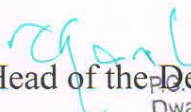





**DOSS GOVERDHAN DOSS VAISHNAV COLLEGE**  
(Autonomous)  
College with Potential for Excellence, Linguistic Minority Institution  
Affiliated to University of Madras  
Arumbakkam, Chennai – 600 106

**PG DEPARTMENT OF COMPUTER SCIENCE**  
**M.Sc. INFORMATION TECHNOLOGY**  
**Course Code: 28**  
**SYLLABUS**  
**With effect from 2019-2020**  
**CHOICE BASED CREDIT SYSTEM**

  
Head of the Department  
Department of Computer Science  
Dwaraka Doss Goverdhan Doss  
Vaishnav College (Shift II)  
Arumbakkam, Chennai-600 106.

  
Principal  
**PRINCIPAL**  
Dwaraka Doss Goverdhan Doss  
Vaishnav College  
Arumbakkam, Chennai - 600106.

**FIRST SEMESTER  
(SYLLABUS)**

**Course Title: CORE THEORY 1 - OPERATING SYSTEM**

<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course the student will be able to gain the knowledge about main components of an Operating system and Process Management and Scheduling, to analyse the mechanisms of OS to handle Processes and Threads and their Communication, to gain knowledge on Distributed Operating System concepts that includes Architecture, Mutual Exclusion Algorithms, Deadlock Detection Algorithms, to discuss the mechanisms involved in Memory Management Policies and Virtual Memory, to gain the knowledge about Paging and various Page Replacement Algorithms, to compile the working of an Files and Directory Structure in OS.*

**Course outcomes: At the end of course, the student will be able to**

CO1	Basic concepts of operating system, process management, Threads - Interprocess Communication. CPU Scheduling
CO2	Discuss various Process Synchronization problems, critical region and monitors
CO3	Discuss about Deadlock Characterization, Methods for handling Deadlocks, Prevention, Avoidance, and Detection of Deadlock and Recovery from deadlock. Analyse the Memory Management and its allocation policies.
CO4	Evaluate the various Page Replacement Algorithms handled by Operating System. Analyse the Virtual memory and Thrashing concepts.
CO5	Interpret the mechanisms adopted for File Sharing in Distributed Applications.
CO6	Demonstrate the basic concepts of operating system

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	2	2	3	3	3	3	3	2
CO2	3	2	3	3	3	3	3	3	3	2	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	2	3	3
CO5	3	3	2	3	3	3	3	3	3	3	3	3	3
CO6	3	2	3	3	3	3	3	3	2	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENT OF MODULE	Hrs	COs
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1	<b>UNIT I:</b> Introduction: Views –Goals –Types of system – OS Structure –Components – Services – System Calls. Process Management: Process - Process Scheduling – Cooperating Process –Threads - Interposes Communication. CPU Scheduling: CPU Schedulers – Scheduling criteria – Scheduling Algorithms.	9	CO1
2	<b>UNIT II:</b> Process Synchronization: Critical-Section problem - Synchronization Hardware – Semaphores – Classic Problems of Synchronization – Critical Region – Monitors.	9	CO2
3	<b>UNIT III:</b> Deadlock: Characterization – Methods for handling Deadlocks – Prevention, Avoidance, and Detection of Deadlock - Recovery from deadlock. Memory Management: Address Binding – Dynamic Loading and Linking – Overlays – Logical and Physical Address Space - Contiguous Allocation – Internal & External Fragmentation. Non Contiguous Allocation:	9	CO3
4	<b>UNIT IV:</b> Paging and Segmentation schemes –Implementation – Hardware Protection – Sharing - Fragmentation.VirtualMemory: Demand Paging – Page Replacement - Page Replacement Algorithms – Thrashing.	9	CO4
5	<b>UNIT V:</b> File System: Concepts – Access methods – Directory Structure - Allocation methods. Secondary Storage Structures: Protection – Goals- Domain Access matrix.	9	CO5,CO6

### TEXT BOOKS

1. Silberschatz A., Galvin P.B., Gange, (2003). *Operating System Principles*, (6th Edition), John Wiley & Sons.
2. AshfaqA.Khan, (2001). *Practical Linux Programming*, (Revised Edition), Firewall Media.

### REFERENCE BOOKS

1. Richard Petersen (2001). *The Complete Reference – Linux*, (6thEdition), TMH.

### E- REFERENCES:

1. <http://www.fretechbooks.com/introduction-to-operating-systems-t340.html>
2. [http://www.tutorialspoint.com/operating\\_system/index.htm](http://www.tutorialspoint.com/operating_system/index.htm)
3. [http://www.spoken\\_tutorial.org](http://www.spoken_tutorial.org)

## FIRST SEMESTER

Course Title: CORE THEORY 2 –

## COMPUTER ORGANIZATIONS AND ARCHITECTURE

<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*Conceptualize the basics of Organizational and Architectural issues of a digital Computer. Understanding the concepts of Boolean algebra, Logical Operations and various Adders. Learn various types of Flip-Flops and Data Transfer Techniques in Digital Computer and Articulate design issues in the development of Processor or other components that satisfy design requirements and objectives to explain different types of Addressing Modes and Memory Organization.*

**Course outcomes: At the end of course, the student will be able to**

COS	Content of module
CO1	Detailed representation about number systems and boolean algebra.
CO2	Describe the various types of flip flops, registers and circuit system.
CO3	Analyse the stack organization and identify the addressing modes.
CO4	Interpret peripheral devices with memory access.
CO5	Acquire a good knowledge about memory hierarchies and mapping.
CO6	Gain knowledge about Virtual memory and data manipulation

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	3	2	1	3	1	1	3	3	2	2	3
<b>CO 2</b>	3	2	3	3	3	2	1	2	3	2	2	2	1
<b>CO 3</b>	3	3	3	2	3	1	1	1	3	2	2	3	2
<b>CO 4</b>	3	3	1	3	2	3	2	2	3	2	2	3	3
<b>CO 5</b>	3	3	2	2	2	2	1	1	3	3	3	3	2
<b>CO 6</b>	3	3	2	2	2	2	2	1	3	3	3	3	1

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	HRS	COS
<b>1</b>	<b>UNIT I: Number System</b> – Converting numbers from one base to– Complements – Binary Codes– Boolean algebra – Properties of	<b>9</b>	CO1

	Boolean algebra – Boolean functions. – Logical Operations – Logic gates - Adder – Subtractor.		
2	<b>UNIT II: Decoders</b> – Multiplexers- Flip Flops – Triggering of flip-flops – Analyzing a sequential circuit – State reduction – excitation tables – Design of sequential circuits – Counters. –shift registers.	9	CO2
3	<b>UNIT III: Central processing unit:</b> General register and stack organizations, instruction formats - Addressing modes, Data transfer and manipulation - program control, RISC.	9	CO3
4	<b>UNIT IV:</b> Input-output organization - peripheral devices, I/O interface, modes of transfer- Interrupt, Direct memory access, I/O processor.	9	CO4
5	<b>UNIT V: Memory Organization</b> - Memory Hierarchy- Main memory- Auxiliary memory-Associative memory and its mapping techniques - Cache memory-cache memory mapping techniques- Virtual Memory.	9	CO5, CO6

### TEXT BOOKS

1. M. Morris Mano (2007). Computer System Architecture (3<sup>rd</sup> Edition), PHI, ISBN: 9789332585607.

2 D. P. Leach and A. P. Malvino (2002). Digital Principles and Applications (5th Edition), TMH, ISBN: 9780070141704.

### REFERENCE BOOKS

1. William Stallings (2015). Computer Organization and Architecture (10<sup>th</sup> Edition), Pearson Education, ISBN: 9780134101613.

2. M. Morris Mano (2007). Digital Logic and Computer Design ( 3<sup>rd</sup> Edition) , Pearson Education, ISBN:817758409X

3. V.C. Hamacher, G. Vranesic, S. G. Zaky (2000). Computer Organization (Revised Edition), TMH, ISBN: 0471467405.

### E-REFERENCES

1. <http://www.fretechbooks.com/computer-organization-and-design-fundamentals-t347.html>

2. <http://www.nptel.iitm.ac.in/video.php?subjectId=106102062>

3. <https://freevideolectures.com/course/2277/computer-organization>

4. <http://www.infocobuild.com/education/audio-video-courses/computer-science/ComputerOrganizationArchitecture-IIT-Madras>

### FIRST SEMESTER

Course Title: CORE THEORY 3 - DATABASE MANAGEMENT SYSTEMS

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

On taking this course the student will be able to assess the applications of DBMS, difference between File Systems vs. DBMS, identify the data models and understand the DBMS structure and identifies the Entity, Attribute and Entity Relationship Diagrams. Understand the Relational Algebra concepts, selection, projection, relational calculus which helps in understanding queries. Study the concepts of functional dependencies and the need of normalization and Normal forms I, II, III, IV BCNF and know the properties of transaction management and the recovery management. Compile various file organization methods and access methods to store the data.

**Course outcomes: At the end of course, the student will be able to**

CO1	Describe a database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. Design ER-models to represent simple database application scenarios.
CO2	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data for current needs. Develop applications using DDL, DML queries.
CO3	Identifies the Functional dependencies, decompositions, lossless join, and dependency preserving decomposition. Classify the various normalization techniques and improve the database design by applying it.
CO4	Use the concept of a transaction and design the database using some tools which satisfies the ACID properties when concurrent transaction occurs in a database. Evaluate the sophisticated access protocols to control access to the database.
CO5	Identifies the suitable File organization methods and access methods and design the database for storing the data.
CO6	Develop and evaluate a real database application using a database management system.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	3
CO 2	3	3	3	3	3	3	3	2	3	3	3	2	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S. No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT- I</b> Introduction to DBMS and ER Model-Advantage of DBMS approach, various view of data, data independence, schema and sub-schema, primary concepts of data models, Database languages, Database administrator and users, data dictionary, overall system Architecture. Basic concepts of <b>ER Model</b> , mapping constraint, keys, ER diagram, weak and strong entity sets, specialization and generalization, aggregation.	9	CO1
2	<b>UNIT- I</b> Domains, Relations and Keys, Relational Algebra & <b>SQL</b> - Domains, Relations, kind of relations, relational database, various types of keys-candidate, primary, alternate and foreign key. Relational algebra,	9	CO2

	SQL- set operations, aggregate functions, null values, nested sub queries, views, join relations, DDL in SQL.		
3	<b>UNIT- III</b> Functional Dependencies and <b>Normalization</b> -Basic definitions, trivial and non-trivial dependencies, introduction to normalization, non-loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, Join dependency and fifth normal form.	9	CO3
4	<b>UNIT- IV</b> Transaction, concurrency and Recovery-Basic concepts of Transaction, <b>ACID properties</b> , Transaction states, implementation of atomicity and durability, concurrent executions, basic idea of serializability, concurrency control-two phase locking and deadlock handling, Recovery system-Failure Classification, Storage Structure ,Recovery and Atomicity , Log-Based Recovery, Shadow Paging.	9	CO4
5	<b>UNIT- V</b> Storage structure and file organizations-Overview of physical storage media, magnetic disks-performance and optimizations, basic idea of RAID, file organizations, organization of records in files, basic concepts of indexing, ordered indices, basic idea of B-tree and B+-tree organization.	9	CO5, CO6

### TEXT BOOK

1. Henry Forth, Abraham Silberschatz, S. Sudharshan (2006). *Database System Concepts* (5<sup>th</sup> Edition), McGraw Hill Publications.
2. R. Elmasri, S.B. Navathe (2007). *Fundamentals of Database Systems* (5<sup>th</sup> Edition), Pearson Education.

### REFERENCE BOOKS

1. Raghu Ramakrishnan , Johannes Gehrke(2014) ,*Database Management Systems*(3rd Edition), McGraw Hill Publications.
2. J. Date, A. Kannan and S. Swamynathan, (2009). *An Introduction to Database Systems* (8<sup>th</sup> Edition), Pearson Education.

### E- REFERENCES:

1. <https://www.coursera.org/course/datasci>
2. <http://www.nptel.iitm.ac.in/video.php?subjectId=106106093>
3. <https://gateoverflow.in/47124/which-video-lecture-will-be-the-best-for-dbms>

### FIRST SEMESTER

Course Title: CORE THEORY 4 - **PRINCIPLES OF PROGRAMMING LANGUAGES**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*On taking this course, student will be able to describe the imperative, functional, object-oriented, and logic programming paradigm, understand data, data types, and basic statements and Expressions and Statements, understand the fundamentals and design issues of Subprograms and Blocks, gain knowledge on the principles of programming languages: Abstract Data types, Concurrency, Exception handling and introduce the power of Functional Programming and scripting languages.*

**Course Outcomes: At the end of the Course, the Student will be able to:**



<b>CO1</b>	Gain knowledge on programming in different paradigms. Express syntax and semantics in formal notation. Design features of programming languages, and justify their design decisions
<b>CO2</b>	Explain the general concepts of data types, Statements and Expressions and identify the design issues.
<b>CO3</b>	Identify the design issues of Subprograms and Blocks in programming languages
<b>CO4</b>	Compare the concepts of concurrency control and exception handling for various programming Languages.
<b>CO5</b>	Analyze and compare functional programming languages and the scripting languages.
<b>CO6</b>	Analyze a problem, and identify and define the computing requirements appropriate to its solution

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	2	2	3	2	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	2	3	2	3	3	3	2	2	3	2
<b>CO 3</b>	3	3	3	2	3	2	3	3	3	2	2	3	2
<b>CO 4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3
<b>CO 5</b>	3	3	3	2	3	3	3	3	3	3	2	3	2
<b>CO 6</b>	3	3	3	3	3	3	3	3	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT I : Preliminary Concepts:</b> Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments. <b>Syntax and Semantics:</b> general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, de-notational semantics and axiomatic semantics for common programming language features.	12	CO1
2	<b>UNIT II :Data types:</b> Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. <b>Expressions and Statements:</b> Arithmetic relational and Boolean expressions, Short	9	CO2



	circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands.		
3	<b>UNIT III :Subprograms and Blocks:</b> Fundamentals of sub-programs, Scope of life time of variables, static and dynamic scope, design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators, co routines.	8	CO3
4	<b>UNIT IV :Abstract Data types:</b> Abstractions and encapsulation, introductions to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in small talk, C++, Java, C#, Ada 95 <b>Concurrency:</b> Subprogram level concurrency, semaphores, monitors, message passing, Java threads, C# threads. <b>Exception handling:</b> Exceptions, exception Propagation, Exception handler in Ada, C++ and Java. <b>Logic Programming Language:</b> Introduction and overview of logic programming, basic elements of prolog, application of logic programming.	8	CO4
5	<b>UNIT V: Functional Programming Languages:</b> Introduction, fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative Languages. <b>Scripting Language:</b> Pragmatics, Key Concepts, Case Study: Python- Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Absraction, Separate Compilation, Module Library.	8	CO5, CO6

#### TEXT BOOKS:

1. W. Sebesta Robert (2008) *Concepts of Programming Languages*, Pearson Education.
2. D. A. Watt (2007) *Programming Language Design Concepts*, Wiley Dreamtech.

#### REFERENCE BOOKS:

1. A. B. Tucker, R. E. Noonan. *Programming Languages* (2<sup>nd</sup> Edition), TMH.
2. K. C. Loudon (2003). *Programming Languages* (2<sup>nd</sup> Edition), Thomson Learning.
3. Patric Henry Winston and Paul Horn. *LISP*, Pearson Education.

#### E- REFERENCES:

1. <http://www.digimat.in/nptel/courses/video/106102067/L01.html>
2. <http://cs.brown.edu/courses/cs173/2012/Videos/>

## **FIRST SEMESTER**

**Course Title: ELECTIVE 1 - LINUX SYSTEM ADMINISTRATION**

<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### **LEARNING OBJECTIVES:**

*On taking this course, student will be able to learn various concepts and commands in Linux, this is aimed at those new to Linux, to understand Installation of Linux and its File Systems, to gain insights of basic concepts in shell scripts, to understand the concepts of Kernel management, backup management, learn the fundamental concepts of networking in Linux.*

### **Course outcomes: At the end of course, the student will be able to**

<b>CO1</b>	Gain knowledge insights of Linux environment basics
<b>CO2</b>	Operate running Linux systems by managing the file system mounts and monitoring, concepts related to user and groups
<b>CO3</b>	Configure Linux packages and kernel and backup management using bacula
<b>CO4</b>	Acquire knowledge on shell commands, scripts, managing files, pipes and redirections. Choose appropriate Linux commands to make effective use of the environment to solve problems
<b>CO5</b>	Configure and manage simple TCP/IP network services, file system and web hosting on a Linux system
<b>CO6</b>	Effectively use the Linux system to accomplish typical personal, office, technical, and

software development task
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### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	2	3	2	3	3	2	2	2	2
CO 2	3	3	3	2	3	3	2	2	3	3	3	3	2
CO 3	2	3	3	2	3	3	2	3	3	3	2	3	3
CO 4	2	3	3	2	2	3	2	3	3	3	2	3	2
CO 5	2	2	2	2	2	3	3	2	3	3	2	2	2
CO 6	3	3	3	2	3	3	3	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	Cos
1	<b>UNIT I:</b> Linux Basics – <b>Linux Distributions</b> – Bootstrapping – Unix Access Control – Pseudo users other than root – Components of Process – The life cycle of process – Signals – Process states - Dynamic monitoring - Cron tab management – Uses of cron	9	CO1
2	<b>UNIT II:</b> File system mounting and unmounts – File types and attributes – Access control lists User and Group Concepts - Default User Files - Understanding File and Directory Permissions –PAM – Centralizing account management	9	CO2
3	<b>Unit III:</b> <b>Backups</b> – dumping and <b>restoring</b> for upgrades – Bacula – Finding log files – Managing log files – logging policies – Installing Linux – <b>Managing Linux packages</b> – Revision control – Using configuration management tools – sharing software over NFS – Kernel adaptation – Linux Kernel configuration – Loadable Kernel modules	9	CO3
4	<b>Unit IV :</b> Shell Scripts and Programming - Shell Variables - Control structures - Test Operations - conditional control - Loop control structures - The File structure-Listing, Displaying and printing files-Managing Directories - File and Directory operations. Pipes and Redirection	9	CO4
5	<b>Unit V:</b> Networking – TCP/IP Networking – Ping/Telnet/SSH/Netstat–Routing – <b>NFS</b> - Sharing System Files – File system Corruptions and Recovery - Email – Network Management – Security – Web Hosting – Virtualization with Linux – Benefits of Virtualization – Amazon Web Services - X Windows – Data Centre Basics – Performance Analysis – Serial Devices and Terminals	9	CO5, CO6

### TEXT BOOKS:

1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley (2010). *UNIX and Linux System Administration Handbook* (4<sup>th</sup> edition), Prentice-Hall, ISBN 978-0131480056

2. MachteltGarrels. *Introduction to Linux (2010)*, Fultus Corporation Publishers (3<sup>rd</sup> Edition), ISBN 978-1596821996
3. Brian Ward (2014). *How Linux Works (2<sup>nd</sup> Edition)*, No Starch Press, ISBN 978-1593275679

### REFERENCE BOOKS:

1. Richard Petersen (200b). *Linux: The Complete Reference (6<sup>th</sup> Edition)*, Tata McGraw Hill Education, ISBN 9780071492478
2. Richard Blum, Christine Bresnahan (2015). *Linux command Line and shell scripting Bible (3<sup>rd</sup> edition)*, ISBN 9781118983843
3. Michael Kerrisk (2010), *The Linux Programming Interface – A Linux and Unix System Handbook (1<sup>st</sup> edition)*, ISBN : 978-1593272203

### E- REFERENCES:

1. <http://courses.cs.vt.edu/~csonline/OS/Lessons/index.html>
2. <http://www.ee.surrey.ac.uk/Teaching/Unix>
3. <http://archive.oreilly.com/oreillyschool/courses/courses.html>

## FIRST SEMESTER

### Course Title: ELECTIVE 1 - WINDOWS PROGRAMMING

<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*On taking this course, student will be able to learn the basic mechanisms of Window programming and tools, to analyze the concept and usage of MFC library and its Architecture, to get insights of GUI Applications, to understand applications of Windows, to gain core knowledge of OLE and ActiveX control.*

### Course outcomes: At the end of course, the student will be able to

CO1	Gain basic knowledge of windows programming and analyses the various windows development tools.
CO2	Construct Windows application by writing windows programming.
CO3	Use the MFC library to design and develop programs with GUI interfaces.
CO4	Demonstrate the workings of Graph and Word processor applications and develop the new applications by using containers.
CO5	Detailed knowledge of ActiveX, COM and DHTML features and design an ActiveX control with MFC. Use tools to customize various controls.
CO6	Analyze the user requirements and develop the various windows applications using new technologies and deploy it into multiple environments.

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5

<b>CO 1</b>	3	3	3	2	2	3	2	3	3	2	2	2	2
<b>CO 2</b>	3	3	3	2	3	3	2	2	3	3	3	3	2
<b>CO 3</b>	2	3	3	2	3	3	2	3	3	3	2	3	3
<b>CO 4</b>	2	3	3	2	2	3	2	3	3	3	2	3	2
<b>CO 5</b>	2	2	2	2	2	3	3	2	3	3	2	2	2
<b>CO 6</b>	3	3	3	2	3	3	3	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

<b>S.No</b>	<b>CONTENTS OF MODULE</b>	<b>Hrs</b>	<b>Cos</b>
1	<b>UNIT I:</b> Windows Fundamentals – Programming Concepts and Vocabulary for Windows – Windows Development Tools – Resource Information.	9	CO1
2	<b>UNIT II:</b> Application Framework- Project Utility – Writing Windows Programming (Procedure Oriented) – Pie-chart Application.	9	CO2
3	<b>UNIT III:</b> MFC Library – MFC Design Considerations – Key features of MFC Library – C Object – Simple Application and Template- Drawing in Client Area- Fourier Series application with Resources- Bar Chart with Resources.	9	CO3
4	<b>UNIT IV:</b> Graph Applications – Word Processor Applications – OLE Features and Specifications - Container Application.	9	CO4
5	<b>UNIT V:</b> Active X Controls – Create simple Active X Controls with MFC – Customizing Controls – COM – DHTML- ATL vs. ActiveX.	9	CO5, CO6

#### **TEXT BOOKS:**

1. L. Klander (2000). *Core Visual C++ 6* (revised edition) Pearson Education, ISBN 978-8131715758
2. Charles Petzold (2011). *Programming Windows: The definitive Guide to the WIN32 API* (5<sup>th</sup> edition), Dreamtech Press, ISBN 978-9350041055
3. Brain Calin, jamie Hanrahan (2014). *Windows Internals* (6<sup>th</sup> edition), Microsoft Press, ISBN 978-0735684188

#### **REFERENCE BOOKS:**

1. Charles Petzold (2013). *Programming Windows, Writing Windows 8 Apps with C# and XAML* ( 6<sup>th</sup> edition), Dreamtech Press, ISBN 978-9350045084
2. Dale Rogerson (2011), *Inside COM Microsoft's Component Object* (1<sup>st</sup> edition), Dreamtech Press, ISBN 978-9350041208
3. Shepherd (2009). *MFC Internals*(1<sup>st</sup> edition), Pearson Education, ISBN 978-8131728956

#### **E-REFERENCES:**

1. [http://msdn.microsoft.com/en-s/library/windows/desktop/ff381398\(v=vs.85\).aspx](http://msdn.microsoft.com/en-s/library/windows/desktop/ff381398(v=vs.85).aspx)
2. <http://www.functionx.com/>

## FIRST SEMESTER

### Course Title: ELECTIVE 1 - UNIX PROGRAMMING

<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

#### LEARNING OBJECTIVES:

*On taking this course, student will be able to understand the basic concepts of single & multiuser Operating System, basic structure of UNIX kernel and its subsystems, to get knowledge on shell programming, services and utilities, shell command structure, directories and user communication commands, to Apply and Analyze the concept of file subsystem, i-nodes, file management by i-nodes, process and process control subsystem, to integrate shell scripts with inter process communications and sockets.*

#### Course outcomes: At the end of course, the student will be able to

<b>CO1</b>	Gain knowledge of Unix environment basics, pipes
<b>CO2</b>	Comprehend SHELL scripts with commands and scripts. Implement shell scripts using decision control, looping and control flow statements
<b>CO3</b>	Acquire knowledge on file management, directory services, system calls and device drivers. Choose appropriate UNIX commands to make effective use of the environment to solve problems
<b>CO4</b>	Configure the shell scripts with process and signals.
<b>CO5</b>	Apply Evaluate the inter-process communication using semaphores in the UNIX environment. Gain insights of sockets and its connections
<b>CO6</b>	Effectively use the UNIX system to accomplish typical personal, office, technical, and software development task.

#### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	3	2	2	3	2	3	3	2	2	2	2
<b>CO 2</b>	3	3	3	2	3	3	2	2	3	3	3	3	2
<b>CO 3</b>	2	3	3	2	3	3	2	3	3	3	2	3	3

<b>CO 4</b>	2	3	3	2	2	3	2	3	3	3	2	3	2
<b>CO 5</b>	2	2	2	2	2	3	3	2	3	3	2	2	2
<b>CO 6</b>	3	3	3	2	3	3	3	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

<b>S.No</b>	<b>CONTENTS OF MODULE</b>	<b>Hrs</b>	<b>COs</b>
1	<b>UNIT I:</b> Unix – Introduction – Basic commands – files – permissions – directories – processes – pipes –redirection – filters – vi editor – Unix file system – Unix file structure.	9	CO1
2	<b>UNIT II:</b> Shell programming – Shell Syntax: Variables – conditions – control structures – functions –commands – command execution – simple programs	9	CO2
3	<b>UNIT III:</b> Unix System Programming – System calls and device drivers – Library functions – low level file access – system calls for managing files – files and directory maintenance – scanning directories.	9	CO3
4	<b>UNIT IV:</b> Process and signals – process – process structure – starting new processes – signals	9	CO4
5	<b>UNIT V:</b> Interprocess communication – Pipes: process pipes – pipe call – parent and child processes -Semaphores: Definition – example – facilities – shared memory: overview – functions – message queue: overview – functions – Sockets: socket connections	9	CO5, CO6

#### **TEXT BOOKS:**

1. Peter Dyson, Stan Kelly Bootle, John Heilborn (1999). “*UNIX Complete*”, BPB Publications.
2. Eric s. Raymond (2003). *The Art of UNIX Programming* (1<sup>st</sup> edition), Addison-Wesley, ISBN 978-0131429017
3. Brain W. Kernighan, Rob Pike (1983). *The Unix Programming Environment* (1<sup>st</sup> edition), Prentice Hall, ISBN 978-0139376818

#### **REFERENCE BOOKS:**

1. Michael Kerrisk (2010). *The Linux Programming Interface – A Linux and Unix System Handbook* (1<sup>st</sup> edition), ISBN 978-1593272203
2. Stephen Kochan, Patrick wood (2016). *Shell Programming in Unix, Linux and OS X* (4<sup>th</sup> edition), Addison-Wesley Professional, ISBN 978-0134496009
3. W. Stevens, Stephen Rago (2013). *Advanced Programming in the UNIX environment* (3<sup>rd</sup> edition), Addison-Wesley Professional, ISBN 978-0321637734

#### **E- REFERENCES:**

1. <http://www.tutorialspoint.com/unix/>
2. <http://www.freetechbooks.com/the-art-of-unix-programming-t165.html>
3. <http://www.freetechbooks.com/unix-text-processing-t293.html>





## FIRST SEMESTER

### Course Title: PRACTICAL I - OS Lab

<b>Course Code :</b>	<b>Credits : 02</b>
<b>L:T:P:S :0:0:5:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES

*On taking this course the student will be able to demonstrate various file/directory handling commands, system administrative commands, Develop shell script to perform basic arithmetic and logical calculations, Demonstrate various shell script instructions such as sed, AWK, Develop shell script to perform various operations on given strings, Explore system variables such as PATH, HOME etc., Develop shell script to check various attributes of files and directories.*

**Course outcomes: At the end of course, the student will be able to**

CO1	Execute various basic and file/directory handling commands, Implement simple shell script for basic arithmetic and logical calculations, check various attributes of files and directories.
CO2	Implement Shell scripts to perform various operations on given strings
CO3	Execution of various system administrative commands
CO4	Implement Shell scripts to explore system variables
CO5	Implement Shell script to delete all the temporary files.
CO6	Implement Shell scripts search an element from an array.

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	2	3	3	3	3	3
CO 5	3	3	3	3	2	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	2	3	3	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

## PRACTICAL – I

<b>S. No</b>	<b>CONTENTS OF MODULE</b>	<b>Hrs</b>	<b>COs</b>
1	Execution of various file/directory handling commands, Simple shell script for basic arithmetic and logical calculations, Shell scripts to check various attributes of files and directories.	9	CO1
2	Shell scripts to perform various operations on given strings, Shell scripts to explore system variables such as PATH, HOME etc., Shell scripts to check and list attributes of processes.	9	CO2
3	Execution of various system administrative commands, AWK script that uses all of its features.	9	CO3
4	Use sed instruction to process /etc/passwd file, Shell script to display list of users currently logged in	9	CO4
5	Shell script to delete all the temporary files, Shell script to search an element from an array using binary searching.	9	CO5, CO6

### **FIRST SEMESTER**

**Course Title: PRACTICAL II - MYSQL LAB**

<b>Course Code :</b>	<b>Credits : 02</b>
<b>L:T:P:S :0:0:5:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*Design and implementation of relational databases. Describe basic concepts of how a database stores information via tables and Explore Updating and inserting data into existing tables. Explaining SQL syntax used with MySQL. Describe how to retrieve and manipulate data from one or more tables using joins. Describe how to filter data based upon multiple conditions. Explaining various functions such as string, date and time, aggregate functions. Describe the complex and various types of sub queries in SQL.*

**Course outcome: At the end of course, the student will be able to**

CO1	Design and implement a Database Systems by creating tables, views for an applications.
CO2	Populate and query a database by performing basic operations like CREATE, DELETE, UPDATE, SELECT, ALTER using SQL DDL and DML commands.
CO3	Develop queries using SQL Operators and Functions.
CO4	Declare and enforce Integrity Constraints on a database using SQL commands.
CO5	Formulate queries by using set operations, join operations, functions, operators and sub queries.
CO6	Show execution of SQL queries using MySQL for database tables using DCL and TCL commands.

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	2
CO 2	3	3	2	3	3	3	2	3	3	3	3	3	3
CO 3	3	3	3	3	2	3	3	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	3	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

### PRACTICAL – II

S. No	CONTENTS OF MODULE	Hrs	COs
1	DDL – Data Types, Create, Alter, Drop, Views.	9	CO1

2	DML – Insert, delete and update commands. Integrity constraints.	9	CO2
3	Select command with operators like arithmetic, comparison, logical, order by, group by etc. Set Operations – union, intersect and minus.	9	CO3
4	SQL Functions – date, numeric, character, conversion, avg, max, min, sum, count.	9	CO4
5	DCL & TCL – grant, revoke, rollback and commit. Join query concept – Inner, Left, Right, Outer joins. Complex and sub queries.	9	CO5, CO6

## **FIRST SEMESTER**

### **SPOKEN TUTORIAL**

#### **SP01 - INTRODUCTION TO COMPUTERS**

S.NO	CONTENTS
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1	Getting to know computers
2	Printer Connection
3	Introduction to Gmail
4	Compose Options for Email
5	Google Drive Options

**Note:**

**Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.**

**SECOND SEMESTER  
SYLLABUS**

**Course Title: CORE THEORY-5 DATA STRUCTURES AND ALGORITHMS**

<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*Develops skills in implementations and applications of data structures. Implements basic algorithms for sorting and searching. Implements basic data structures such as stacks, queues and trees. Applies algorithms and data structures in various real-life software problems.*

**Course outcomes: At the end of course, the student will be able**

CO1	Define data structures like array, stack, queues and linked list.
CO2	Explain insertion, deletion and traversing operations on data structures.
CO3	Identify the asymptotic notations to find the complexity of an algorithm.
CO4	Compare various searching and sorting techniques.
CO5	Choose appropriate data structure while designing the algorithms.
CO6	Design advanced data structures using nonlinear data structures.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	3	3	1	3	2	1	3	3	2	2	3
CO 2	3	2	3	3	3	2	1	2	3	2	2	2	1
CO 3	3	3	3	2	3	1	1	1	3	2	2	3	2
CO 4	3	3	1	3	2	3	2	2	3	2	2	3	3
CO 5	3	3	2	2	2	2	1	1	3	3	3	3	2
CO 6	3	3	2	2	2	2	2	1	3	3	3	3	1

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	HRS	COS
1	<b>UNIT I:</b> Abstract data types asymptotic notations – complexity analysis – Arrays- representation of arrays – Linked lists: Singly linked list - Circular linked lists – Doubly linked lists – stacks – <b>queues</b> - circular queues – Postfix Notation.	10	CO1, CO2
2	<b>UNIT II:</b> Trees – Binary Trees – Binary Tree Traversals – Binary Tree Representations – Binary Search Trees – Threaded Binary Trees -Introduction to AVL Trees-Red-Black Trees, Splay Trees, <b>B-Trees.</b>	8	CO3, CO4
3	<b>UNIT III:</b> – Representation of <b>Graphs</b> – Graph Implementation – Graph Traversals- Minimum Cost Spanning Trees – Shortest Path Problem.	9	CO5



4	<b>UNIT IV:</b> Divide and conquer – Quick sort, Merge sort – Greedy Method: General Method –knapsack problem.	9	CO6
5	<b>UNITV:</b> Back Tracking: General Method – 8-queens - Branch and Bound: General Method - Traveling Salesperson problem.	9	CO2

### TEXT BOOKS

1. E. Horowitz, S. Sahni and S. Rajasekaran (2001). *Computer Algorithms*, Galgotia publishers, ISBN:9788173716126
2. E.Horowitz, S. Sahni and Mehta(2000).*Fundamentals of Data Structures in C++*, Galgotia publishers,ISBN:0929306376

### REFERENCE BOOKS

1. G. L. Heileman(1999). *Data Structures, Algorithms and Object Oriented Programming*, Revised Edition, TMH, ISBN: 0070278938.
2. A.V.Aho, J.D. Ullman, J.E. Hopcraft (1983). *Data Structures and Algorithms*, Revised Edition, Addison Wesley publishers, ISBN: 0201000237.
3. A.V. Aho, J.E. Hopcroft, J.D. Ullmann (1974).*The design and analysis of Computer Algorithms*, Revised Edition, Addison Wesley publishers,ISBN:0201000237.

### E-REFERENCES

1. [www.freetechbooks.com/a-practical-introduction-to-data-structures-and-algorithm-analysis-third-edition-c-version-t804.html](http://www.freetechbooks.com/a-practical-introduction-to-data-structures-and-algorithm-analysis-third-edition-c-version-t804.html)
2. [www.nptel.iitm.ac.in/courses/106101060](http://www.nptel.iitm.ac.in/courses/106101060)
3. <http://www.nptel.iitm.ac.in/courses/106104019/>
4. <https://www.techiedelight.com/best-online-courses-data-structures-algorithms/>
5. <https://freevidelectures.com/course/2279/data-structures-and-algorithms/>

## SECOND SEMESTER

**Course Title: CORE THEORY 6 - COMPUTER NETWORKS**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*On taking this course the student will be able to assess the basic taxonomy and terminology of the Computer Networks and the layers of OSI model and TCP/IP model and various Transmission Medias. Understand the Telephone System Structure of Physical layer and Data link layer protocols. Describe data link layer and MAC layer concepts, design issues, and protocols. Gain core knowledge of Network layer Routing protocols and IP addressing. Discuss the Session layer design issues, Transport layer services, and protocols.*

**Course outcomes: At the end of course, the student will be able to**

CO1	Gain a basic knowledge of Networking and functions of each layer in OSI and TCP/IP model. Demonstrate the network topology.
CO2	Diagnose the problems of a Current Multiplexing Techniques.
CO3	Classify the various multiple access protocols and identify the deficiencies in existing protocols, and then go onto formulate new and better protocols.
CO4	Apply the mathematical background of routing protocols. Analyze the collision occurred in current networks. Classify the classes of IP protocols and select the IP addresses for the given network.
CO5	Describe the issues surrounding in Session layer and Transport layer and identify how to rectify.
CO6	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

### Mapping of Course Outcomes to Program Specific Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	2	2	2	2	3	2	3	2	2
CO2	3	3	3	2	2	3	3	2	2	3	3	3	2
CO3	3	2	3	2	3	2	3	3	2	3	2	3	2
CO4	2	3	3	3	2	3	2	3	2	2	2	2	3
CO5	3	3	2	3	2	3	2	3	2	3	3	3	3
CO6	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

SNO	CONTENT OF MODULE	Hrs	COS
1	<b>UNIT I:</b> Introduction: Network Hardware – Software – Reference Models – OSI and TCP/IP Models. Physical Layer: Transmission Media- <b>Wireless Transmission</b> -Narrow Band ISDN.	9	CO1
2	<b>UNIT II:</b> Telephones Structure: Local Loops – Trunks, Multiplexing, and Switching. Data Link Layer: Design Issues – Error Detection and Correction - Elementary data link protocols - <b>Sliding Window Protocols</b> .	9	CO2
3	<b>UNIT III:</b> Medium Access Sub Layer: Channel Allocation Problem. Multiple Access Protocols: ALOHA – Carrier Sense Multiple Access Protocols – Collision Free Protocols – Limited Contention Protocols. <b>Bridges:</b> Transparent Bridges – Spanning Tree Bridges – Source Routing Bridges.	9	CO3
4	<b>UNIT IV:</b> Network layer Design Issues. <b>Routing Algorithms:</b> Shortest Path Routing – Flooding – Distance Vector Routing – Link State Routing – Hierarchical Routing. Congestion control algorithms: General Principles – Congestion Control in Virtual Circuit Subnets – Choke Packets – Load Shedding – Jitter Control. IP protocol: IP Address – <b>Subnets</b> - Internet Control Protocol.	9	CO4

<b>5</b>	<b>UNIT V:</b> Transport layer: Elements – Connection management – Addressing, Establishing & Releasing a connection – <b>Transport Control Protocol</b> : TCP Protocol – TCP segment Header – Connection Management – Congestion control.	<b>9</b>	<b>CO5, CO6</b>
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**TEXT BOOK**

1. A.S.Tanenbaum (2003). *Computer Networks* (4th Edition), Pearson Education, Prentice hall of India Ltd.

**REFERENCE BOOKS**

1. B. Forouzan (1998). *Introduction to Data Communications in Networking*, TMH.
2. Fred Halsall (1995). *Data Communications, Computer Networks and Open Systems*, Addison Wesley.

**E-REFERENCES:**

1. <http://www.technolamp.co.in/2010/08/computer-networks-tanenbaum-powerpoint.html>
2. <http://www.freetechbooks.com/computer-networks-performance-and-quality-of-service-t830.html>
3. <https://freevideolectures.com/course/3162/computer-networking-tutorial>
4. [http://video.bilkent.edu.tr/course\\_videos.php?courseid=32](http://video.bilkent.edu.tr/course_videos.php?courseid=32)

**SECOND SEMESTER**

Course title: **CORE THEORY 7 - MICROPROCESSOR AND MICROCONTROLLER**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking the course, the students will be able to Illustrate the Architecture and programming concepts of the microprocessor 8086 and 8051 Microcontrollers and introduce the programming and interfacing techniques of 8086 microprocessor. They can acquire the knowledge of Macros and Assembler Directives. Also Analyze Interrupts of 8086 microprocessor and Cognize to interface the circuits for various applications. Absorb the 8051 Microcontroller configuration and Instruction Sets.*

**Course outcome: the end of course, the student will be able to**

<b>COS</b>	<b>Content of module</b>
<b>CO1</b>	Recognize 8086 microprocessor simulator, knowledge of 8086 instruction set and ability to utilize it in assembly language programming. Importance of various kinds of Project Management methods, Tracking Software Quality, Quality Standards and Metrics.
<b>CO2</b>	Assess and solve basic binary math operations using the microprocessor and explain the microprocessor's and Microcontroller's internal architecture and its operation

	within the area of manufacturing and performance.
<b>CO3</b>	Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller.
<b>CO4</b>	Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.
<b>CO5</b>	Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) and Microcontroller to meet specified performance requirements.
<b>CO6</b>	Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices. Evaluate assembly language programs and download the machine code that will provide solutions real-world control problems.

**Mapping of Course outcomes to program outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO1</b>	3	3	2	3	3	3	2	2	3	3	3	3	2
<b>CO2</b>	3	3	2	3	3	3	2	2	3	3	3	3	2
<b>CO3</b>	3	3	2	3	3	3	2	3	2	3	3	3	2
<b>CO4</b>	3	3	2	3	3	3	2	3	2	3	3	3	3
<b>CO5</b>	3	3	3	3	3	3	3	3	2	3	3	3	2
<b>CO6</b>	3	3	3	3	3	3	3	3	3	2	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

SNO	CONTENT OF MODULE	Hrs	COS
<b>1</b>	<b>UNIT-I:</b> Introduction to <b>8086</b> assembly language programming - Development steps – Construction - Writing Programs and Development Tools – Standard program structures – simple Programs – Jumps – While-do – repeat-until- <b>Delay loops</b> .	<b>9</b>	<b>CO1</b>
<b>2</b>	<b>UNIT-II:</b> Strings – Procedures – Macros – Instruction Descriptions – Assembler Directives.	<b>9</b>	<b>CO2</b>
<b>3</b>	<b>UNIT-III:</b> 8086 Microcomputer – Observing Bus signals – Minimum mode System – Troubleshooting – 8086 interrupts – Interrupt Applications – Programmable <b>timer/Counter</b> – Interrupt Controller.	<b>9</b>	<b>CO3</b>
<b>4</b>	<b>UNIT-IV:</b> Programmable Parallel Ports and Handshake Input/Output, Interfacing a Microprocessor to Keyboards, Interfacing to Alphanumeric Displays - Analog Interfacing - Review of Operational-amplifier Characteristics and Circuits Sensors and Transducers D/A Converter Operation, Interfacing, and Applications A/D Converter - specifications, Types.	<b>9</b>	<b>CO4</b>
<b>5</b>	<b>UNIT-V:</b> <b>8051</b> Microcontrollers- Introduction to 8051 Microcontrollers – 8051 <b>Instruction Set</b> and Programming , Hardware Features of 8051 – 8051 Interfacing examples.	<b>9</b>	<b>CO5, CO6</b>

**TEXT BOOKS:**

1. D. V. Hall (1992). *Microprocessors and Interfacing, Programming and Hardware*, (Second Edition), TMH, ISBN no:13:978-8120331914

2. Ramesh S. Gaonkar (2000), *Microprocessor Architecture Programming and Applications with 8085*, (Fourth Edition), Penram International Publishing (i) Pvt Ltd. ISBN no: 10 8187972882
3. N.Senthil Kumar, M.Saravanan and S.Jeevananthan (2010). *Microprocessors and Microcontrollers*, Oxford University Press, (Unit V) ISBN no:10 9780198079064

**REFERENCE BOOKS:**

1. Yu-Cheng Liu and Glenn A.Gibson (2001).*Microcomputer Systems: The 8086 / 8088 Family Architecture, Programming & Design*, (Second Edition), Prentice Hall of India Pvt. Ltd. ISBN no: 10- 013580499X
2. A. P Godse and D.A. Godse (2009). *Microprocessors and Interfacing*, (First edition), Technical Publications. ISBN no: 13-978-8189411602.

**E- REFERENCES:**

1. [www.cosc.brocku.ca/~bockusd/3p92/Local.../8086\\_achitecture.htm](http://www.cosc.brocku.ca/~bockusd/3p92/Local.../8086_achitecture.htm)
2. [www.reference.com/motif/.../interrupt-in-8086-microprocessor](http://www.reference.com/motif/.../interrupt-in-8086-microprocessor)
3. [https://onlinecourses.nptel.ac.in/noc19\\_ee11](https://onlinecourses.nptel.ac.in/noc19_ee11)
4. <https://www.class-central.com/course/nptel-microprocessors-and-microcontrollers-9894>
5. <https://www.arrow.com/en/microcontrollers-and-processors>

**SECOND SEMESTER**

Course Title: **CORE THEORY 8 - PROGRAMMING IN PHP**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course the student will be able to develop a basic understanding of how server-side programming works on the web and to learn basic syntax for variable types and calculations in PHP. Creating conditional structures, storing data in arrays and learn how to design using PHP built-in functions and creating custom functions in PHP. To develop the skills of designing form submission using POST and GET methods and how to receive and process form submission data in PHP. Understanding the concept of object-oriented programming in PHP, reading and writing Cookies and Sessions in PHP and to provide knowledge on how to develop the ability to write database application using MYSQL in PHP.*

**Course Outcomes: At the end of the Course, the Student will be able to:**

<b>CO1</b>	Develop the knowledge of Hardware and Software requirements, Installation of PHP, data types, different types of operators and Control Structures in PHP.
<b>CO2</b>	Implementation of arrays, Looping Structures, Functions in PHP.
<b>CO3</b>	Learn the concepts of File System. Working with Forms and Implementation of Regular Expressions in Forms.
<b>CO4</b>	Gain the Knowledge of OOPS concept.

CO5	Implementation of Database Connectivity using MYSQL and Learn the concepts of Cookies.
CO6	Implementation of Session and AJAX

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S. No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT-I: Introduction</b> -The Origin of PHP-PHP is better than Its alternatives-How PHP works with the Web Server-Hardware and Software requirements and installation-PHP Pros and Cons-PHP: past, present and future (PHP 3.0, PHP 4.0, and PHP 5)-Strength of PHP <b>Basic PHP Development</b> -How PHP scripts work-Basic PHP syntax-PHP variables-PHP data types-Displaying type information-Testing for a specific data type-Operators-Variable manipulation-Dynamic variables-String in PHP <b>Control Structures</b> -The if statement-Using the else clause with if statement, multiple if, nested if-The switch statement-Using the ? Operator- Summary	9	CO1
2	<b>UNIT-II: Arrays</b> -Single-Dimensional Arrays-Multidimensional Arrays-Casting Arrays-Associative arrays-Accessing arrays-Getting the size of an array-Looping through an array-Looping through an associative array- Examining arrays-Joining arrays-Sorting arrays-Sorting an associative arrays <b>Loops</b> -The while statement-The do while statement-The for statement-Break & continue Nesting loops-For each loops <b>Functions</b> -Introduction of functions <b>-PHP Library Function</b> -Array functions-String functions-Date and time functions-Other important functions- <b>User Defined Function</b> -Defining a function with parameters and without parameters-Returning value from function-Dynamic function calls Accessing variable with the global statement-Function calls with the static statement-Setting default values for arguments-Passing arguments to a function by value-Passing arguments to a function by reference.	9	CO2
3	<b>UNIT-III: Working with the File System</b> -Creating and deleting a file-Reading and writing text files Working with directories in PHP-Checking for existence of file-Determining file size-Opening a file for	9	CO3

	writing, reading, or appending-Writing Data to the file-Reading characters <b>Working With Forms</b> -Forms-Super global variables-The server array-A script to acquire user input-Importing user input-Accessing user input-Combine HTML and PHP code-Using hidden fields -Redirecting the user-File upload and scripts . <b>Validation</b> -Server side validation-Client side validation (Java script)-Working With Regular Expressions.		
4	<b>UNIT-IV: Classes And Objects</b> -Introduction of Objects oriented programming, Define a class-Creating an object-Object properties-Object methods-Object constructors and destructors-Class constants, Access modifier, Class inheritance-Abstract classes and methods-Object serialization Checking for class and method existence-Exceptions-Summary <b>Introduction To Database</b> -Introduction to SQL-Connecting to the MYSQL-Database creation and selection-Database table creation, update table structure-insert, update, delete data to a table-Fetch data from table, Acquiring the value, Joins, sub query-Finding the number of rows-Executing multiple queries- <b>Cookies</b> -The anatomy of a cookie-Setting a cookie with PHP-Deleting a cookie-Creating session cookie-Working with the query string-Creating query string.	9	CO4
5	<b>UNIT-V: Session</b> -What is session-Starting a session-Working with session variables -Destroying session-Passing session Ids-Encoding and decoding session variables <b>Disk Access, I/O, And Mail</b> -File upload-File download-Environment variables-E-mail in PHP-Random numbers AJAX (Asynchronous JavaScript and XML)-Introduction to AJAX-Introduction to XMLHttpRequest Object-Method and Properties of XMLHttpRequest-Application of AJAX in web application	9	CO5 , CO6

#### TEXT BOOKS:

1. David Sklar, Nathan Torkington (2004). *Learning PHP* (5<sup>th</sup> edition), O'Reilly publishers.
2. W. Jason Gilmore(2006).*Beginning PHP and MySQL 5 From Novice to Professional*, Apress
3. Kevin Yank (2009).*Build Your Own Database Driven Web Site Using PHP & MySQL*, Sitepoint.

#### REFERENCE BOOKS:

1. RasmusLerdorf, Kevin Tatroe, Peter MacIntyre (2006).*Programming PHP*, O'Reilly publishers.
2. Luke Welling, Laura Thomson, (2004).*PHP and MySQL Web Development*, 3<sup>rd</sup> Edition, Sams publishers.

#### E-REFERENCES:

1. [https://www.wired.com/2010/02/php\\_tutorial\\_for\\_beginners/](https://www.wired.com/2010/02/php_tutorial_for_beginners/)
2. <http://php.net/manual/en/tutorial.firstpage.php>
3. <http://php.happycodings.com/>
4. <https://www.codingunit.com/php-tutorial-language-introduction>



5. [http://www.spoken\\_tutorial.org](http://www.spoken_tutorial.org)
6. <https://www.killerphp.com/php-videos/>
7. <https://www.geeksforgeeks.org/php-objects/>
8. <https://www.phptpoint.com/php-this-class/>
9. [https://www.startutorial.com/homes/oo\\_beginner](https://www.startutorial.com/homes/oo_beginner)

## SECOND SEMESTER

Course title: **ELECTIVE 2 - OBJECT ORIENTED SOFTWARE ENGINEERING**

<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*On taking the course, the students will be able to Develop the knowledge and practical skills needed to successfully participate in the analysis, design and development of large software systems, using object-oriented approaches, they can Apply team dynamics by working in teams, focus on object-oriented approaches and project management techniques Communicate the science and Development of graphical user interfaces, and quality assurance.*

### Course outcome: the end of course, the student will be able to

CO1	Knows the reason about the basic Software life cycle models Importance of various kinds of Project Management methods, Tracking Software Quality, Quality Standards and Metrics.
CO2	Develop System Concepts for Object Modelling Design and implement a software design concept to meet desired needs and Requirements. Design the UML concepts like sequential, Use cases and Activity diagram
CO3	Concepts of Use cases, actors, and common modelling techniques. Implementing the concept use cases, business actors, Significance of identifying the subsystems and business requirements
CO4	Explain Design Workflow and System Design Concept Create Mapping Object Model to Database Schema Testing and verification process Creation.
CO5	Usage of Software Configuration Management Definition and Types of maintenance Life Build Reverse and re-engineering process.

### Mapping of Course outcomes to program outcomes:

<b>C0/PO/PSO</b>	<b>PO</b>	<b>PSO</b>
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	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>CO1</b>	3	3	3	3	3	3	3	3	2	2	2	3	2
<b>CO2</b>	3	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO3</b>	3	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO4</b>	3	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO5</b>	3	3	2	2	2	2	3	3	2	3	2	3	2
<b>CO6</b>	3	3	2	3	3	2	3	3	2	3	2	3	2

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

<b>SNO</b>	<b>Content of module</b>	<b>Hrs</b>	<b>COS</b>
<b>1</b>	<b>UNIT-I:</b> Software life cycle models: Waterfall, <b>RAD</b> , and Spiral model Process metric – Product metrics – Estimation – LOC, FP, COCOMO models – Project Management – Planning, Scheduling and Tracking Software Quality – Quality Standards, Quality Metrics.	<b>9</b>	<b>CO1</b>
<b>2</b>	<b>UNIT-II:</b> System Concepts for <b>Object Modeling</b> – Abstraction, Inheritance, Polymorphism, Encapsulation, Message Sending, Association, Aggregation – Requirement Workflow Functional, Non-functional – Characteristics of Requirements – Requirement Elicitation Techniques – Requirement Documentation – Use case specification, Activity Diagram.	<b>9</b>	<b>CO2</b>
<b>3</b>	<b>UNIT-III:</b> <b>Use-Case Modeling</b> – Actors, Use Cases, Use Case Relationships. The Process of Requirements Use-Case – Identify Business Actors, Identify Business Requirements, Use Cases, Construct, Use Case Model Diagram – Class Diagrams and Object Diagrams – Package Diagrams – Sequence and Collaboration diagrams, State chart diagram.	<b>9</b>	<b>CO3</b>
<b>4</b>	<b>UNIT-IV:</b> Design Workflow: System Design Concept – Coupling and Cohesion – Architectural Styles – Identifying Subsystems and Interfaces – Design Patterns Implementation Workflow – Mapping models to Code – Mapping Object Model to Database Schema Testing – Formal Technical Reviews – Walkthrough and Inspection.	<b>9</b>	<b>CO4</b>
<b>5</b>	<b>UNIT-V:</b> <b>Software Configuration Management</b> – Managing and controlling Changes – Managing and controlling versions Maintenance- Types of maintenance – Maintenance Log and defect reports – Reverse and re-engineering.	<b>9</b>	<b>CO5,CO6</b>

#### **TEXT BOOKS:**

1. Roger Pressman, (2005). *Software Engineering*, (Sixth Edition), TMH. ISBN no: 13:978-007-126782-3.
2. Bahrami, (2008). *Object Oriented Systems Development*, (Second edition), TMH. ISBNno: 13 978-0070265127.
3. Bernd Bruegge, (2004). *Object oriented software engineering*, (Second Edition), Pearson Education. ISBN no: 13 978-93332518681.

#### **REFERENCE BOOKS:**

1. Stephan R Schach, (2007). *Object oriented software engineering*, (Second edition), TMH. ISBN no: 9780071259415
2. Timothy C Lethbridge, Robert Laganriere (2004). *Object-Oriented Software Engineering Practical software development using UML and Java*, (Second edition), TMH.

**E-REFERENCES:**

1. [www.enginumdumich.edu/CIS/coursedes/cis200//tutorial/onedoc](http://www.enginumdumich.edu/CIS/coursedes/cis200//tutorial/onedoc)
2. [www.nptel.iitm.ac.in/courses/Webcourse-contents/IISc/LNm9.pdf](http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IISc/LNm9.pdf)
3. [www.niecdelhi.ac.in/uploads/Notes/btech/6sem/.../oose lecture plan.pdf](http://www.niecdelhi.ac.in/uploads/Notes/btech/6sem/.../oose lecture plan.pdf)
4. <https://vabringreaba.cf/f0o4tuHDIKGa5C.php>
5. <https://www.edutechlearners.com/oose-notes/>

## SECOND SEMESTER

Course Title: **ELECTIVE 2 - UNIFIED MODELING LANGUAGE**

<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES:

*On taking the course, the students will be able to understand the importance of various basic concepts of object modeling Gain the knowledge about various basic structural modeling along with their applicability contexts. The students can Analyze various basic Behavioral modeling of object-oriented software design (UML) and Review the concepts of Advance Behavioral modeling.*

**Course outcomes: At the end of course, the student will be able to**

<b>CO1</b>	Analyze the basic concepts of object modeling.
<b>CO2</b>	Demonstrate various Basic Structural Modeling using the appropriate notation
<b>CO3</b>	Demonstrate various Basic Behavioral Modeling using the appropriate notation
<b>CO4</b>	Analyze various Advanced Behavioral Modeling using the appropriate notation
<b>CO5</b>	Analyze Architectural Modeling using the appropriate notation
<b>CO6</b>	Apply various UML diagrams for software development.

### Mapping of Course Outcomes to Program Specific Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO1</b>	3	2	2	2	2	2	2	1	3	2	2	2	2
<b>CO2</b>	3	3	2	2	3	1	3	3	1	3	3	3	2
<b>CO3</b>	3	2	2	2	3	2	3	3	2	3	2	3	2
<b>CO4</b>	2	3	2	2	2	2	2	2	2	2	2	2	3
<b>CO5</b>	3	3	2	2	3	2	2	3	2	3	3	3	3
<b>CO6</b>	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

SNO	CONTENT OF MODULE	Hrs	COS
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1	<b>UNIT-I:</b> Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture	9	CO1
2	<b>UNIT-II:</b> Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Interfaces, Types and Roles, Packages. Class Diagram & Object Diagram: Terms, Concepts, modeling techniques for Class & Object Diagrams.	9	CO2
3	<b>UNIT-III:</b> Basic Behavioral Modeling: Interactions, Interaction diagrams. Use cases, Use case Diagrams, Activity Diagrams.	9	CO3
4	<b>UNIT-IV:</b> Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.	9	CO4
5	<b>UNIT-V:</b> Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.	9	CO5,CO6

#### TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson (2005). *The Unified Modeling Language User Guide*, (Second Edition), Pearson Education, ISBN no: 0-201-57168-4
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado (2003). *UML Toolkit*, (Second Edition), WILEY-Dreamtech India Pvt. Ltd, ISBN no: 13:978-81-265-0466-4
3. Grady Booch (2007). *Object Oriented Analysis and Design*, (Third Edition), Addison Wesley, ISBN no :0-8053-5340-2

#### REFERENCE BOOKS:

1. Pascal Roques, Modeling (2007). *Software Systems Using UML2*, (Fourth Edition), WILEY-Dreamtech India Pvt. Ltd. ISBN no :13-978-81-265-0505-0
2. AtulKahate, (2000). *Object Oriented Analysis & Design*, Tata McGraw-Hill. ISBN no: 0-07-058376-5
3. Ali Bahrami, (1999). *Object Oriented Systems Development*, McGraw Hill. ISBN no:13-978-0-07-026512-7

#### E-REFERENCES:

1. [www.uml-tutorials.trireme.com](http://www.uml-tutorials.trireme.com)
2. [www.smartdraw.com/resources/tutorials/uml-diagrams](http://www.smartdraw.com/resources/tutorials/uml-diagrams)

## SECOND SEMESTER

Course title: **ELECTIVE 2 - OBJECT ORIENTED ANALYSIS AND DESIGN**

Course Code :

Credits : 03

<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks : 40</b>
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking the course, the students will be able to understand the concept of object-oriented development, and create a static object model and a dynamic behavioral model and a functional model of the system. They can easily understand the approaches to system design and object design, and the techniques of translating design to implementation.*

**Course Outcome:** At the end students will be able to

<b>CO1</b>	Analyze object basics and UML
<b>CO2</b>	Gain knowledge about attributes and relationship.
<b>CO3</b>	Interpret axioms and do a case study
<b>CO4</b>	Detailed study about Micro level process
<b>CO5</b>	Digital signatures
<b>CO6</b>	Gain knowledge about various testing strategies.

**Mapping of Course Outcomes to Program Specific Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	2	2	2	2	2	2	3	3	2	2	2	2
CO2	3	3	2	2	3	1	3	3	1	3	3	3	2
CO3	3	2	2	2	3	2	3	3	2	3	2	3	2
CO4	2	3	2	2	2	2	2	2	2	2	2	2	3
CO5	3	3	2	2	3	2	2	3	2	3	3	3	3
CO6	2	2	2	3	3	3	2	2	2	2	3	2	2

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

SNO	CONTENT OF MODULE	Hrs	COS
1	<b>UNIT-I:</b> System development - object basics - development life cycle - methodologies - patterns - frameworks - unified approach - UML.	<b>9</b>	<b>CO1</b>
2	<b>UNIT-II:</b> Use Case models - object analysis - object relations - attributes - methods, class and object responsibilities - case studies	<b>9</b>	<b>CO2</b>
3	<b>UNIT-III:</b> Design processes - design axioms - class design - object storage - object interoperability - case studies.	<b>9</b>	<b>CO3</b>

4	<b>UNIT-IV:</b> User interface design - view layer classes - micro - level processes - view layer interface - case studies.	<b>9</b>	<b>CO4</b>
5	<b>UNIT-IV:</b> Quality assurance tests - testing strategies - object orientation on testing - test cases - test plans - continuous testing - debugging principles - system usability - measuring user satisfaction - case studies	<b>9</b>	<b>CO5,CO6</b>

**TEXT BOOKS:**

1. Ali Bahrami, (1999). *Object Oriented Systems Development*, McGraw Hill. ISBN no:13-978-0-07-026512-7
2. Grady Booch (2007). *Object Oriented Analysis and Design*, (Third Edition), Addison Wesley, ISBN no :0-8053-5340-2
3. Bernd Bruegge, (2004). *Object oriented software engineering*, (Second Edition), Pearson Education. ISBN no: 13 978-93332518681.

**REFERENCE BOOKS:**

1. James Rumbaugh, Michael R. Blaha, (2004). *Object-Oriented Modeling and Design with UML* , (Second Edition),Prentice Hall ISBN no: 978-81-317-1106-4
2. AtulKahate, (2000). *Object Oriented Analysis &Design*, Tata McGraw-Hill. ISBN no: 0-07-058376-5
3. Roger Pressman, (2005). *Software Engineering*, (Sixth Edition), TMH. ISBN no: 13:978-007-126782-3.

**E-REFERENCES:**

1. <http://www.exforsys.com/tutorials/ood/ood-introduction.html>
2. <http://www.devshed.com/c/a/Practices/Introducing-UMLObjectOriented-Analysis-and-Design>

**SECOND SEMESTER**

**Course Title: PRACTICAL III - MICROPROCESSOR LAB**

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<b>Course Code :</b>	<b>Credits : 02</b>
<b>L:T:P:S : 0:0:5:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking the course, the students will be able to demonstrate the insight of an exciting growing field of microprocessor 8086.Learn the instruction sets to develop the knowledge of assembly language programs 8086.Analyze assembly language programs to acquire the*

*knowledge of Macros and Assembler Directives. Derive the coding of assembly language programs 8086 techniques focusing on industry applications. Exhibit the fundamental techniques and principles in achieving assembly language instructions.*

**Course outcome: the end of course, the student will be able to**

CO1	Derive the steps of algorithms for every exercise.
CO2	Cognize to interface the circuits for various applications. Absorb the 8051 Microcontroller configuration and Instruction Sets.
CO3	Implementation of assembly language programs in 8086
CO4	Validate the students to have skills that will help them to solve complex real-world problems in for decision support.
CO5	Exhibit the fundamental techniques and principles in achieving assembly language instructions.
CO6	Validate the students to have skills that will help them to solve complex real-world problems in for decision support.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO1</b>	3	2	2	2	2	2	3	3	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	3	3	1	3	3	3	2
<b>CO3</b>	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO5</b>	3	3	2	2	3	3	3	3	3	3	3	3	3
<b>CO6</b>	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

SNO	CONTENT OF MODULE	HRS	COS
1	8 Bit Addition and Subtraction. 16 Bit Addition.	9	<b>CO1</b>
2	BCD Addition. BCD Subtraction.	9	<b>CO2</b>
3	8 Bit Multiplication. BCD Multiplication.	9	<b>CO3</b>
4	8 Bit Division. Searching for an Element in an Array.	9	<b>CO4</b>



5	Sorting in Ascending and Descending Orders. Finding Largest and Smallest Elements from an Array. Reversing Array Elements. Block Move.	9	CO5,CO6
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**SECOND SEMESTER**

**Course Title: PRACTICAL IV - PHP PROGRAMMING LAB**

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<b>Course Code :</b>	<b>Credits : 02</b>
<b>L:T:P:S : 0:0:5:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course the student will be able to understand and develop simple applications using control flow, loops, to create arrays and perform various array functions ,string functions, date functions, to create files and perform various file access operations, develop applications using object oriented programming concepts, to create database connection application using MYSQL , to develop applications using Cookies and Sessions and to acquire knowledge about designing server-side cross-platform HTML-embedded scripts in forms using*

*Get and Post method.*

**Course Outcomes: At the end of the Course, the Student will be able to:**

<b>CO1</b>	Develop application using Control structures and Looping statements.
<b>CO2</b>	Develop application using array functions, string functions, date functions.
<b>CO3</b>	Develop applications using user defined functions and file operations
<b>CO4</b>	Build and develop application using Cookies and Session management.
<b>CO5</b>	Built and implement applications using object oriented programming concept.
<b>CO6</b>	Design database connection application using MYSQL

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>CO 3</b>	3	3	3	3	3	3	3	2	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	3	2	2	2	3	3	3	3	3
<b>CO 5</b>	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>CO 6</b>	3	3	3	3	3	3	2	3	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

<b>S. No</b>	<b>CONTENTS OF MODULE</b>	<b>Hrs</b>	<b>COs</b>
1	Create applications using Control Structures such as if-statement, if-else, if-else if, nested if, Switch statement. Built applications using Looping statements such as For, While, Do- while, For each statement.	9	CO1
2	Create applications using array – creating, sorting, merging .Develop programs using String functions and Date functions	9	CO2
3	Create application using File System-Creating and deleting a file-Reading and writing text files. File upload-Checking for existence of file-Determining file size. Developing programs using built in and user defined functions.	9	CO3
4	Create applications using Forms – communication between HTML and PHP server. Redirecting Forms, Checking hidden fields and Form Validation. Develop applications using cookies and session management.	9	CO4
5	Develop applications using Object Oriented Programming such as constructors and destructors, Class inheritance, Abstract classes and methods, Object serialization. Design database connection applications using MYSQL.	9	CO5, CO6

**SECOND SEMESTER  
SPOKEN TUTORIAL**

**SP02 - LINUX**

<b>S.NO</b>	<b>CONTENTS</b>
<b>1</b>	Ubuntu Desktop- Desktop Customization- Synaptic Package Manager- Ubuntu Software Center- Basic Commands- General Purpose Utilities in Linux- File System- Working with Regular Files- File Attributes- Redirection Pipes- Working with Linux Process- The Linux Environment- Basics of System Administration- Simple filters- The grep command- More on grep command- The sed command- More on sed command- Basics of AWK.

**Note:**

**Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.**

## THIRD SEMESTER

### SYLLABUS

**Course Title: CORE THEORY 9 - ENTERPRISE COMPUTING**

<b>Course Code:</b>	<b>Credits</b>	<b>: 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks</b>	<b>: 40</b>
<b>Exam Hours: 03</b>	<b>ESE Marks</b>	<b>: 60</b>

#### LEARNING OBJECTIVES:

*On taking this course, student will be able to understand the various concepts of Enterprise programming, developing RMI Application, Servlet and session management and learn data manipulation using JDBC, develop web applications using JSP, implement Javamail API and familiarize the students with the concepts of reusable classes using JavaBeans, Hibernate and Spring Framework applications.*

#### Course Outcomes: At the end of the Course, the Student will be able to:

<b>CO1</b>	Understand various concepts of Enterprise Computing, analyze and implement the RMI Architecture for the necessary applications.
<b>CO2</b>	Implement Session management using Servlet and implement JDBC for the database connectivity.
<b>CO3</b>	Develop Web applications using JSP and JSP error pages.
<b>CO4</b>	Design an application that sends and receives email with attachments.
<b>CO5</b>	Implement Database connectivity through Hibernate Framework and also build web applications using Spring MVC.
<b>CO6</b>	Study and use modern tools for rapidly building enterprise applications.

#### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	2	3	3	2	2	2	3	3	3	2	3
<b>CO 2</b>	3	3	2	3	3	2	2	2	2	3	3	3	3
<b>CO 3</b>	2	3	2	2	3	2	3	3	2	3	3	2	3
<b>CO 4</b>	3	3	2	3	3	2	2	2	2	3	2	3	2
<b>CO 5</b>	2	3	3	3	3	3	3	3	3	3	2	3	3
<b>CO 6</b>	3	3	3	3	3	3	3	3	3	2	3	2	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT-I:</b> Need for Enterprise Programming – J2EE Advantage – Enterprise Architecture types– Architecture of J2EE – J2EE Components – J2EE Containers – Introducing RMI – RMI	9	CO1

	Architecture – Application Development with RMI – RMI over IIOP.		
2	<b>UNIT-II:</b> Introduction to <b>Servlets</b> – Servlet Life Cycle – Servlet API Basics – HTTP Redirects –Cookies –State and Session Management –Hidden Fields – URL rewriting –Session Management with the Servlet API –Inter Servlet Communication – Server Side Includes and Request Forwarding –Data Base Access with JDBC.	9	CO2
3	<b>UNIT-III:</b> <b>JSP:</b> Introduction JSP –Examining MVC and JSP –JSP scripting elements &directives –Working with variables scopes – Error Pages –using Java Beans in JSP.	6	CO3
4	<b>UNIT-IV:</b> <b>Javamail:</b> Working with Java Mail –Understanding Protocols for Javamail –Components –Javamail API –Understanding <b>Java Messaging Services:</b> JMS Components EJB Fundamentals – EJB Architecture – EJB Roles – Introduction to Session Beans, Entity Beans & Message Driven Beans.	9	CO4
5	<b>UNIT-V:</b> <b>Hibernate:</b> Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language – <b>Spring MVC</b> – Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, and Managing Transaction.	12	CO5, CO6

#### TEXT BOOKS:

1. Jason hunter, William Crawford (2001). *Java Server Programming* (2<sup>nd</sup> Edition), O'Reilly Media, Inc., ISBN: 9780596000400.
2. J McGovern, RAdatia, Y Fain (2003). *J2EE 14 Bible*, Wiley-dreamtech India Pvt Ltd.
3. James Holmes, Herbert Schildt (2000). *Struts: The complete Reference* (2<sup>nd</sup> Edition), TMH.
4. H.Schildt (2002). *Java 2 Complete Reference* (5<sup>th</sup> Edition), TMH.

#### REFERENCE BOOKS:

1. K Moss (1999). *Java Servlets* (Second Edition), TMH.
2. Joseph O'Neil (1998). *Java Beans from the Ground Up*, TMH.
3. TomValesky (2000). *Enterprise JavaBeans*, Addison Wesley.
4. Cay S Horstmann & Gary Cornell (2002). *Core Java Vol II Advanced Features* (8<sup>th</sup>Edition), Addison Wesley.

#### E- REFERENCES:

1. <https://www.tutorialspoint.com/servlets/servlets-first-example.htm>
2. <http://www.servlets.com/jservlet2/examples/>
3. [http://www.j2eetutorials.50webs.com/JSP\\_example1.html](http://www.j2eetutorials.50webs.com/JSP_example1.html)
4. <http://www.javatpoint.com/ejb-tutorial>
5. <https://slideplayer.com/slide/7362666/>

### THIRD SEMESTER

Course Title: **CORE THEORY 10 - PROGRAMMING IN PYTHON**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course the student will be able to develop a basic understanding of programming and the Python programming language and understand the basics of Strings, Lists and Tuples, learn how to design object-oriented programs with Python classes, learn how to use class inheritance in Python for reusability and how to use exception handling in Python applications for error handling, to provide knowledge on how to develop the ability to write database applications in Python, to develop the skills of designing Graphical user interface in Python and to acquire knowledge about Data science in Python using numpy.*

**Course Outcomes: At the end of the Course, the Student will be able to:**

<b>CO1</b>	To acquire basic programming skills of Python programming language.
<b>CO2</b>	To develop applications using python sequence.
<b>CO3</b>	Implement basic object oriented concepts like inheritance and polymorphism.
<b>CO4</b>	Develop GUI applications using PyGTK. and GUI applications.
<b>CO5</b>	To have basic knowledge of implementing data science in python.
<b>CO6</b>	To use python as a tool for research.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO 3</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO 5</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO 6</b>	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S. No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT-I :</b> Introduction to Python - Installing in various Operating Systems - Variables and Data Types - Operators – Conditional Statements- if-if-else-nested if – Looping – for-while-nested loops– Control Statements- break-continue-pass- Input/output Statements	9	CO1
2	<b>UNIT-II:</b> Sequences -String Manipulations - Lists – Tuples – Mapping and Set types - Dictionaries –Set- Functions- Defining a function – calling a function – types of function – function arguments-lambda function- <b>Exception Handling-</b>	9	CO2

	Modules		
3	<b>UNIT-III</b> : File handling - Object Oriented Programming - Classes - Objects –Attributes - Inheritance - Overloading - Polymorphism -Interacting with Databases - Introduction to MySQL - interacting with MySQL – <b>Database connection</b> -creating database table, insert operation, read operation-update operation-delete operation - Regular Expressions - Text handling	9	CO3
4	<b>UNIT-IV</b> : Introduction to Graphics programming - Introduction to GTK - PyGTK - Developing GUI applications using PyGTK–Tooltip, Check button, Combo box, Menus, Calendar, Image, Image processing- <b>Network Programming</b> - socket module - server socket methods - client socket methods - general socket methods- Web services using SOAP	9	CO4, CO6
5	<b>UNIT-V</b> : <b>Data Science in Python</b> –Numpy – Numpy introduction, Data types Object – dtype-Numerical operations on Numpy arrays– Changing the dimensions of arrays -matrix arithmetic Scipy–introduction – basic functions – special function – optimization – linear algebra – Pandas-Introduction to Series and DataFrames – reading and writing data – Data Exploration – Data Munging- Introduction to version control system – subversion/Git	9	CO5, CO6

#### TEXT BOOKS:

1. Allen B Downey(2012), *Think Python: How to Think Like a Computer Scientist*(1<sup>st</sup> Edition), O’Reilly Publications.
2. Jeff McNeil(2010), *Python 26 Text Processing: Beginners Guide*, Packet Publications.
3. Mark Pilgrim(2009), *Dive into Python*(2<sup>nd</sup> edition), Apress publications.

#### REFERENCE BOOKS:

1. Kent D Lee(2010), *Python Programming Fundamentals*(2<sup>nd</sup> Edition), Springer,.
2. John V Guttag , *Introduction to Computation and Programming Using Python*, Prentice Hall of India.

#### E- REFERENCES

1. <http://wwwswaroopchcom/notes/python>
2. [http://enwikibooksorg/wiki/Python\\_Programming](http://enwikibooksorg/wiki/Python_Programming)
3. <http://docspythonorg/release/301/tutorial/>
4. <http://learnpythonthehardwayorg/>
5. <https://wwwcourseraorg/course/interactivepython>
6. <http://wwwpython-courseeu/pandasphp>
7. [http://wwwspoken\\_tutorialorg](http://wwwspoken_tutorialorg)
8. <https://www.coursera.org/learn/python-data?specialization=python>
9. <https://www.coursera.org/learn/python-programming-introduction>



**THIRD SEMESTER**

Course Title: CORE THEORY 11 - **DATAWAREHOUSING AND DATAMINING**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course the student will be able to understand and implement classical models and algorithms in data warehousing and data mining. To analyze the data, identify the problems, and choose the relevant algorithms for the chosen dataset. To compare and contrast different conceptions of data mining, to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering*

**Course Outcomes: At the end of the Course, the Student will be able to:**

CO1	To appreciate the basic principles, concepts and applications of data warehousing and data mining
CO2	Have a good knowledge of the preprocessing techniques
CO3	To perform Data Mining using association rules
CO4	To get insights from data using classification and prediction techniques
CO5	Knowledge of clustering techniques and outliers
CO6	To be able to apply data mining techniques to real world data by cleaning the data, integrating the data from different sources, predicting a model to group the data tuples into classes, discovering patterns using association rule mining and grouping the data set into clusters.

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	3
CO 2	3	3	3	3	3	3	3	2	3	3	3	2	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S. No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT I:</b> Introduction to data warehousing – OLAP – Data Mining tasks – Data Mining versus Knowledge Discovery in Data bases – Mining Issues – Metrics – Social implications of Data mining Data Mining Techniques – Introduction – A statistical perspective on Data Mining – similarity measures – Decision Trees – Neural Networks – Genetic Algorithms.	9	CO1
2	<b>UNIT II:</b> Data <b>Preprocessing</b> : Why preprocess the data – Data cleaning – Data Integration – Data Transformation – Data Reduction – Data Discretization.	9	CO2
3	<b>UNIT III:</b> Data Mining Techniques: Association Rule Mining – The Apriori Algorithm – Multilevel Association Rules – Multidimensional Association Rules – Constraint Based Association Mining.	9	CO3
4	<b>UNIT IV:</b> <b>Classification</b> and Prediction: Issues regarding Classification and Prediction – Decision Tree induction – Bayesian Classification – Back Propagation – Classification Methods – Prediction – Classifiers accuracy.	9	CO4

5	<b>UNIT V: Clustering</b> Techniques: cluster Analysis – Clustering Methods – Similarity and Distance Measures – Hierarchical Methods – Partitional Methods – <b>Outlier Analysis.</b>	9	CO5, CO6
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### TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei (2008), *Data Mining: Concepts and Techniques*, 2<sup>nd</sup> edition, Morgan Kaufmann.
2. Mohammed J.Zaki, Wagnew Meira, Jr, Wagner Meira, (2014), *Data Mining and Analysis*, Cambridge University Press.
3. Charu C. Aggarwal (2015), *Data Mining*, 2<sup>nd</sup> edition, Springer International Publishing.

### REFERENCE BOOKS:

1. Rasmus Lerdorf MH Dunham (2003), *Data Mining: Introductory and Advanced Topics*, 2003, Pearson Education.
2. Paulraj Ponnaiah (2001), *Data Warehousing Fundamentals*, 2001, Wiley Publishers.
3. SN Sivananda and S Sumathi (2006), *Data Mining*, 2006, Thomson Learning, Chennai.

### E-REFERENCES:

1. <http://nptel.iitm.ac.in/video.php?subjectId=106106093>
2. <http://cecs.louisville.edu/datamining/PDF/0471228524.pdf>
3. <http://www.spoken-tutorials.org>
4. <https://www.udemy.com/fundamentals-of-data-mining/>
5. <https://www.coursera.org/learn/cluster-analysis>

## THIRD SEMESTER

Course Title: CORE THEORY 12 - **SOFTWARE TESTING**

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<b>Course Code :</b>	<b>Credits : 04</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES

*On taking this course the student will be able to study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods, to discuss various software testing issues and solutions in software unit test; integration, regression, and system testing, to learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report, to learn various software testing process like verification and validation, to gain the techniques and skills on how to use modern software testing tools to support software testing projects.*

**Course outcomes: At the end of course, the student will be able to**

CO1	Discuss about the concept of bugs and analyses the principles in software testing to prevent and remove bugs.
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CO2	Discuss about domains and path Analyze Linguistic and Structural Metric
CO3	Discuss about Verification and Validation. Analyse various levels of Testing, Testing Approaches, and Types of Testing & Test Plan.
CO4	Analyze Defect Management Discuss about Acceptance testing and special test.
CO5	Analyze various automation testing tools.
CO6	Gain the knowledge about various testing tools.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	2	3	3	3	3	3	3	3	3	2	3
CO2	3	2	3	3	2	3	3	3	3	2	3	3	3
CO3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	3	3	3	2	3	3
CO5	3	3	2	3	3	3	3	2	3	3	3	3	3
CO6	3	2	3	3	3	2	3	3	2	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No.	CONTENT OF MODULE	Hrs	COs
1	<b>UNIT I:</b> Introduction: Purpose – Productivity and Quality in Software – <b>Testing</b> Vs Debugging Model for Testing – <b>Bugs</b> – Types of Bugs – Testing during Development Life-cycle. Requirement Traceability matrix-Work Bench. Principles of software testing, Salient features of Good Testing-Challenges in Testing-cost Aspect of Testing-Developing Testing Methodologies.	<b>9</b>	CO1
2	<b>UNIT II:</b> Domain Testing: Domains and Paths – Domains and Interface Testing- <b>Metrics</b> –Linguistic and Structural Metric.	<b>9</b>	CO2
3	<b>UNIT III:</b> Software Testing Process-Verification and Validation-Levels of Testing-Testing Approaches-Types of Testing-Test Plan.	<b>9</b>	CO3
4	<b>UNIT IV:</b> <b>Test Model</b> - Defect Management-Levels of Testing-Acceptance Testing-Special Tests-Test Planning.	<b>9</b>	CO4

5	<b>UNIT V:</b> Software Testing Tools Overview- QTP Tools- Performance Testing Tools-LoadRunner Tool. Testing Management Tools-TestDirector-GUI Testing-SilkTest- Open Source Testing Tool-JMeter.	9	CO5,CO6
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### TEXT BOOKS

1. B. Beizer (2003). *Software Testing Techniques*, Second Edition), DreamTechIndia, New Delhi. (UNIT I and II).
2. K.V.KK. Prasad (2005). *Software Testing Tools*, DreamTech. , India, New Delhi.
3. (UNIT III, IV and V).
4. M.G.Limaye (2009). *Software Testing Principles, Techniques and Tools*, TataMc.Graw Hill Education Private Limited, New Delhi.(UNIT III and IV)

### REFERENCE BOOKS

1. I.Burnstein (2003). *Practical Software Testing*, Springer International Edition.
2. M G Limaye (2009). *Software Testing*, TMH, New Delhi.

### E-REFERENCES

1. <http://awards.istqb.org/award-winner/boris-beizer.html>
2. <http://www.testingreferences.com/testinghistory.php>
3. <http://www.swquality.com/users/pustaver/Books/books.htm>
4. <http://www.bullseye.com/coverage.html>
5. [https://www.tutorialspoint.com/software\\_testing/](https://www.tutorialspoint.com/software_testing/)
6. <https://lecturenotes.in/subject/129/software-testing-st>
7. [www.ecs.csun.edu/~rlingard/COMP595VAV/SoftwareTesting.ppt](http://www.ecs.csun.edu/~rlingard/COMP595VAV/SoftwareTesting.ppt)

### THIRD SEMESTER

Course Title: **ELECTIVE 3 - CRYPTOGRAPHY**

<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

### LEARNING OBJECTIVES

*To understand the mathematics behind cryptography, security concepts, vulnerabilities, different types of cryptosystems and attacks on various cryptosystems.*

**Course outcomes: At the end of course, the student will be able**

COS	Content of module
CO1	Gain knowledge about Conventional encryption model
CO2	Analyse Euclidean Algorithm and Number theory

CO3	Understanding Key exchanges.
CO4	Detailed representation of Hashing functions.
CO5	Describe the various Digital signatures logic.
CO6	Apply different encryption and decryption techniques

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	1	3	1	1	3	3	2	2	3
CO 2	3	2	3	3	3	2	1	2	3	2	2	2	1
CO 3	3	3	3	2	3	1	1	1	3	2	2	3	2
CO 4	3	3	1	3	2	3	2	2	3	2	2	3	3
CO 5	3	3	2	2	2	2	1	1	3	3	3	3	2
CO 6	3	3	2	2	2	2	2	1	3	3	3	3	1

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	HRS	COS
1	<b>UNIT I:</b> Conventional encryption model –Security Concepts- Substitution and Transposition Ciphers- <b>DES</b> algorithm –AES algorithm - Random number generation.	9	CO1
2	<b>UNIT II:</b> <b>Number Theory:</b> Modular arithmetic – Euler’s theorem – Euclid’s algorithm – Extended Euclidean Algorithm and its applications. Chinese remainder theorem – Prime numbers and factorization –Discrete Logarithms.	9	CO2
3	<b>UNIT III:</b> Principles of Public key Cryptography– <b>RSA</b> algorithm – Key Management- Diffie – Hellman key exchange	9	CO3
4	<b>UNIT IV:</b> Message Authentication and Hash functions: Authentication requirements –Authentication function- Message Authentication codes-Hash functions-Secure Hash Algorithm.	9	CO4
5	<b>UNIT V:</b> <b>Digital Signature and Authentication Protocols:</b> Digital Signature Authentication Protocols –Digital Signature Standard.	9	CO5 ,CO6

**TEXT BOOK**

1. Stallings. W (2013). Cryptography and Network Security Principles and Practice, Pearson Education, Delhi, ISBN: 9788131761663.

#### REFERENCE BOOKS

1. Charlie Kaufman, Radia Perlman, Mike specimen (2016). Network Security Private Communication in a public world, Prentice Hall PTR, ISBN: 9789332586000
2. Michael Welsehenbach (2013). Cryptography in C & C++, Apress, ISBN: 9781430250999.

#### E-REFERENCES

1. <http://www.webopedia.com/TERM/C/cryptography.html>
2. <http://www.sagemath.org/pdf/en/reference/cryptography/cryptography.pdf>
3. <http://www.freotechbooks.com/lecture-notes-on-cryptography-t565.html>
4. <https://nptel.ac.in/courses/10610503/>
5. <https://nptel.ac.in/courses/106105162/>

### THIRD SEMESTER

#### Course Title: ELECTIVE3 - INFORMATION SECURITY

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<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

#### LEARNING OBJECTIVES:

*On taking this course the student will be able to understand and revise the common threats faced today. To understand the foundational theory behind information security and analyze what are the basic principles and techniques when designing a secure system .To apply attacks and defenses work in practice. How to assess threats for their significance 414453.6. How to gauge the protections and limitations provided by today's technology*

#### Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand Information Security Principles such as security attacks and services.
CO2	Design Terms, concepts related to public key cryptography and digital signatures.
CO3	Apply the Concepts of various privacy methods.

CO4	Analyse Typical Network Attacks and Threats from the Internet.
CO5	Create SNMP, Firewall design Principles and Intrusion detection system.
CO6	Create the protections and limitations provided by internet security technology

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	3
CO 2	3	3	3	3	3	3	3	2	3	3	3	2	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S. No	CONTENTS OF MODULE	Hrs	COs
1	<b>UNIT I:</b> Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms	9	CO1
2	Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos,X.509 Directory Authentication Service	9	CO2
3	<b>UNIT III:</b> Email privacy: Pretty Good Privacy (PGP) and S/MIME.P Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management	9	CO3
4	<b>UNIT IV:</b> Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)	9	CO4
5	<b>UNIT V:</b> Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3, Intruders, Viruses and related threats Firewall Design principles, Trusted Systems, Intrusion Detection Systems	9	CO5, CO6

### TEXT BOOKS:

- 1 William Stallings (2008). *Network Security Essentials (Applications and Standards)*,



- Pearson Education.
- 2 Chris McNab (2016). *Network Security* (3<sup>rd</sup> edition), O'Reilly Media.
  - 3 Joseph Migga Kizza (2014). *Computer Network Security*, Springer International Publishing.

**REFERENCE BOOKS:**

- 1 Eric Maiwald (2004). *Fundamentals of Network Security*, Dreamtech press.
- 2 Charlie Kaufman, Radia Perlman and Mike Speciner, *Network Security - Private Communication in a Public World* (Second Edition), Pearson/PHI.

**Website Reference:**

1. <http://www.freetechbooks.com/an-introduction-to-computer-security-the-nist-handbook-t725.html>
2. <http://www.freetechbooks.com/fundamentals-of-cryptology-t801.html>

### THIRD SEMESTER

**Course Title: ELECTIVE 3 - INTERNET SECURITY AND COMPUTER FORENSICS**

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<b>Course Code :</b>	<b>Credits : 03</b>
<b>L:T:P:S : 4:0:0:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*To provide understanding of the main issues related to security in modern networked computer systems .Covers underlying concepts and foundations of computer security, basic knowledge about security-relevant decisions in designing IT infrastructures .To provide an understanding Computer forensics fundamental. To provide a comprehensive overview of collecting, investigating, preserving, and presenting evidence of cybercrime left in digital storage devices. To analyze various computer forensics technologies and to identify methods for data recovery.*

**Course outcomes: At the end of course, the student will be able to**

<b>CO1</b>	Gain a good understanding of the concepts and foundations of computer security, and identify vulnerabilities of IT systems
<b>CO2</b>	Analyse basic security tools to enhance system security and can develop basic security enhancements in stand-alone applications
<b>CO3</b>	Identify some of the factors driving the need for network security and analyse various computer forensics systems
<b>CO4</b>	Analyse and summarize duplication and preservation of digital evidence
<b>CO5</b>	Illustrate the methods for data recovery, evidence collection and data seizure.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	3	2	1	3	1	1	3	3	2	2	3
<b>CO 2</b>	3	2	3	3	3	2	1	2	3	2	2	2	1
<b>CO 3</b>	3	3	3	2	3	1	1	1	3	2	2	3	2
<b>CO 4</b>	3	3	1	3	2	3	2	2	3	2	2	3	3
<b>CO 5</b>	3	3	2	2	2	2	1	1	3	3	3	3	2

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	HRS	COS
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1	<b>UNIT I - NETWORK LAYER SECURITY &amp; TRANSPORT LAYER SECURITY</b> IPsec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPsec . Transport layer Security: SSL protocol, Cryptographic Computations - TLS Protocol. 189 CS-Engg&Tech- SRM 2013	8	CO1
2	<b>UNIT II - E-MAIL SECURITY &amp; FIREWALLS</b> PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls - Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.	10	CO2
3	<b>UNIT III - INTRODUCTION TO COMPUTER FORENSICS</b> (9 hours) Computer Forensics Fundamentals – Types of Computer Forensics – Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition	9	CO3
4	<b>UNIT IV - EVIDENCE COLLECTION AND FORENSICS TOOLS</b> Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9	CO4
5	<b>UNIT V - ANALYSIS AND VALIDATION</b> Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics	9	CO5

### TEXT BOOK

1. Man Young Rhee (2003). *Internet Security: Cryptographic Principles, Algorithms and Protocols*, Wiley Publications, ISBN: 9780470862469.

### REFERENCE BOOKS

1. Nelson, Phillips, Enfinger, Stuart (2014). *A Guide to Computer Forensics and Investigations*, Publisher: engage, ISBN: 9781305176089.
2. John R.Vacca (2002). *Computer Forensics*, Firewall Media, ISBN: 1584503890
3. Richard E.Smith (2008).*Internet Cryptography*, Pearson Education, 3<sup>rd</sup> Edition, ISBN: 8131704122
4. MarjieT.Britz (2013), *Computer Forensics and Cyber Crime: An Introduction*, Pearson Education, 1<sup>st</sup> Edition, ISBN: 0132677717

### E-REFERENCES

1. <https://www.geeksforgeeks.org/information-security-and-computer-forensics/>
2. <https://nptel.ac.in/courses/106106178/>

## THIRD SEMESTER

**Course Title: PRACTICAL V - ENTERPRISE COMPUTING LAB**

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<b>Course Code :</b>	<b>Credits : 02</b>
<b>L:T:P:S :0:0:5:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course, student will be able to equip the students with the advanced feature of contemporary java, to enable them in handling complex programs relating to managing data and processes over the network, to provide a sound foundation on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.*

**Course Outcomes: At the end of the Course, the Student will be able to:**

<b>CO1</b>	Invoke the remote methods in an application using Remote Method Invocation, Access database through Java programs, using Java Data Base Connectivity.
<b>CO2</b>	Manage sessions within an application and communication between sessions.
<b>CO3</b>	Implement and manage web sessions using Servlet and JSP. Handling Errors and Exceptions in any web application
<b>CO4</b>	Understanding Java Messaging Services done through javamail API.
<b>CO5</b>	Develop applications with hibernate framework.
<b>CO6</b>	Develop spring applications with spring framework.

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	2	3	2	3	3	3	3	2	3	3	3
<b>CO 2</b>	3	2	2	2	3	2	3	3	2	3	2	2	2
<b>CO 3</b>	3	2	2	3	2	2	3	3	3	3	2	3	2
<b>CO 4</b>	3	2	3	2	3	2	3	2	3	2	2	3	3
<b>CO 5</b>	3	3	3	3	2	3	3	3	3	2	3	3	3
<b>CO 6</b>	3	3	3	3	2	3	3	3	3	2	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	a) Develop an RMI Application for arithmetic operations b) Simple Servlet Application with login page.	5	CO1

2	<p>a) Design Web application using HTML and java servlet for session tracking and management using cookies, Hidden form field, URL rewriting, HTTP session.</p> <p>b) Display session details of any web application.</p>	9	CO2
3	<p>a) Implementation of JSP: student scoring system</p> <p>b) Implement exception handling using Error pages in JSP.</p> <p>c) Design web page using JSP and implement the concept of Java Bean in JSP</p> <p>d) Design web page using HTML and java servlet pages for the implementation of inter servlet communication using Request Dispatcher.</p> <p>e) MYSQL database connectivity using JDBC.</p>	6	CO3
4	<p>a) Design a web page with options for sending email using Javamail API.</p>	7	CO4
5	<p>a) Implementation of database manipulation using ORM Mapping in Hibernate.</p>	7	CO5
6	<p>a) Design Simple application using spring framework.</p> <p>b) Web application for connecting database in spring.</p>	11	CO6

### THIRD SEMESTER

**Course Title: PRACTICAL VI - PYTHON PROGRAMMING LAB**

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<b>Course Code :</b>	<b>Credits : 02</b>
<b>L:T:P:S :0:0:5:0</b>	<b>CIA Marks :</b>
<b>40</b>	
<b>Exam Hours : 03</b>	<b>ESE Marks : 60</b>

**LEARNING OBJECTIVES:**

*On taking this course the student will be able to develop simple applications using control flow and loops, to create files and perform file access operations, develop applications using object oriented concepts, to create a database and connect to the database from python, to develop GUI programs using PYGTK, to acquire knowledge about Data science in Python using numpy.*

**Course Outcomes: At the end of the Course, the Student will be able to:**

<b>CO1</b>	To do programs using conditional statements and control statements
<b>CO2</b>	To do programs in List, Tuples, Function and handle exceptions
<b>CO3</b>	To do File handling, programs using classes, inheritance and regular expression
<b>CO4</b>	To connect to MYSQL database from python
<b>CO5</b>	To develop GUI applications using PyGTK
<b>CO6</b>	To develop programs using Numpy and Pandas

**Mapping of Course Outcomes to Program Outcomes:**

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO1</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3	3	2	2	3	3	3	3	3
<b>CO6</b>	3	3	3	3	3	3	2	2	3	3	3	3	3

**3-Strong Correlation    2- Medium Correlation    1- Low Correlation**

**PRACTICAL – VI**

<b>S. No</b>	<b>CONTENTS OF MODULE</b>	<b>Hrs</b>	<b>COs</b>
1	Simple calculator to do all the arithmetic operations, Programs to use control flow tools like if, Programs to use for loop, New module for mathematical operations and use in your program	9	CO1
2	Programs to read and write files, create and delete directories, Programs for String handling and regular expressions	9	CO2
3	Programs to read and write files, create and delete directories, Programs with exception handling, Programs using classes and objects	9	CO3
4	Connect with MYSQL and create an address book and do the operations, Insert, read, update and delete and GUI program using PYGTK	9	CO4, CO5
5	Programs Using Numpy, Programs Using scipy, Programs using series and data frames and Programs using charts/graphs	9	CO6

### **THIRD SEMESTER**

#### **SPOKEN TUTORIAL**

#### **SP03 - PHP and MYSQL**

S.NO	CONTENTS
1	XAMPP in Windows- XAMPP in Linux- Echo Function- Variables in PHP- If Statement- Switch Statement- Arithmetic Operators- Comparison Operators- Logical Operators- Arrays- Multi Dimensional Arrays- Loops While Statement- Loops Do While Statement- Loops For Statement- Loops Foreach Statement- Functions Basic- Functions Advanced- GET Variable- POST Variable- Embedding PHP- Common Way to Display HTML- Common Errors Part 1- Common Errors Part 2- Common Errors Part 3-MYSQL part 1-MYSQL part 2-MYSQL part 3-MYSQL part 4-MYSQL part 5-MYSQL part 6-MYSQL part 7-MYSQL part 8- Simple Visitor Counter.
2	PHP String Functions Part 1- PHP String Functions Part 2-file upload part 1- File Upload Part 2- Cookies Part 1- Cookies Part2- Sessions- MD5 Encryption- Sending Email Part 1- Sending Email Part 2- Sending Email Part 3- Display Images from a Directory- User Login Part 1- User Login Part 2- User Login Part 3- User Password Change Part 1- User Password Change Part 2- User Password Change Part 3- User Registration Part 1- User Registration Part 2- User Registration Part 3- User Registration Part 4- User Registration Part 5- User Registration

**Note:**

**Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.**

**FOURTH SEMESTER**

**Course Title: PROJECT & VIVA-VOCE**

<b>Course Code:</b>	<b>Credits</b>	<b>: 15</b>
<b>L:T:P:S : 0:0:0:0</b>	<b>CIA Marks</b>	<b>: 40</b>
<b>Exam Hours: 03</b>	<b>ESE Marks</b>	<b>: 60</b>



## LEARNING OBJECTIVES:

*On taking the course, the students will be able to Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum, Identify, formulate and implement computing solutions, Design and conduct experiments, analyze and interpret data, Record the result, demonstrate skills to use modern tools, software and equipment's to analyse the chosen problem.*

**Course Outcomes: At the end of the Course, the Student will be able to:**

<b>CO1</b>	Demonstrate a depth of knowledge of modern technology.
<b>CO2</b>	Complete an independent research project, resulting in dissertation.
<b>CO3</b>	Communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.
<b>CO4</b>	Self-study, reflect on their learning and take appropriate actions to improve it.

### Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
<b>CO 1</b>	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO 2</b>	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO 3</b>	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO 4</b>	3	3	3	3	3	3	3	3	3	3	3	3	3

3-Strong Correlation    2- Medium Correlation    1- Low Correlation

## PROCEDURE

- The final semester will be entirely assigned for the student to carry out their project work.
- The Head of the Department will assign an Internal Guide for each student.
- The students should submit the contact details of the organization to their guide.
- During regular intervals, student should report his/her progress of the project work.
- After the submission of the final report, an external examiner will evaluate the project document and conduct the viva voce examination.

## FOURTH SEMESTER

### SPOKEN TUTORIAL

#### SP04 - LaTeX

S.NO	CONTENTS
1	Beamer - Bibliography - Equations - Inside Story of Bibliography - Latex on Windows

using Texworks - Letter-Writing - Mathematical Typesetting - Report Writing - Tables and Figures.
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**Note:**

**Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.**

## **FOURTH SEMESTER**

### **Course Title: MOOC Certification Course**

#### **LEARNING OBJECTIVE**

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme.

#### **Massive Open Online Courses (MOOC)**

Through an online portal, 4-, 8-, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. The enrolment to and learning from these courses involves no cost. Following these online courses, an in-

person, proctored certification exam will be conducted and a certificate is provided through the participating institutions and industry, when applicable.

Massive Open Online Courses (MOOC) is essentially an asynchronous platform and a process for teaching through pre-recorded lectures, resource video materials, lecture notes, assignments and quizzes, which are usually online and provide self-assessment in regular intervals during learning.

The learning, through scheduling of fixed time duration for completion of courses and, therefore, the simultaneous participation of teachers and a large number of students may be termed synchronous and is thus similar to a classroom, albeit on the Internet and being much larger in size.

When offered with consideration for students in non-urban and rural areas through supplementary DVDs and mobile delivered content, they enable quality and equitable access to a much larger population of students and can lead to a significant rise in the Gross Enrollment Ratio.

These courses are open for anyone to access – at no cost. So anyone who is interested in learning gets access to quality content, which also includes discussion with the content creator and access to assignments for self-testing.

The faculty who are currently offering courses are from the IITs or from other reputed institutes such as CMI, IMSc etc.

# APPENDIX

## **APPENDIX – A: OUTCOME-BASED EDUCATION (OBE)**

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes. There are three educational Outcomes as defined by the National Board of Accreditation.

### **Program Educational Objectives (PEOs)**

The Programme Educational Objectives of a program are the statements that describe the expected achievements of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after graduation

### **Programme Outcomes (POs)**

Program outcomes are finer statements that designate what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

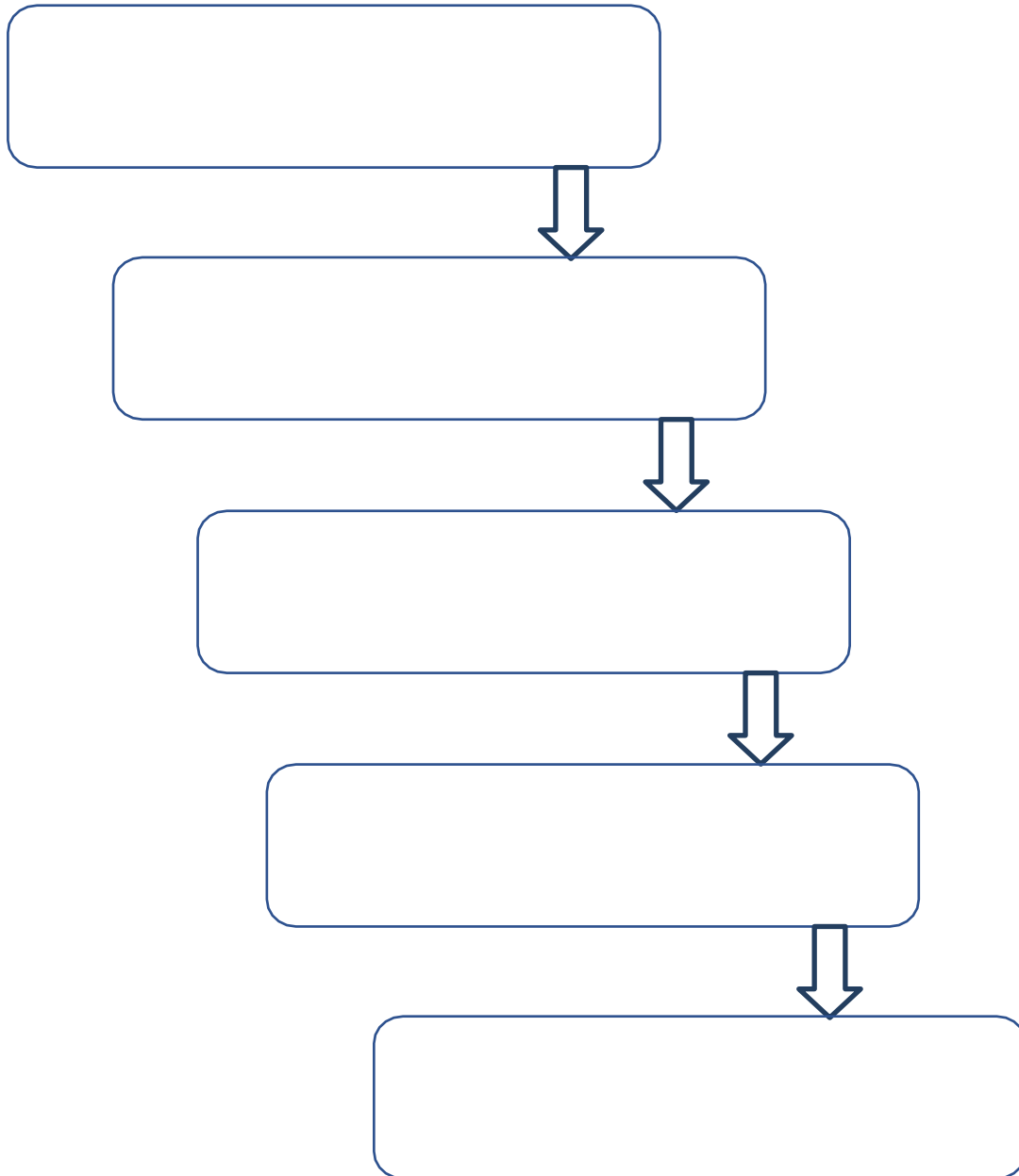
**Programme Specific Outcomes (PSO)**

Programme Specific Outcomes are what the students should be able to do at the time of graduation with reference to a specific discipline.

**Course Outcome (CO)**

Course outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course

**MAPPING OF OUTCOMES**



**APPENDIX - B**

**PROGRAM OUTCOMES (PO) IN RELATION TO GRADUATE ATTRIBUTES**

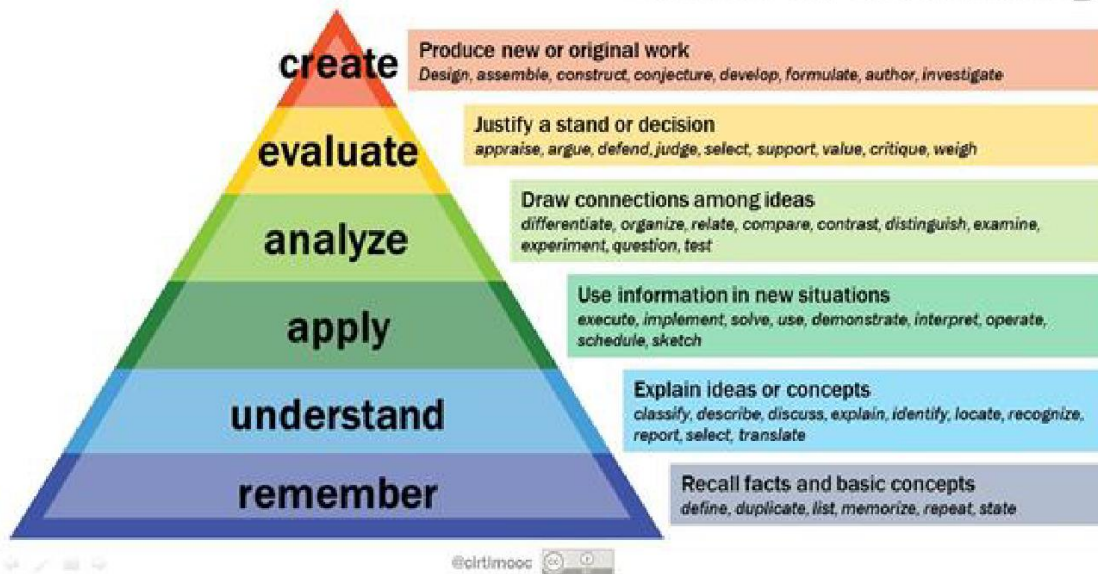
S.No	Graduate Attributes	Description
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<b>1</b>	<b>Knowledge</b>	Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of a graduate programme of study.
<b>2</b>	<b>Critical Thinking</b>	Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
<b>3</b>	<b>Problem Solving</b>	Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
<b>4</b>	<b>Usage of Modern Tools</b>	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
<b>5</b>	<b>Communication</b>	Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself;
<b>6</b>	<b>Life-Long Learning</b>	Ability to acquire knowledge and skills, including learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
<b>7</b>	<b>Ethical Practices and Social Responsibility</b>	Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work.
<b>8</b>	<b>Independent and Reflective Learning</b>	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

### APPENDIX - C: BLOOM'S TAXONOMY

**Bloom's taxonomy** is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglossary.org]

# Bloom's Taxonomy



## Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

Level	Parameter	Description
K1	Remember	It is the ability to remember the previously learned material/information
K2	Understand	It is the ability to grasp the meaning of material
K3	Apply	It is the ability to use learned material in new and concrete situations
K4	Analyze	It is the ability to break down material/concept into its component parts/subsections so that its organizational structure may be understood
K5	Evaluate	It is the ability to put parts/subsections together to form a new whole material/idea/concept/information
K6	Create	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.