2-3 students and formulate a problem statement for application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize Relational data model. Note: Student groups are required to continue same problem statement throughout all the assignments in order to design and develop an application as a part Mini Project. Further assignments will be useful for students to develop a backend for system. To design front end interface students should use the different concepts learnt in the other subjects also.
2.	SQL Queries: - Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc. - Write at least 10 SQL queries on the suitable database application using SQL DML statements. Note: Instructor will design the queries which demonstrate the use of concepts like Insert, Select, Update, Delete with operators, functions, and set operator etc.
3.	SQL Queries - all types of Join, Sub-Query and View: Write at least 10 SQL queries for suitable database application using SQL DML statements. Note: Instructor will design the queries which demonstrate the use of concepts like all types of Join, Sub-Query and View

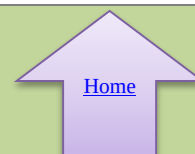
4.	Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory. Suggested Problem statement: Consider Tables: 1. Borrower(Roll_no, Name, DateofIssue, NameofBook, Status) 2. Fine(Roll_no,Date,Amt) • Accept Roll_no and NameofBook from user. • Check the number of days (from date of issue). • If days are between 15 to 30 then fine amount will be Rs 5per day. • If no. of days>30, per day fine will be Rs 50 per day and 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. • Also handles the exception by named exception handler or user define exception handler. OR Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 5 to 9. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns, radius and area. Note: Instructor will frame the problem statement for writing PL/SQL block in line with above statement.
5.	Named PL/SQL Block: PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and 900 category is first class, if marks 899 and 825 category is Higher Second Class. Write a PL/SQL block to use procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class) Note: Instructor will frame the problem statement for writing stored procedure and Function in line with above statement.
6.	Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) 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. Note: Instructor will frame the problem statement for writing PL/SQL block using all types of Cursors in line with above statement.

7.	Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). 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. Note: Instructor will Frame the problem statement for writing PL/SQL block for all types of Triggers in line with above statement.
8.	Database Connectivity: Write a program to implement MySQL/Oracle database connectivity with any front end language to implement Database navigation operations (add, delete, edit etc.)
Group B: NoSQL Databases	
1.	MongoDB Queries: Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc.).
2.	MongoDB - Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable example using MongoDB.
3.	MongoDB - Map reduces operations: Implement Map reduces operation with suitable example using MongoDB.
4.	Database Connectivity: Write a program to implement MongoDB database connectivity with any front end language to implement Database navigation operations (add, delete, edit etc.)
Group C: Mini Project	
1.	Using the database concepts covered in Group A and Group B, develop an application with following details: - Follow the same problem statement decided in Assignment -1 of Group A. - Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. - Develop application considering: - Front End : Java/Perl/PHP/Python/Ruby/.net/any other language - Backend : MongoDB/MySQL/Oracle - Test and validate application using Manual/Automation testing. - Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle: - Title of the Project, Abstract, Introduction - Software Requirement Specification - Conceptual Design using ER features, Relational Model in appropriate Normalize form - Graphical User Interface, Source Code - Testing document - Conclusion. Note: - Instructor should maintain progress report of mini project throughout the semester from project group - Practical examination will be on assignments given above in Group A and Group B only - Mini Project in this course should facilitate the Project Based Learning among students

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	3	-	3	1	1	1	3	1	-	1
CO2	2	2	3	-	2	-	1	-	3	-	1	-
CO3	-	1	2	-	2	1	-	1	3	-	-	2
CO4	-	1	2	-	2	-	-	-	3	2	1	-
CO5	-	1	2	-	2	-	2	-	3	1	-	1
CO6	2	2	3	-	3	1	-	-	3	-	2	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310247:Computer Networks and Security Laboratory



Teaching Scheme
Practical: 02 Hours/Week

Credit Scheme: 01

Examination Scheme and Marks
Term work: 25 Marks
Oral: 25 Marks

Companion Course: Computer Network and Security (310244)

Course Objectives:

- To learn computer network hardware and software components
- To learn computer network topologies and types of network
- To develop an understanding of various protocols, modern technologies and applications
- To learn modern tools for network traffic analysis
- To learn network programming

Course Outcomes:

On completion of the course, learners will be able to

- CO1:** Analyze the requirements of network types, topology and transmission media
- CO2:** Demonstrate error control, flow control techniques and protocols and analyze them
- CO3:** Demonstrate the subnet formation with IP allocation mechanism and apply various routing algorithms
- CO4:** Develop Client-Server architectures and prototypes
- CO5:** Implement web applications and services using application layer protocols
- CO6:** Use network security services and mechanisms

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), curriculum of the course, conduction and Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

Guidelines for Oral Examination

Oral examination should be jointly conducted by the internal examiner and external examiner. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementations in term work. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Operating System recommended: -64-bit Open-source Linux or its derivative

Programming tools recommended: - Open-Source /C/C++/JAVA

Programming tool like G++/GCC, Wireshark/Ethereal and Packet Tracer

Virtual Laboratory:

- <http://vlabs.iitb.ac.in/vlab/>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A, B, C) are compulsory

Sr. No.	Group A (Unit I and II): Attempt any two assignments from Sr. No. 1 to 3. Assignments 4 and 5 are compulsory.
1.	Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.
2.	Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.
3.	Setup a WAN which contains wired as well as wireless LAN by using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN2 (Wireless LAN).
4.	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC.
5.	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in Peer-to-Peer mode.
Group B (Unit III and IV)	
6.	Write a program to demonstrate Sub-netting and find subnet masks.
7.	Write a program to implement link state /Distance vector routing protocol to find suitable path for transmission.
8.	Use packet Tracer tool for configuration of 3 router network using one of the following protocol RIP/OSPF/BGP.
9.	Write a program using TCP socket for wired network for following - Say Hello to Each other - File transfer - Calculator
10.	Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.
Group C (Unit V and VI): Assignment Sr. No. 11 is Compulsory and attempt any four from Assignments Sr. No 12 to 17.	
11.	Write a program for DNS lookup. Given an IP address as input, it should return URL and vice-versa.
12.	Installing and configure DHCP server and write a program to install the software on remote machine.

13.	Capture packets using Wireshark, write the exact packet capture filter expressions to accomplish the following and save the output in file: 1. Capture all TCP traffic to/from Facebook, during the time when you log in to your Facebook account 2. Capture all HTTP traffic to/from Facebook, when you log in to your Facebook account 3. Write a DISPLAY filter expression to count all TCP packets (captured under item #1) that have the flags SYN, PSH, and RST set. Show the fraction of packets that had each flag set. 4. Count how many TCP packets you received from / sent to Face book, and how many of each were also HTTP packets.
14.	Study and Analyze the performance of HTTP, HTTPS and FTP protocol using Packet tracer tool.
15.	To study the SSL protocol by capturing the packets using Wireshark tool while visiting any SSL secured website (banking, e-commerce etc.).
16.	Illustrate the steps for implementation of S/MIME email security through Microsoft® Office Outlook.
17.	To study the IPsec (ESP and AH) protocol by capturing the packets using Wireshark tool.

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	2	-	2	1	1	-	-	1	-	1
CO2	-	3	-	1	1	-	-	1	-	-	-	-
CO3	3	2	1	1	-	-	-	1	-	-	1	1
CO4	-	1	2	1	1	1	-	-	-	-	-	1
CO5	2	3	-	-	1	-	-	-	1	-	-	-
CO6	-	1	3	1	1	-	1	-	2	-	-	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310248: Laboratory Practice I


[Home](#)
Teaching Scheme**Practical: 04 Hours/Week****Credit Scheme:****02****Examination Scheme and Marks****Term work: 25 Marks****Practical: 25 Marks****Companion Course:** Systems Programming and Operating System (310243), Elective I (310245)**Course Objectives:**

- To learn system programming tools
- To learn modern operating system
- To learn various techniques, tools, applications in IoT and Embedded Systems /Human Computer Interface/Distributed Systems/ Software Project Management

Course Outcomes:

On completion of the course, learners will be able to

- **Systems Programming and Operating System**

CO1: Implement language translators**CO2:** Use tools like LEX and YACC**CO3:** Implement internals and functionalities of Operating System

- **Internet of Things and Embedded Systems**

CO4: Design IoT and Embedded Systems based application**CO5:** Develop smart applications using IoT**CO6:** Develop IoT applications based on cloud environment**OR**

- **Human Computer Interface**

CO4: Implement the interactive designs for feasible data search and retrieval**CO5:** Analyze the scope of HCI in various paradigms like ubiquitous computing, virtual reality, multi-media, World wide web related environments**CO6:** Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems**OR**

- **Distributed Systems**

CO4: Demonstrate knowledge of the core concepts and techniques in Distributed Systems**CO5:** Apply the principles of state-of-the-Art Distributed Systems in real time applications**CO6:** Design, build and test application programs on Distributed Systems**OR**

- **Software Project Management**

CO4: Apply Software Project Management tools**CO5:** Implement software project planning and scheduling**CO6:** Analyse staffing in software project**Guidelines for Instructor's Manual**

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Programming tools recommended: -

Human computer Interface-GUI in python

Internet of Things and Embedded System- Raspberry Pi/Arduino Programming; Arduino IDE/Python Interfacing. Other IoT devices

Software project management-MS project/Gantt Project/Primavera

Virtual Laboratory:

- <http://cse18-iiith.vlabs.ac.in/Introduction.html?domain=Computer%20Science>
- <http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php>

Suggested List of Laboratory Experiments/Assignments

Assignments from all Groups (A, B, C) are compulsory

Part I: Systems Programming and Operating System

Sr. No.	Group A (Any Two Assignments from Sr. No. 1 to 3)
1.	Design suitable Data structures and implement Pass-I and Pass-II of a two-pass assembler for pseudo-machine. Implementation should consist of a few instructions from each category and few assembler directives. The output of Pass-I (intermediate code file and symbol table) should be input for Pass-II.

2.	Design suitable data structures and implement Pass-I and Pass-II of a two-pass macro-processor. The output of Pass-I (MNT, MDT and intermediate code file without any macro definitions) should be input for Pass-II.
3.	Write a program to recognize infix expression using LEX and YACC.
Group B (Any Two Assignments from Sr. No. 4 to 7)	
4.	Write a program to solve Classical Problems of Synchronization using Mutex and Semaphore.
5.	<u>Write a program to simulate</u> CPU Scheduling Algorithms: FCFS, SJF (Preemptive), Priority (Non-Preemptive) and Round Robin (Preemptive).
6.	<u>Write a program to simulate</u> Memory placement strategies – best fit, first fit, next fit and worst fit.
7.	<u>Write a program to simulate</u> Page replacement algorithm.
Part II : Elective I	
Suggested List of Laboratory Experiments/Assignments (Any Two assignments from each elective subject are compulsory and Instructor will take care that all the assignments should be covered among different batch students)	
Internet of Things and Embedded Systems	
1.	Understanding the connectivity of Raspberry-Pi / Arduino with IR sensor. Write an application to detect obstacle and notify user using LEDs.
2.	Understanding the connectivity of Raspberry-Pi / Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, generate alerts using LEDs.
3.	Understanding and connectivity of Raspberry-Pi / Beagle board with camera. Write an application to capture and store the image.
4.	Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.
Human Computer Interface	
1.	Design a paper prototype for selected Graphical User Interface.
2.	Implement GOMS (Goals, Operators, Methods and Selection rules) modeling technique to model user's behavior in given scenario.
3.	Design a User Interface in Python.
4.	To redesign existing Graphical User Interface with screen complexity.
Distributed System	
1.	Implementation of Inter-process communication using socket programming: implementing multithreaded echo server.
2.	Implementation of RPC Mechanism.
3.	Simulation of election algorithms (Ring and Bully).
4.	Implementation of Clock Synchronization: a) NTP b) Lamports clock.
Software Project Management	
1.	Create Project Plan ▪ Specify project name and start (or finish) date. ▪ Identify and define project tasks. ▪ Define duration for each project task. ▪ Define milestones in the plan ▪ Define dependency between tasks ▪ Define project calendar. ▪ Define project resources and specify resource type ▪ Assign resources against each task and baseline the project plan

2.	Execute and Monitor Project Plan ▪ Update % Complete with current task status. ▪ Review the status of each task. ▪ Compare Planned vs Actual Status ▪ Review the status of Critical Path ▪ Review resources assignation status
3.	Generate Dashboard and Reports ▪ Dashboard - o Project Overview - o Cost Overview - o Upcoming Tasks • Resource Reports - o Over-allocated Resources - o Resource Overview ▪ Cost Reports - o Earned Value Report - o Resource Cost Overview - o Task Cost Overview ▪ Progress Reports - o Critical Tasks - o Milestone Report - o Slipping Tasks

@The CO-PO Mapping Matrix (SPOS and IoT&ES)

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	-	-	-	-	-	-	1
CO2	1	2	2	2	2	-	-	-	-	-	-	1
CO3	1	2	2	2	2	-	-	-	-	-	-	1
CO4	1	2	3	2	-	2	-	-	2	1	2	-
CO5	1	2	2	1	-	2	-	-	3	2	1	-
CO6	2	2	2	1	-	2	-	-	2	-	2	1

@The CO-PO Mapping Matrix (SPOS and HCI)

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	-	-	-	-	-	-	1
CO2	1	2	2	2	2	-	-	-	-	-	-	1
CO3	1	2	2	2	2	-	-	-	-	-	-	1
CO4	-	-	-	2	3	1	-	-	1	-	-	-
CO5	-	2	2	-	2	2	2	-	-	2	2	3
CO6	-	-	2	1	2	3	-	1	-	-	-	2

@The CO-PO Mapping Matrix (SPOS and DS)

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	-	-	-	-	-	-	1
CO2	1	2	2	2	2	-	-	-	-	-	-	1
CO3	1	2	2	2	2	-	-	-	-	-	-	1
CO4	2	2	2	-	2	-	-	-	-	-	-	-

CO5	2	2	2	1	2	-	-	-	-	-	-	-
CO6	2	3	3	2	2	-	-	-	-	-	-	-
<u>@The CO-PO Mapping Matrix (SPOS and SPM)</u>												
PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	3	-	-	-	-	-	-	1
CO2	1	2	2	2	2	-	-	-	-	-	-	1
CO3	1	2	2	2	2	-	-	-	-	-	-	1
CO4	-	-	1	-	-	-	-	-	1	-	3	-
CO5	-	-	-	-	2	-	-	-	1	-	3	-
CO6	-	-	-	-	-	-	-	-	2	-	3	-

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310249: Seminar and Technical Communication

**Teaching Scheme****Practical: 01 Hours/Week****Credit Scheme****01****Examination Scheme and Marks****Term Work: 50 Marks****Course Objectives:**

- To explore the basic principles of communication (verbal and non-verbal) and active, empathetic listening, speaking and writing techniques
- To explore the latest technologies
- To enhance the communication skills
- To develop problem analysis skills

Course Outcomes:

On completion of the course, learners will be able to

CO1: Analyze a latest topic of professional interest**CO2:** Enhance technical writing skills**CO3:** Identify an engineering problem, analyze it and propose a work plan to solve it**CO4:** Communicate with professional technical presentation skills**Guidelines**

- Each student will select a topic in the area of Computer Engineering and Technology preferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years.
- The topic must be selected in consultation with the Institute guide.
- Each student will make a seminar presentation using audio/visual aids for a duration of 20-25 minutes and submit the seminar report prepared in Latex only.
- Active participation at classmate seminars is essential.
- BoS has circulated the Seminar Log book and it is recommended to use it.

Guidelines for Assessment

Panel of staff members along with a guide would be assessing the seminar work based on these parameters-Topic, Contents and Presentation, regularity, Punctuality and Timely Completion, Question and Answers, Report, Paper presentation/Publication, Attendance and Active Participation.

Recommended Format of the Seminar Report

- Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and Year and University
- Seminar Approval Sheet/Certificate
- Abstract and Keywords
- Acknowledgements
- Table of Contents, List of Figures, List of Tables and Nomenclature
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any/,Discussions and Conclusions ,Bibliography/References
- Plagiarism Check report
- Report Documentation page

Reference Books :

1. Rebecca Stott, Cordelia Bryan, Tory Young, "Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)", Longman, ISBN-13: 978-0582382435

2. Johnson-Sheehan, Richard, “Technical Communication”, Longman. ISBN 0-321-11764-6

3. Vikas Shirodka, “Fundamental skills for building Professionals”, SPD, ISBN 978-93-5213- 146-5

@The CO-PO Mapping Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	-
CO2	-	1	2	1	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
310250: Audit Course 5



In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP 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 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 [1]

Guidelines for Conduction and Assessment (Any one or more of following but not limited to):

- | | |
|--|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations or presentations | <ul style="list-style-type: none"> Surveys Mini-Project Hands on experience on focused topic |
|--|---|

Course Guidelines for Assessment (Any one or more of following but not limited to):

- Written Test
- Demonstrations/ Practical Test
- Presentation or Report

Audit Course 5 Options

Audit Course Code	Audit Course Title
AC5-I	Cyber Security
AC5-II	Professional Ethics and Etiquette
AC5-III	MOOC- Learn New Skills
AC5- IV	Engineering Economics
AC5-V	Foreign Language (one of Japanese/ Spanish/ French/ German). Course contents for Japanese (Module 3) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.
<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>
http://www.unipune.ac.in/university_files/syllabi.htm

AC5-I: Cyber Security**Prerequisites:** Computer Network and Security (310244)**Course Objectives:**

- To motivate students for understanding the various scenarios of cybercrimes
- To increase awareness about the cybercrimes and ways to be more secure in online activities
- To learn about various methods and tools used in cybercrimes
- To analyze the system for various vulnerabilities

Course Outcomes : On completion of the course, learners will be able to**CO 1:** Understand and classify various cybercrimes**CO 2:** Understand how criminals plan for the cybercrimes**CO 3:** Apply tools and methods used in cybercrime**CO 4:** Analyze the examples of few case studies of cybercrimes**Course Contents**

- 1. Introduction to Cybercrime:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective.
- 2. Cyber offenses: How Criminals Plan Them:** Introduction, How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.
- 3. Tools and Methods Used in Cybercrime :** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks (**Expected to cover the introduction to all these terms**).
- 4. Cybercrime: Illustrations, Examples and Mini-Cases:** Introduction, Real-Life Examples, Mini-Cases, Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital Forensics Case Illustrations, Online Scams.

Text Books :

1. Nina Godbole, Sunit Belapure , “Cyber Security- Understanding Cyber Crimes”, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1
2. William Stallings, “Computer Security: Principles and Practices”, Pearson 6th Ed, ISBN 978-0-13-335469-0

Reference Books :

1. Berouz Forouzan, “Cryptography and Network Security”, TMH, 2 edition, ISBN -978-00-707-0208-0. 5.
2. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed., ISBN- 978-81-317-1288-7
3. CK Shyamala et el., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1	1	2	1	-	3	-	1	-	2
CO2	1	1	1	1	1	1	-	3	-	1	-	2
CO3	1	1	1	1	1	1	-	3	-	1	-	2
CO4	1	1	1	1	1	1	-	3	-	1	-	2

AC5-II: Professional Ethics and Etiquettes**Prerequisites:** Business Communication Skill**Course Objectives:**

- To learn importance of ethics and the rules of good behavior for today's most common social and business situations
- To acquire basic knowledge of ethics to make informed ethical decisions when confronted with problems in the working environment
- To develop an understanding towards business etiquettes and the proper etiquette practices for different business scenarios
- To learn the etiquette requirements for meetings, entertaining, telephone, email and Internet business interaction scenario

Course Outcomes:

On completion of the course, learners will be able to

CO1: Summarize the principles of proper courtesy as they are practiced in the workplace**CO2:** Apply proper courtesy in different professional situations**CO3:** Practice and apply appropriate etiquettes in the working environment and day to day life**CO4:** Build proper practices personal and business communications of Ethics and Etiquettes**Course Contents**

1. **Introduction to Ethics:** Basics, Difference Between Morals, Ethics, and Laws, Engineering Ethics: Purpose of Engineering Ethics-Professional and Professionalism, Professional Roles to be played by an Engineer, Uses of Ethical Theories, Professional Ethics, Development of Ethics.
2. **Professional Ethics:** IT Professional Ethics, Ethics in the Business World, Corporate Social Responsibility, Improving Corporate Ethics, Creating an Ethical Work Environment, Including Ethical Considerations in Decision Making, Ethics in Information Technology, Common Ethical issues for IT Users, Supporting the Ethical Practices of IT users.
3. **Business Etiquette:** ABC's of Etiquette, Developing a Culture of Excellence, The Role of Good Manners in Business, Enduring Words Making Introductions and Greeting People: Greeting Components, The Protocol of Shaking Hands, Introductions, Introductory Scenarios, Addressing Individuals Meeting and Board Room Protocol: Guidelines for Planning a Meeting, Guidelines for Attending a Meeting.
4. **Professional Etiquette:** Etiquette at Dining, Involuntary Awkward Actions, How to Network, Networking Etiquette, Public Relations Office(PRO)'s Etiquettes, Technology Etiquette : Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, interview Etiquette, Dressing Etiquettes : for interview, offices and social functions.

References Books:

1. Ghillyer, "Business Ethics Now", 3rd Edition, McGraw-Hill.
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, ISBN-10:1285197151.
3. Charles E Harris, Micheat J. Rabins, "Engineering Ethics", Cengage Learning, ISBN- 13:978-1133934684,4th Edition.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	3	1	2	-	2
CO2	-	-	-	-	-	1	1	3	1	2	-	2
CO3	-	-	-	-	-	1	1	3	1	2	-	2
CO4	-	-	-	-	-	1	1	3	1	2	-	2

AC5-III: MOOC- Learn New Skills (Full stack Developer)**Prerequisites:** Programming Skills**Course Objectives:**

- To understand the fundamental concepts in designing web based applications and applying frontend and backend technologies
- To understand the fundamental concepts in applying database techniques in application
- To progress the student towards term "industry ready engineer"

Course Outcomes:

On completion of the course, learners will be able to

CO1: Design and develop web application using frontend and backend technologies.

CO2: Design and develop dynamic and scalable web applications

CO3: Develop server side scripts

CO4: Design and develop projects applying various database techniques

Course Contents

Full stack Developer

1. HTML5
2. CSS3
3. Bootstrap
4. Vanilla JS (ES6+)
5. Flask or Django
6. Wagtail CMS
7. Node.js
8. MySQL
9. jQuery

Team Projects: Design and develop an e-commerce a dynamic, scalable and responsive web application. (Sample Project similar problem statements and be formulated).

Reference Books:

1. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, "Mastering HTML, CSS & Javascript Web Publishing", SAMS, BPB Publications
2. DT Editorial Services " HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)" 2Ed , Dreamtech Press.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	3	3	3	3	1	1	1	1	1	1	1
CO2	3	3	3	3	3	1	1	1	1	1	1	1
CO3	3	3	3	3	3	1	1	1	1	1	1	1
CO4	3	3	3	3	3	1	1	1	1	1	1	1

AC5-IV: Engineering Economics

Engineering economics is one of the most practical subject matters in the engineering curriculum, but it is an always challenging, ever-changing discipline. Engineers are planners and builders. They are also problem solvers, manager, decision makers. Engineering economics touches of these activities.

Course Objectives:

- To understand engineering economics and money management
- To understand financial project analysis
- To estimate project cost and apply for business
- To understand making financial decisions when acting as team member or manager in the engineering project

Course Outcomes:

On completion of the course, learners will be able to

CO1: Understand economics, the cost money and management in engineering

CO2: Analyze business economics and engineering assets evaluation

CO3: Evaluate project cost and its elements for business

CO4: Develop financial statements and make business decisions

Course Contents

1. **Understanding money and its management:** Engineering Economic Decisions, Time value of money, Money management, Equivalence calculations.
2. **Evaluating business and engineering assets:** Present worth analysis, Annual equivalence Analysis, Rate of Return Analysis, Benefit Cost Analysis.
3. **Development project cash flow:** Accounting of Income Taxes, Project cash flow Analysis, Handling Project Uncertainty.
4. **Special topics in Engineering Economics:** Replacement decisions, understanding financial statements.

Reference Books :

1. Chan S Park, "Fundamentals of Engineering Economics", Pearson, ISBN-13: 9780134870076
2. James Riggs, "Engineering Economics", Tata McGraw-Hill, ISBN – 13: 9780070586703

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1	-	-	-	-	-	2	2	3	1
CO2	1	1	1	-	-	-	-	-	2	2	3	1
CO3	1	1	1	-	-	-	-	-	2	2	3	1
CO4	1	1	1	-	-	-	-	-	2	2	3	1

AC5-V: Foreign Language (Japanese) Module 3

Prerequisites: We recommend that candidates should have previously completed AC3-V(210251) and AC4-V (210260)

Course Objectives:

- To open up more doors and job opportunities
- To introduce to Japanese society, culture and entertainment

Course Outcomes:

On completion of the course, learners will be able to

CO1: Apply language to communicate confidently and clearly in the Japanese language

CO2: Understand and use Japanese script to read and write

CO3: Apply knowledge for next advance level reading, writing and listening skills

CO4: Develop interest to pursue further study, work and leisure

Course Contents

1. The Kanji: Brief Historical Outline, Introduction to Kanji, From Pictures to characters
2. Read and Write 58 Kanji Characters, talk about yourself/family/others, things, time, events, and activities-in the present, future, and past tense; shop at stores and order food at restaurants;
3. Lessons: Karate, Park(Playground), The Grandpa's Inaka, The Sun and the Moon, My little sister, Rice Fields, My Teacher, People who Exit and People who Enter.

Reference Books :

1. Japanese Kanji and Kana, "A complete guide to the Japanese writing system", Wolfgang Hadamitzky & Mark Spahn, Tuttle Publishing, Third edition ISBN: 978-1-4629-1018-2 (eBook)
2. Banno, Eri, Yoko Ikeda, et al. Genki I, "An Integrated Course in Elementary Japanese", 2nd ed. Japan Times/Tsai Fong Books, 2011. ISBN: 9784789014403.
3. Anna Sato and Eriko Sato, "My First Japanese Kanji Book, Learning kanji the fun and easy way", TUTTLE PUBLISHING, First Edition ISBN: 978-1-4629-1369-5 (eBook)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1