

**UNIVERSITY OF MUMBAI**



**Bachelor of Engineering**

**Computer Engineering**  
( Sem. V to VIII)

Revised course

(REV- 2012) from Academic Year 2014-15,

Under

**FACULTY OF TECHNOLOGY**

(As per Semester Based Credit and Grading System)

## **Preamble**

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education.

Semester based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance. Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

**Dr. S. K. Ukarande**

**Dean,**

**Faculty of Technology,**

**Member - Management Council, Senate, Academic Council**

**University of Mumbai, Mumbai**

## **Preamble:**

The engineering education in India in general is expanding in manifolds. Now, the challenge is to ensure its quality to the stakeholders along with the expansion. To meet this challenge, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education and reflects the fact that in achieving recognition, the institution or program of study is committed and open to external review to meet certain minimum specified standards. The major emphasis of this accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

The Program Educational Objectives finalized for undergraduate program in Computer Engineering are listed below:

1. To prepare Learner's with a sound foundation in the mathematical, scientific and engineering fundamentals
2. To prepare Learner's to use effectively modern tools to solve real life problems
3. To equip Learner's with broad education necessary to understand the impact of computer Technology in a global and social context
4. To encourage , motivate and prepare Learner's for Lifelong-learning
5. To inculcate professional and ethical attitude, good leadership qualities and commitment to social responsibilities

In addition to above 2 to3 more program educational objectives of their own may be added by affiliated Institutes.

The Program outcomes are the skills and ability that Learner will demonstrate upon completion of undergraduate degree program in Computer Engineering. Few may be listed as follows:

1. Ability to effectively apply knowledge of computing and mathematics to computer science problems.
2. Ability to design, implement and evaluate computer-based components, systems, processes or programs to meet desired needs and specifications.
3. Ability and skills to effectively use state-of-the-art techniques and computing tools for analysis, design, and implementation of computing systems.
4. Ability to function effectively as a member of a team assembled to undertake a common goal.
5. An understanding of professional, ethical, legal, security, and social issues and responsibilities.

6. Ability to communicate effectively to both technical and non-technical audiences.
7. The ability to successfully pursue professional development thru lifelong learning

In addition to Program Educational Objectives, for each course of undergraduate program, Course Objectives and expected outcomes from learner's point of view are also included in the curriculum to support the philosophy of outcome based education. I believe strongly that small step taken in right direction will definitely help in providing quality education to the stake holders.

Dr. Prachi Gharpure

Chairperson, Adhoc Board of Studies in Computer Engineering,

University of Mumbai, Mumbai

**Program Structure for B.E. Computer Engineering**  
**Third Year (Computer)**  
**( Semester V)**  
**(REV 2012)**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
CPC501	Microprocessor	4	2	-	4	1	-	5
CPC502	Operating Systems	4	2	-	4	1	-	5
CPC503	Structured and Object Oriented Analysis and Design	4	2	-	4	1	-	5
CPC504	Computer Networks	4	2	-	4	1	-	5
CPL501	Web Technologies Laboratory	-	4	-	-	2	-	2
CPL502	Business Communication and Ethics*	-	2+ 2*	-	-	2		2
	<b>Total</b>	<b>16</b>	<b>16</b>	<b>-</b>	<b>16</b>	<b>8</b>	<b>-</b>	<b>24</b>

\* 2 hours shown as Practicals to be taken class wise and other 2 hours to be taken as batch wise

Course Code	Course Name	Examination Scheme									
		Internal Assesment					End Sem Exam	Exam Duration ( in Hrs)	TW	Oral / Pract	Total
		Internal Assesment			Avg	Exam					
		Test 1	Test 2	Avg			Exam	Duration	TW	Oral / Pract	Total
CPC501	Microprocessor	20	20	20	80	03	25	25 (prac)	150		
CPC502	Operating Systems	20	20	20	80	03	25	25 (prac)	150		
CPC503	Structured and Object Oriented Analysis and Design	20	20	20	80	03	25	25 (oral)	150		
CPC504	Computer Networks	20	20	20	80	03	25	25 (pract)	150		
CPL501	Web Technologies Laboratory	-	-	-	-	-	25	50 (oral)	75		
CPL502	Business Communication and Ethics	-	-	-	-	-	50	-	50		
	<b>Total</b>	<b>-</b>	<b>-</b>	<b>80</b>	<b>320</b>		<b>175</b>	<b>150</b>	<b>725</b>		

## Program Structure for B.E. Computer Engineering

### Third Year (Computer) ( Semester VI)

(REV 2012)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
CPC601	System Programming and Compiler Construction	4	2	-	4	1	-	5
CPC602	Software Engineering	4	2	-	4	1	-	5
CPC603	Distributed Databases	4	2	-	4	1	-	5
CPC604	Mobile Communication and Computing	4	2	-	4	1	-	5
CPE6011	Elective-I	-	2+ 2*	-	-	2	-	2
CPL601	Network Programming Laboratory	-	4	-	-	2	-	2
<b>Total</b>		<b>16</b>	<b>16</b>	<b>-</b>	<b>16</b>	<b>8</b>	<b>-</b>	<b>24</b>

\* Hours shown as Practicals to be taken class wise

Course Code	Course Name	Examination Scheme									
		Internal Assesment					End Sem Exam	Exam Duration ( in Hrs)	TW	oral / pract	Tot
		Internal Assesment			Test 1	Test 2					
		Test 1	Test 2	Avg							
CPC601	System Programming and Compiler Construction	20	20	20	20	20	80	03	25	25 (pract)	150
CPC602	Software Engineering	20	20	20	20	20	80	03	25	25 (oral)	150
CPC603	Distributed Databases	20	20	20	20	20	80	03	25	25 (oral)	150
CPC604	Mobile Communication and Computing	20	20	20	20	20	80	03	25	25 (pract)	150
CPE601X	Elective-I	-	-	-	-	-	-	-	50	-	50
CPL601	Network Programming Laboratory	-	-	-	-	-	-	-	25	50 (oral)	75
<b>Total</b>		<b>-</b>	<b>-</b>	<b>80</b>	<b>320</b>	<b>-</b>	<b>320</b>	<b>-</b>	<b>175</b>	<b>150</b>	<b>725</b>

**Program Structure B.E. Computer Engineering**  
**Fourth Year (Computer) ( Semester VII)**  
**( REV 2012)**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
CPC701	Digital Signal Processing	4	2	-	4	1	-	5
CPC702	Cryptography and System Security	4	2	-	4	1	-	5
CPC703	Artificial Intelligence	4	2	-	4	1	-	5
CPE7042X	Elective-II	4	2	-	4	1	-	5
CPP701	Project I	-	6#	-	-	3	-	3
CPL701	Network Threats and Attacks Laboratory	-	4	-	-	2	-	2
<b>Total</b>		<b>16</b>	<b>18</b>	<b>-</b>	<b>16</b>	<b>9</b>	<b>-</b>	<b>25</b>

Course Code	Course Name	Examination Scheme									
		Internal Assessment					End Sem Exam	Exam Duration ( in Hrs)	TW	oral	Total
		Internal Assessment			Test 1	Test 2					
		Test 1	Test 2	Avg							
CPC701	Digital Signal Processing	20	20	20	20	20	80	03	25	-	125
CPC702	Cryptography and System Security	20	20	20	20	20	80	03	25	25	150
CPC703	Artificial Intelligence	20	20	20	20	20	80	03	25	25	150
CPE7042X	Elective-II	20	20	20	20	20	80	03	25	25	150
CPP701	Project I	-	-	-	-	-	-	-	50	50	100
CPL701	Network Threats and Attacks Laboratory	-	-	-	-	-	-	-	25	50	75
<b>Total</b>		<b>-</b>	<b>-</b>	<b>80</b>	<b>320</b>	<b>-</b>	<b>320</b>	<b>-</b>	<b>175</b>	<b>175</b>	<b>750</b>

**Program Structure for B.E. Computer Engineering**  
**Second Year (Computer) ( Semester VIII)**

(REV 2012)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tu t	Theory	TW/ Pract	Tut	Total
CPC801	Data Warehouse and Mining	4	2	-	4	1	-	5
CPC802	Human Machine Interaction	4	2	-	4	1	-	5
CPC803	Parallel and distributed Systems	4	2	-	4	1	-	5
CPE803X	Elective-III	4	2	-	4	1	-	5
CPP802	Project II	-	12 #	-	-	6	-	6
CPL801	Cloud Computing Laboratory	-	2	-	-	1	-	1
	<b>Total</b>	<b>16</b>	<b>22</b>	<b>-</b>	<b>16</b>	<b>11</b>	<b>-</b>	<b>27</b>

Course Code	Course Name	Examination Scheme									
		Internal Assesment					End Sem Exam	Exam Duration ( in Hrs)	TW	oral	Tot
		Internal Assesment			Test 1	Test 2					
		Test 1	Test 2	Avg							
CPC801	Data Warehouse and Mining	20	20	20	20	80	03	25	25	150	
CPC802	Human Machine Interaction	20	20	20	20	80	03	25	25	150	
CPC803	Parallel and distributed Systems	20	20	20	20	80	03	25	25	150	
CPE803X	Elective-III	20	20	20	20	80	03	25	25	150	
CPP802	Project II	-	-	-	-	-	-	50	50	100	
CPL801	Cloud Computing Laboratory	-	-	-	-	-	-	25	-	25	
	<b>Total</b>			80		320		175	150	725	

# Indicate workload for Learner and not for Faculty in semester VII and VIII



**Elective I Sem 6****CPE6011 Operation Research****CPE6012 Project Management****CPE6013 Foreign Language – German****CPE6014 Foreign Language – French****Elective II Sem 7**

<b>System Group</b>	<b>CPE7021</b>	Advance Algorithms
	<b>CPE7022</b>	Computer Simulation and Modeling
<b>Electronics Group</b>	<b>CPE7023</b>	Image Processing
<b>Software Group</b>	<b>CPE7024</b>	Software Architecture
	<b>CPE7025</b>	Soft Computing
<b>DB Group</b>	<b>CPE7026</b>	ERP and Supply Chain Management

**Elective III - Sem 8**

<b>Electronics Group</b>	<b>CPE8031</b>	Machine Learning
<b>Digital Group</b>	<b>CPE8032</b>	Embedded Systems
<b>Network Group</b>	<b>CPE8033</b>	Adhoc wireless networks
	<b>CPE8034</b>	Digital Forensic
<b>DB Group</b>	<b>CPE8035</b>	Big data Analytics

Course Code	Course/Subject Name	Credits
CPC501	<b>Microprocessor</b>	<b>5</b>

**Objectives:**

1. To understand basic architecture of 16 bit and 32 bit microprocessors.
2. To understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design.
3. To understand techniques for faster execution of instructions and improve speed of operation and performance of microprocessors.
4. To understand RISC and CISC based microprocessors.
5. To understand concept of multi core processors.

**Outcomes:** Learner will be able to...

1. Write programs to run on 8086 microprocessor based systems.
2. Design system using memory chips and peripheral chips for 16 bit 8086 microprocessor.
3. Understand and devise techniques for faster execution of instructions, improve speed of operations and enhance performance of microprocessors.
4. Distinguish between RISC and CISC processors.
5. Understand multi core processor and its advantages.

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Intel 8086/8088 Architecture</b> 1.1 8086/8088 Microprocessor Architecture, Pin Configuration, Programming Model, Memory Segmentation, Study of 8284 Clock Generator, Operating Modes, Study of 8288 Bus Controller, Timing diagrams for Read and Write operations, Interrupts.	10
<b>02</b>	<b>Instruction Set and Programming</b> 2.1 Instruction Set of 8086, Addressing Modes, Assembly Language Programming, Mixed Language Programming with C Language and Assembly Language.	08
<b>03</b>	<b>System designing with 8086</b> 3.1 Memory Interfacing: SRAM, ROM and DRAM (using DRAM Controller-Intel 8203). 3.2 Applications of the Peripheral Controllers namely 8255-PPI, 8253-PIT, 8259-PIC and 8237-DMAC. Interfacing of the above Peripheral Controllers with 8086 microprocessor. 3.3 Introduction to 8087 Math Coprocessor and 8089 I/O Processor.	12
<b>04</b>	<b>Intel 80386DX Processor</b> 4.1 Study of Block Diagram, Signal Interfaces, Bus Cycles, Programming Model, Operating Modes, Address Translation Mechanism in Protected Mode, Memory Management, Protection Mechanism.	06
<b>05</b>	<b>Pentium Processor</b> 5.1 Block Diagram, Superscalar Operation, Integer & Floating Point Pipeline Stages, Branch Prediction, Cache	08

	Organization. 5.2 Comparison of Pentium 2, Pentium 3 and Pentium 4 Processors. Comparative study of Multi core Processors i3, i5 and i7.	
<b>06</b>	<b>SuperSPARC Architecture</b> 6.1 SuperSPARC Processor, Data Formats, Registers, Memory model. Study of SuperSPARC Architecture.	04

### Term Work:

The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/practical & case studies):..... (15) Marks.
- Assignments..... (05) Marks.
- Attendance ..... (05) Marks
- TOTAL: ..... (25) Marks.**

### Practical/Experiments:

1. Total eight experiments / practical must be performed out of which five practical must be performed on assemblers for 8086 and three experiments must be performed on interfacing of 8086 with peripheral chips like 8255 PPI, 8253 PIT, 8259 PIC and 8237 DMAC.
2. In addition to eight experiments/practical, two case studies are mandatory, one case study on RISC processor and second case study on CISC processor.

**Practical examination will be conducted based on the above syllabus.**

### Text Books:

1. Microprocessor and Interfacing: Douglas Hall, Tata McGraw Hill.
2. Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: Liu & Gibson, PHI Publication.
3. Pentium Processor System Architecture: Tom Shanley & Don Anderson, Addison-Wesley.
4. Advanced Microprocessor: Daniel Tabak, Tata McGraw Hill.
5. The 80386DX Microprocessor: Hardware, Software and Interfacing: Walter A Triebel, Prentice Hall.

### Reference Books:

1. 8086/8088 family: Design Programming and Interfacing: John Uffenbeck , PHI.
2. Intel Microprocessors: Barry B. Brey, 8<sup>th</sup> Edition, Pearson Education India.
3. Processor Architecture and Interfacing: Swati Joshi, Atul Joshi, Hemlata Jadhav, Wiley.
4. The X86 Microprocessors: Architecture and Programming (8086 to Pentium): Das Lyla B, Pearson Education India.
5. The SPARC Architecture Manual
6. I Intel Manuals

7. Programmer's Reference Manual for IBM Personal Computers: Steven Armbrust, Ted Forgeron, McGraw Hill
8. IBM PC Assembly Language and Programming: Peter Abel, 5<sup>th</sup> Edition, Prentice Hall of India

Course Code	Course/Subject Name	Credits
CPC502	<b>Operating Systems</b>	<b>5</b>

**Objectives:**

1. To introduce students with basic concepts of Operating System, its functions and services.
2. To familiarize the students with various views and management policies adopted by O.S. as pertaining with processes , Deadlock , memory , File and I/O operations.
3. To brief the students about functionality of various OS like Unix , Linux and Windows XP as pertaining to resource management.
4. To provide the knowledge of basic concepts towards process synchronization and related issues.

**Outcomes:** Learner will be able to...

1. Appreciate the role of operating system as System software.
2. Compare the various algorithms and comment about performance of various algorithms used for management of memory , CPU scheduling, File handling and I/O operations.
3. Apply various concept related with Deadlock to solve problems related with Resources allocation, after checking system in Safe state or not.
4. To appreciate role of Process synchronization towards increasing throughput of system.
5. Describe the various Data Structures and algorithms used by Different Oss like Windows XP , Linux and Unix pertaining with Process , File , I/O management.
6. To control the behavior of OS by writing Shell scripts.

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Introduction</b> 1.1 Introduction to Operating System, Objectives and Functions of O.S., OS Services, Special purpose systems, Types Of OS, System Calls, types of system calls, Operating system structure ,System Boot.	04
<b>02</b>	<b>Process Management</b> 2.1 <b>Process concept</b> , operations on process Process scheduling: basic concepts , scheduling criteria , scheduling algorithms, Preemptive, Non-preemptive, FCFS ,SJF ,SRTN ,Priority based, Round Robin ,Multilevel Queue scheduling,Operating System Examples. 2.2 <b>Synchronization:</b> Background , the critical section problem , Peterson's Solution, Synchronization Hardware Semaphores, classic problems of Synchronization: The Producer Consumer Problem:Readers writers problem, Semaphores, Dinning Philosopher Problem	10
<b>03</b>	<b>Deadlock</b> 3.1 Deadlock Problem, Deadlock Characterization, Deadlock Prevention. Deadlock avoidance Banker's algorithm for single & multiple resources , Deadlock recovery , Deadlock Detection,	04

<b>04</b>	<b>Memory Management</b> 4.1 <b>Memory management strategies:</b> background , swapping ,contiguous memory allocation, paging , structure of page tables , segmentation 4.2 <b>Virtual memory management:</b> Demand paging , copy-on write,Page replacement, FIFO, Optimal, LRU, LRU Approximation,Counting Based, , Allocation of frames , Thrashing	05
<b>05</b>	<b>File Management</b> 5.1 Files-System Structure, File System implementation, Directory implementation , Allocation Methods contiguous allocation, linked list allocation, indexed allocations, Free space management. 5.2 <b>Secondary storage</b> : structures: Disks Scheduling Algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, Disk Management	06
<b>06</b>	<b>Input Output Management</b> 6.1 Overview , I/O Hardware , Application I/O Interface	02
<b>07</b>	<b>Case Study of UNIX</b> 7.1 History of UNIX, Overview of UNIX ,UNIX File System, Data structures for process/memory management ,Process states and State Transitions, Using the System(Booting and login ),Process scheduling , Memory management , Shell programming	08
<b>08</b>	<b>Case Study of Linux</b> 8.1 History , Design Principles , Kernel Modules , Process management , Scheduling , Memory management , File Systems , Input and Output , Inter process communication , Network structure , Security	05
<b>09</b>	<b>Case study: Windows 7</b> 9.1 History, Design Principles , System components , environmental subsystems , File System, Networking, Programmer Interface	04

### Term Work:

The distribution of marks for term work shall be as follows:

- Laboratory work (experiments+mini project ): ..... (15)
- Assignments:..... (05)
- Attendance ..... (05)
- TOTAL: ..... (25)**

### Practical/Experiments:

Laboratory work shall consist of minimum **08** experiments and mini project, 2 assignments based on above theory syllabus.

The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.

**Practical exam will be based on the above syllabus.**

**Text Books:**

1. Silberschatz A., Galvin P., Gagne G. "Operating Systems Principles", Willey Eight edition
2. Achyut S. Godbole , Atul Kahate "Operating Systems" McGraw Hill Third Edition
3. "Operating System-Internal & Design Principles", William Stallings, Pearson
4. Andrew S. Tanenbaum, "Modern Operating System", Prentice Hall.

**Reference Books:**

1. "Linux Command Line & Shell Scripting", Richard Blum and Christine Bresnahan, 2nd edition, Wiley.
2. "The Design of Unix Operating System", Maurice J. Bach, Prentice Hall.
3. Unix and Shell Programming by B. M. Harwani Oxford
4. Unix Concept and Application 4th Edition by Sumitabha Das 'Mc Graw Hill'
5. Thomas Rebecca : Yates A user guide to the Unix system.

**Syllabus for Practical:**

Suggested topics for experiment but not limited to:

1. \*Exploring basic commands for handling File system under Unix/Linux using shell scripts.  
( creating groups , chown , chmod , directory name, tty , diff, umask )
2. \*Pattern matching utilities like awk, grep , nroff , troff , sort etc.
3. \*Exploring the boot process of Unix/Linux and implementing practical on it (for ex. MBR, passing different parameter to kernel, do different activity while booting and power-off ).
4. Basic Process management algorithms ( Any from FCFS , SJF , SRTN, RR , multilevel Queue scheduling )
5. Process synchronization algorithms like producer consumer problem , dining philosopher problem
6. Implementing Various page replacement policies: FIFO, Optimal, LRU, LFU
7. Implementation of Disk scheduling algorithms like FCFS,SSTF,SCAN ,CSCAN,LOOK.
8. Implementing Various file allocation methods : Index Allocation , Contiguous allocation.
9. Simulating Paging and Segmentation
10. Implementation of System calls like printing a file, display file using Unix/Linux internals.
11. Study booting process of Windows , Linux , and Unix.

**\* Marked experiments are mandatory**

Course Code	Course/Subject Name	Credits
CPC503	<b>Structured and Object Oriented Analysis and Design</b>	<b>5</b>

**Outcomes:** Learner will be able to...

1. Understand and apply techniques to get the system requirements and present it in standard format.
2. Apply key modeling concepts to both the traditional structured approach and the object-oriented approach.
3. Construct the candidate system following design methodology.

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Introduction</b> 1.1 System overview, Types of Systems , 1.2 Key Differences Between Structured and Object-Oriented Analysis and Design 1.3 Role of the System Analyst 1.4 Systems Development Life Cycle	06
<b>02</b>	<b>System Analysis</b> 2.1 Business process Reengineering and the Zachman Framework, System Requirement, Stakeholders, Techniques for information gathering, Validating the requirements.	06
<b>03</b>	<b>Feasibility Analysis</b> 3.1 Feasibility Analysis, Tests for feasibility, Cost-Benefit Analysis, Feasibility analysis of candidate system. 3.2 The system Proposal.	06
<b>04</b>	<b>Modeling System Requirements</b> 4.1 Traditional Approach to Requirement: Data Flow Diagrams, Documentation of DFD Components. Information Engineering Models, 4.2 Object-Oriented Approach to Requirement: Object-Oriented Requirements, The System Activities, Identifying Input and Outputs, Identifying Object Behavior, Integrating Object-Oriented Models. 4.3 Evaluating Alternatives for requirements, Environment and Implementation	12
<b>05</b>	<b>System Design</b> 5.1 Moving To Design 5.2 The traditional Approach to design 5.3 The Object-Oriented Approach to design: Use Case REALization 5.4 Designing Database, Designing the User Interface, Designing System Interfaces, Controls and security	12
<b>06</b>	<b>Application Architecture</b> 6.1 IT Architecture, Application Architecture Strategies, Modeling Application Architecture for Information System. 6.2 Deployment using UML diagrams, Component and deployment diagram for various architectures.	06

**List of Assignment:**



Assignments can be based on following topics

1. Feasibility analysis
2. Design patterns.

### **Term Work:**

The distribution of marks for term work shall be as follows:

- Laboratory work: ..... (10) Marks.
- Mini Project presentation:..... (10) Marks.
- Attendance ..... (05) Marks
- TOTAL: ..... (25) Marks.**

**Oral exam will be based on the above syllabus and tLaboratory work.**

### **Suggested Practical List:**

1. Develop Requirement specification document of the selected / allotted project.
2. Develop DFD model (level-0, level-1 DFD and Data dictionary) of tselected / allotted project.
3. Develop UML Use case model for selected / allotted project. .
4. Develop sequence diagram selected / allotted project. .
5. Develop Class diagram selected / allotted project.
6. Develop prototype of your project selected / allotted project.
7. Draw system architecture diagram selected / allotted project.

### **Text Books:**

1. System Analysis & Design by Satzinger, Jackson and Burd, Cengage Learning, 2007
2. System Analysis and Design Methods by Jeffery I. Whitten, Lonnie D Bentley, McGraw Hill, 7<sup>th</sup> edition.
3. System Analysis and Design by Alan Dennis, Barbara H. Wixom, Roberta M. Roth, Wiley India 4<sup>th</sup> edition

### **Reference Books:**

1. Systems Analysis and Design by Kendall & Kendall, PHI Publication, 7<sup>th</sup> Edition.
2. Analysis and Design of Information Systems by James a. Senn, 2<sup>nd</sup> Edition, McGrawHill.
3. Object-Oriented Modeling and Design with UML by Michael Blaha, James Rumbaugh, Pearson Education Publication, 2<sup>nd</sup> Edition.
4. The Unified Modeling Language - User Guide by Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education Publication.
5. Modern Systems Analysis and Design by Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, Prabin K. Panigrahi, Pearson Education Publication, 4<sup>th</sup> Edition.
6. UML Distilled by Martin Fowler, Pearson Edition, 3<sup>rd</sup> Edition.
7. Object Oriented Systems Development Using the Modified Modeling Language by Ali Bahrami, Tata McGraw Hill Publication.
8. Appling UML and Patterns by Craig Larman, Pearson Education, 2<sup>nd</sup> Edition.

Course Code	Course/Subject Name	Credits
CPC504	<b>Computer Networks</b>	<b>4+1</b>

**Objectives:**

1. To provide students with an overview of the concepts and fundamentals of data communication and computer networks
2. To familiarize with the basic taxonomy and terminology of computer networking area.
3. To experience the designing and managing of communication protocols while getting a good exposure to the TCP/IP protocol suite.

**Outcomes:**

**After completion of this course learner will be able to:**

1. Conceptualize all the OSI Layers
2. Use appropriate network tools to build network topologies
3. Install and configure an open source tool NS2
4. Test simple protocols in a laboratory scenario

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Introduction</b> 1.1 History and development of computer network, network application, network software and hardware components, topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services, reference models: layer details of OSI, TCP/IP models. Communication between layers.	06
<b>02</b>	<b>Physical Layer</b> 2.1 Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. 2.2 Unguided media (Wireless Transmission): Radio Waves, Bluetooth, Infrared, Virtual LAN.	06
<b>03</b>	<b>3.1 Data Link Layer</b> DDL Design Issues, Functionalities of DLL, Flow control algorithms - Sliding Window, Error Detection & Correction techniques, SDLC, PPP, Framing. <b>3.2 MAC Layer</b> Aloha protocols, Control Access Protocol, Carrier Sense Multiple Access(CSMA), Ethernet, Local Area Networks - Ethernet, Token ring, FDDI.	09
<b>04</b>	<b>Network layer</b> 4.1 Communication Primitives: Unicast, Multicast, Broadcast. IP Addressing, Subnetting, IPv4, IPv6, Routing algorithms : Link state routing, Distance Vector Routing, ARP, RARP, ICMP, Routing protocols - RIP, OSPF, BGP, IGRP, Congestion control algorithms: Open Loop congestion control, Closed Loop congestion control.	08

<b>05</b>	<b>Transport Layer</b> 5.1 The Transport Service: Transport service primitives, Berkeley Sockets, Connection management, UDP, TCP, Socket Programming (TCP & UDP), Socket Programming examples, TCP Flow control, TCP Congestion Control, Multiplexing.	08
<b>06</b>	<b>Application Layer</b> 6.1 DNS, HTTP, E-mail, SMTP, Telnet, FTP, Security-PGP-SSH.	06
<b>07</b>	<b>Network Management</b> 7.1 SNMP Concept, Management Components, SMI, MIB, SNMP Format, Messages.	04

### Term Work:

Term work shall consist of minimum **12** experiments.

Journal must include at least 2 assignments.

The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.

The distribution of marks for term work shall be as follows:

- Experiments: ..... (15) Marks.
- Assignments:..... (05) Marks.
- Attendance ..... (05) Marks
- TOTAL: ..... (25) Marks.**

**Practical exam will be based on the above syllabus.**

### Suggested Practicals:

1. Study of LAN Topology.
2. Study of various Network devices.
3. Building of any topology using Network tool.
4. Installation & Configuration of NS2 in Linux environment.
5. Basic wired & wireless topology in NS2.
6. Build class A & Class B Network using router in Network tool.
7. Implement subnetting concept using Network tool.
8. Write a program to implement find out class of a given IP address, subnet mask & first & last IP address of that block.
9. Write a program to build client-server model on different computers.
10. Congestion Control: Stop & Wait, Sliding Window & Selective Repeat, Go Back n.
11. Datalink Layer : Error Detection and correction, Flow Control, Framing
12. Network Layer : IP Addressing, Routing
13. Transport Layer : Socket Programming, Network Management/ Monitoring Tools.

### Text Books:

1. A.S. Tanenbaum, “Computer Networks”, Pearson Education, Fourth Edition.

2. B.A. Forouzan, "Data Communications and Networking", TMH, Fourth Edition.

**Reference Books:**

1. M. A. Gallo and W. M. Hancock, Computer Communications and Networking Technologies, Cengage Learning (Indian Edition), First Edition.
2. Natalia Olifer & Victor Olifer, "Computer Networks : Principles, Technologies & Protocols for Network Design", Wiley India, 2011.
3. Computer Networks: A Systems Approach, Second Edition (The Morgan Kaufmann Series in Networking) Larry L.Peterson(Author),Bruce S.Davie(Author)
4. Computer Networking, 6e,James F. Kurose , Keith W. Ross.
5. An Engineering Approach To Computer Networking: Atm Networks, The Internet ...By Keshav

Course Code	Course/Subject Name	Credits
CPL502	<b>Business Communication &amp; Ethics</b>	<b>2</b>

**Objectives:**

1. To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer's social responsibilities.
2. To provide students with an academic environment where they will be aware of the excellence, leadership and lifelong learning needed for a successful professional career.
3. To inculcate professional ethics and codes of professional practice
4. To prepare students for successful careers that meets the global Industrial and Corporate requirement' provide an environment for students to work on Multidisciplinary projects as part of different teams to enhance their team building capabilities like leadership, motivation, teamwork etc.

**Outcomes:** A learner will be able to .....

1. communicate effectively in both verbal and written form and demonstrate knowledge of professional and ethical responsibilities
2. Participate and succeed in Campus placements and competitive examinations like GATE, CET.
3. Possess entrepreneurial approach and ability for life-long learning.
4. Have education necessary for understanding the impact of engineering solutions on Society and demonstrate awareness of contemporary issues.

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Report Writing</b> 1.1 Objectives of report writing 1.2 Language and Style in a report 1.3 Types of reports 1.4 Formats of reports: Memo, letter, project and survey based	08
<b>02</b>	<b>Technical Proposals</b> 2.1 Objective of technical proposals 2.2 Parts of proposal	02
<b>03</b>	<b>Introduction to Interpersonal Skills</b> 3.1 Emotional Intelligence 3.2 Leadership 3.3 Team Buliding 3.4 Assertiveness 3.5 Conflict Resolution 3.6 Negotiation Skills 3.7 Motivation 3.8 Time Management	08
<b>04</b>	<b>Meetings and Documentation</b> 4.1 Strategies for conducting effective meetings 4.2 Notice 4.3 Agenda	02

	4.4 Minutes of the meeting	
<b>05</b>	<b>Introduction to Corporate Ethics and etiquettes</b> 5.1 Business Meeting etiquettes, Interview etiquettes, Professional and work etiquettes, Social skills 5.2 Greetings and Art of Conversation 5.3 Dressing and Grooming 5.4 Dinning etiquette 5.5 Ethical codes of conduct in business and corporate activities (Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions)	02
<b>06</b>	<b>Employment Skills</b> 6.1 Cover letter 6.2 Resume 6.3 Group Discussion 6.4 Presentation Skills 6.5 Interview Skills	06

**List of Assignment:**

1. Report Writing (Synopsis or the first draft of the Report)
2. Technical Proposal (Group activity, document of the proposal)
3. Interpersonal Skills (Group activity and Role play)
4. Interpersonal Skills ( Documentation in the form of soft copy or hard copy)
5. Meetings and Documentation ( Notice, Agenda, Minutes of Mock Meetings)
6. Corporate ethics and etiquettes (Case study, Role play)
7. Cover Letter and Resume
- 8.** Printout of the PowerPoint presentation

**Term Work:**

Term work shall consist of all assignments from the list. The distribution of marks for term work shall be as follows:

- Assignments: ..... (20) Marks.
- Project Report Presentation..... (15) Marks.
- Group Discussion..... (10) Marks.
- Attendance .....(05) Marks
- TOTAL: ..... (50) Marks.**

The final certification and acceptance of term work ensures the satisfactory performance of work assigned and minimum passing in the term work.

**References:**

1. Fred Luthans, “*Organisational Behavior*” , Mc Graw Hill, edition

2. Lesiker and Petit, "*Report Writing for Business*", Mc Graw Hill, edition
3. Huckin and Olsen, "*Technical Writing and Professional Communication*", Mc Graw Hill
4. Wallace and Masters, "*Personal Development for Life and Work*", Thomson Learning, 12<sup>th</sup> edition
5. Heta Murphy, "*Effective Business Communication*", Mc Graw Hill, edition
6. R.C Sharma and Krishna Mohan, "*Business Correspondence and Report Writing*",
7. B N Ghosh, "*Managing Soft Skills for Personality Development*", Tata McGraw Hill. Lehman, Dufrene, Sinha, "*BCOM*", Cengage Learning, 2<sup>nd</sup> edition
8. Bell . Smith, "Management Communication" Wiley India Edition, 3<sup>rd</sup> edition. Dr.K. Alex, "Soft Skills", S Chand and Company
9. Dr.K Alex, "Soft Skills", S Chand and Company

Course Code	Course/Subject Name	Credits
CPL501	<b>Web Technologies Laboratory</b>	2

Module	Detailed Contents	Lab Sessions
01	<p><b>Title:</b> Create HTML Forms. Use of various HTML Tag on Web Forms.</p> <p><b>Concept:</b> Designing of effective web site, Introduction of different Web Technologies: HTML, and Different HTML Tag.</p> <p><b>Objective:</b> objective of this module is to provide students an overview of the concepts Web Technologies, and HTML.</p> <p><b>Scope:</b> Designing static client side web page using various HTML tags.</p> <p><b>Technology:</b> HTML</p>	01
02	<p><b>Title:</b> Use of CSS on HTML Form.</p> <p><b>Concept:</b> Cascaded Style Sheets</p> <p><b>Objective:</b> In this module student will learn, defining a CSS and unstaring its purpose different syntax and types of CSS.</p> <p><b>Scope:</b> Creating web pages and use CSS to control the layout pages.</p> <p><b>Technology:</b> HTML with Cascade Style Sheet.</p>	01
03	<p><b>Title:</b> Use of Java Script functions on Web Forms and Use of Dynamic HTML Page.</p> <p><b>Concept:</b> Scripting Languages, Dynamic web pages</p> <p><b>Objective:</b> in this lab student will learn how to define client side scripting and understand its advantages and disadvantages. Embedding JavaScript code into HTML document using script tag, and will understand dynamic HTML.</p> <p><b>Scope:</b> Create animation using JavaScript.</p> <p><b>Technology:</b> HTML with JavaScript.</p>	02
04	<p><b>Title:</b> Creation of Web page with the help of Quanta Plus /Aptana /Kompozer.</p> <p><b>Concept:</b> Web development Environment</p> <p><b>Objective:</b> This module students will learn how will introduce editors for development of web pages.</p> <p><b>Scope:</b> Development of web pages using any web tool.</p> <p><b>Technology:</b> Quanta Plus /Aptana /Kompozer</p>	03



<b>05</b>	<p><b>Title:</b> Write an XML file marksheet.xml representing your semester mark sheet.</p> <p><b>Concept:</b> Extensible Mark up Language (XML)</p> <p><b>Objective:</b> is to learn about basics of XML and how it can be used to store information away from the mechanism of processing or formatting of such data. Will also learn how to build simple XML files and be able to manipulate and refer to them.</p> <p><b>Scope:</b> is to creating an XML file in that it must include basic syntax of an XML doc and DTD for the same.</p>	03
<b>06</b>	<p><b>Title:</b> server side scripting. Use HTML form to accept the two numbers N1 and N2 and using PHP program display only prime numbers in between N1 and N2.</p> <p><b>Concept:</b> Server side scripting, introduction to PHP</p> <p><b>Objective:</b> this lab gives a basic introduction of to PHP and dynamic programming on the server side.</p> <p><b>Scope:</b> creating a server side script using PHP, decisions, looping</p> <p><b>Technology:</b> PHP, HTML</p>	03

### Term work Assessment:

Term work will consist of small assignments testing all the technologies included in syllabus and a Mini project solving an appropriate problem using the above technology

The distribution of marks for term work shall be as follows:

- Assignments: ..... (10) Marks.
- Project Report Presentation..... (10) Marks.
- Attendance .....(05) Marks
- TOTAL: ..... (25) Marks.**

### End Semester Examination:

**Oral examination is to be conducted by pair of internal and external examiners based on the mini projects undertaken by student groups.**

### Text Books:

1. Ralph Moseley ,M.T. Savaliya “Developing Web Applications “, Willy India,Second Edition , ISBN:978-81-265-3867-6
2. “Web Technology Black Book ”,Dreamtech Press, First Edition, ISBN 978-7722-997

Course Code	Course/Subject Name	Credits
CPC601	<b>System Programming Compiler Construction</b>	05

**Objectives:**

1. To help students appreciate the role and functioning of various system programs over application program
2. To initiate an understanding of compilers in general and brief about phases of compiler.
3. To provide a theoretical framework for optimizing the code.
4. To familiarize and encourage the students to use various software tools for Developing System programs.

**Outcomes:** Learner will be able to...

1. Identify different system software
2. Use Lex tool used for generating lexical analyser.
3. Write macros as and when required to increase readability and productivity
4. Design hand written lexical analyzer
5. Design new language structures with the help of grammars
6. Appreciate the role of Operating System functions such as memory management as pertaining to run time storage management
7. Appreciate role of Intermediate Code Generation in connection with language designing
8. Apply optimization principles on given code
9. Implement various parser types and use YACC.

Module	Detailed Contents	Hours
<b>01</b>	<b>System Software</b> 1.1 Concept, introduction to various system programs such as assemblers, loaders , linkers ,macro processors, compilers, interpreters, operating systems, device drivers	01
<b>02</b>	<b>Assemblers</b> 2.1 General Design Procedure , Design of Assembler (Single Pass – Assembler IBM PC , multi pass Assembler - IBM 360/370 Processor), Statement of Problem , Data Structure , format of Databases , Algorithm , Look for modularity	06
<b>03</b>	<b>Macros &amp; Macro processors</b> 3.1 Macro instructions, Features of Macro facility, Design of 2 pass macroprocessor	04
<b>04</b>	<b>Loaders and Linkers</b> 4.1 loader schemes, Design of Absolute loader , Design of Direct linking loader	04
<b>05</b>	<b>Software Tools</b> 5.1 Software Tools for Program development, Editors: Types of Editors , Design of Editor ,Debug Monitors	02

<b>06</b>	<b>Compilers</b> 5.1 Introduction to Compilers, Phases of a compiler, comparison of compilers and interpreters.	02
<b>07</b>	<b>Lexical Analysis</b> 5.1 Role of a Lexical analyzer, input buffering, specification and recognition of tokens, Designing a lexical analyzer generator, Pattern matching based on NFA's.	02
<b>08</b>	<b>Syntax Analysis</b> 5.1 Role of Parser, Top-down parsing, Recursive descent and predictive parsers (LL), Bottom-Up parsing, Operator precedence parsing, LR, SLR and LALR parsers.	08
<b>09</b>	<b>Syntax Directed Translation</b> 9.1 Syntax directed definitions, Inherited and Synthesized attributes, Evaluation order for SDDs , S attributed Definitions , L attributed Definitions	3
<b>10</b>	<b>Intermediate Code Generation</b> 10.1 Intermediate languages: declarations, Assignment statements, Boolean expression, case statements, back patching , procedure calls.	04
<b>11</b>	<b>Code Generation</b> 11.1 Issues in the design of Code Generator , Basic Blocks and Flow graphs, code generation algorithm , DAG representation of Basic Block	04
<b>12</b>	<b>Code Optimization</b> 12.1 Principal sources of Optimization, Optimization of Basic Blocks , Loops in Flow graph ,Peephole Optimization	03
<b>13</b>	<b>Run Time storage</b> 11.1 Storage Organization , storage allocation strategies, parameter passing , Symbol table , introduction to garbage collection and compaction	04
<b>14</b>	<b>Compiler-compilers</b> 11.1 JAVA compiler environment, YACC compiler-compiler	01

### Term Work:

Journal should include at least 10 experiments (out of which at least 7 from suggested list below) and at least 2 assignments.

The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.

The distribution of marks for term work shall be as follows:

- Laboratory work (experiments): ..... (15) Marks.
- Assignment:..... (05) Marks.
- Attendance ..... (05) Marks
- TOTAL: ..... (25) Marks.**

### **Practical/Oral examination:**

Practical examination will be conducted based on above syllabus

### **Theory Examination:**

**In question paper, weight age of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total 6 questions, each of 20 Marks.
2. Only 4 questions need to be solved.
3. Question 1 will be compulsory and based on maximum part of the syllabus.
4. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

### **Text Books:**

1. J. J Donovan: Systems Programming Tata McGraw Hill Publishing Company
2. A. V. Aho, R. Shethi and J.D. Ulman; Compilers - Principles, Techniques and Tools, *Pearson Education*
3. A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman : Compilers - Principles, Techniques and Tools , Pearson Education , Second Edition.
4. D. M Dhamdhere: Systems programming, *Tata McGraw Hill*

### **Reference Books:**

1. lex & yacc, 2nd Edition by John R. Levine, Tony Mason & Doug Brown O'Reilly
2. D.M. Dhamdhere : Systems programming ,*Tata McGraw Hill*

## **Syllabus for LAB**

Experiments can be conducted based on the suggested topics below:

**However list is not limited to mentioned topics.**

**Use of Open source tools is suggested.**

1. Lexical analyzer tool : flex
2. Parser generator tool : Yacc.
3. Find first() , follow() set of given grammer
4. removing left recursion direct as well as indirect given the set of production rule
5. Assemblers : 2 pass Assembler .
6. Macroprocessor : 2 pass Macro processor.
7. Syntax Analysis : ( any 1 of LL(1) , LR(0) , LR(1) , LALR(1) , operator precedence parser. )
8. Create your library in Linux environment and using it.
9. Code Generation algorithm.
10. Code Optimization techniques.
11. Study ld command in Unix/Linux.

Course Code	Course/Subject Name	Credits
CPC602	<b>Software Engineering</b>	05

**Objectives:**

The main objective is to introduce to the students about the product that is to be engineered and the process that provides a framework for the engineering technology.

1. To provide knowledge of software engineering discipline.
2. To analyze risk in software design and quality.
3. To introduce the concept of advance software methodology.

**Outcomes:** Learner will be able to...

1. Students will demonstrate basic knowledge in software engineering.
2. Students will be able to plan, design, develop and validate the software project.
3. Students will be apply advance software methodology to create high quality WebApps.
4. Students will have an understanding of impact of sound engineering principles.

Module	Detailed Contents	Hrs
<b>01</b>	<b>Introduction</b> 1.1 Software Engineering Process Paradigms 1.2 Process Models – Incremental and Evolutionary models, 1.3 Typical Application for each model, 1.4 Agile methodology 1.5 Process and Project Metrics.	06
<b>02</b>	<b>Software project scheduling, Control &amp; Monitoring</b> 2.1 Software estimation – Empirical estimation models – Cost/Effort estimation 2.2 Planning – Work breakdown Structure, Gantt Chart. Discuss schedule and cost slippage.	04
<b>03</b>	<b>Risk Management</b> 3.1 Risk Identification, Risk Assessment, Risk Projection, RMMM	04
<b>04</b>	<b>Software Configuration Management</b> 4.1 Software Configuration items, SCM process, Identification of objects in software configuration, version and change control, configuration audit , status reporting, SCM standards and SCM issues.	04
<b>05</b>	<b>Software Design Specification</b> 5.1 Software Design – Abstraction , Modularity 5.2 Software Architecture – Effective modular design, Cohesion and Coupling, Example of code for cohesion and coupling.	08

	5.3 User Interface Design – Human Factors, Interface standards, Design Issues – User Interface Design Process.	
<b>06</b>	<b>Software Quality</b> 6.1 Software Quality Assurance – Software standards , Quality metrics Software Reliability ,Quality Measurement and Metrics	04
<b>07</b>	<b>Software Testing</b> 7.1 Basic concept and terminology, Verification & validation, White Box Testing- Path Testing, Control Structures Testing , DEF-USE testing, 7.2 Black Box Testing –BVA Integration, Validation and system testing. 7.3 OO testing methods-Class Testing, Interclass testing, testing architecture, Behavioral testing. 7.4 Software Maintenance – Reverse Engineering.	12
<b>08</b>	<b>Web Engineering</b> 8.1 For web based applications – attributes, analysis and design, testing. 8.2 Security Engineering, 8.3 Service-Oriented Software Engineering. 8.4 Test Driven Development 8.5 Software engineering with aspects	06

### **Term Work:**

Term work shall consist of at least 10 Laboratory assignments and two written tests.

The final certification and acceptance of Term Work ensures the satisfactory performance of laboratory Work and Minimum Passing in the term work.

### **Practical/Oral examination:**

Oral examination will be conducted based on above syllabus.

### **Suggested List of Experiments:**

1. SRS in IEEE format for any case study.
2. Use project management tool to schedule project plan.
3. RMMM plan for case study.
4. Develop test cases for white box testing.
5. Assignment / code for stubs and drivers.
6. Change specifications and make different versions using any SCM tool.
7. For one scenario- Implement TDD

## **Text Books:**

1. Roger Pressman, Software Engineering: A Practitioners Approach, (6th Edition), McGraw Hill, 2010
2. Ian Somerville, Software Engineering, 9th edition, Addison Wesley, 2011

## **Reference Books:**

1. Eric J. Braude and Micheal E. Bernstein, Software Engineering Modern Approach, 2<sup>nd</sup> edition, Wiley, 2011.
2. Ali Behforooz Fredrick Hudson, Software Engineering Fundamentals, Oxford University Press, 2006.
3. James F. Peters and Witold Pedrycz, “ Software Engineering – An Engineering Approach”, Wiley.
4. Mouratidis and Giorgini. “Integrating Security and Software Engineering – Advances and Future”, IGP. ISBN – 1-59904-148-0



Course Code	Course/Subject Name	Credits
CPC603	<b>Distributed Databases</b>	05

**Objectives:**

1. To introduce principles and foundations of distributed databases, including architecture, design issues, integrity control, query processing and optimization, transactions, and concurrency control.
2. To enable students to understand the difference between different database system and integrate the.

**Outcomes:** Learner will be able to...

1. Design and implement distributed database for enterprise application.
2. Provides solutions for heterogeneous database
3. Use XML for schema integration.

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Concept and Overview Distributed Database system</b> 1.1 What is Distributed Database System (DDBS), Features of DDBS, promises of DDBS, Design issue in DDBS, Distributed DBMS architecture: Client/server System, Peer-to-Peer, Mutli-Database system.	08
<b>02</b>	<b>Distributed Database Design</b> 2.1 Distributed database design concept, objective of Data Distribution, Data Fragmentation, The allocation of fragment , Transparencies in Distributed Database Design	08
<b>03</b>	<b>Distributed Transaction and concurrency control</b> 3.1 Basic concept of Transaction management, objective Distributed transaction management, Model for Transaction management 3.2 Distributed Concurrency control: Objective, concurrency control anomalies, Distributed Serializability, Locking based algorithm, Timestamp based algorithm.	08
<b>04</b>	<b>Distributed Deadlock and Recovery</b> 4.1 Introduction to Deadlock, Distributed Deadlock prevention, avoidance, detection and recovery, Two-Phase and Three-Phase Commit Protocol.	06
<b>05</b>	<b>Distributed query processing and optimization</b> 5.1 Concept, objective, and phases of distributed query processing; join strategies in fragment relation , Global query optimization	04
<b>06</b>	<b>Heterogeneous Database</b> 6.1 Architecture of Heterogeneous Database, Database Integration: Schema Translation and schema Integration, Query processing issues in Heterogeneous database.	06

<b>07</b>	<b>XML</b> 7.1 XML for data integration, structure of XML, XML document schema, Querying and Transformation, storage of XML data, XML application.	<b>08</b>
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**Term Work:**

Assign a case study for group of 2/3 students and each group to perform the following experiments on their case-study:

- Creation of centralized database (Global Schema).
- Perform Fragmentation (PHF, DHF, VF, and HF) and allocation in DDBS design.
- Implementation of concurrency control.
- Implementations of two phase or three phases commit protocol.
- Implementations of three deadlock detection.
- Simulation of distributed query processor.
- Implementation of query optimization.
- Implementation any two experiment on XML

The distribution of marks for term work shall be as follows:

- |  |             |               |
|--|-------------|---------------|
| • Laboratory work (experiments/assignments): ..... | (10)        | Marks.        |
| • Course project:.....                             | (10)        | Marks.        |
| • Attendance .....                                 | (05)        | Marks         |
| <b>TOTAL: .....</b>                                | <b>(25)</b> | <b>Marks.</b> |

**Practical/Oral examination:**

An oral exam will be held based on the above syllabus.

**Text Books:**

1. Chhanda Ray , “Distributed Database System”, Pearson Education India.
2. A. Siberschatz, H. Korth, “Database System”, Six Edition, Mc-Graw Hill.
3. Seed K. Rahimi and Frank S. Haug, “Distributed Database Management System”, Wiley India.

## **Reference Books:**

1. M. Tamer Ozsu , Patrick Valduriez, “Principles of Distributed Database”, Pearson Education India.
2. Elmasri and Navathe, “Fundamentals of Database Systems”, 6<sup>th</sup> Edition, Pearson Education India.

Course Code	Course/Subject Name	Credits
CPC604	<b>Mobile Communication and Computing</b>	05

**Objectives:**

1. To introduce the basic concepts and principles in mobile computing. This includes the major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.
2. To explore both theoretical and practical issues of mobile computing.
3. To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

**Outcomes:** Learner will be able to...

1. Understand GSM and CDMA Cellular architecture.
2. Setup and configure wireless access points.
3. Use Network Simulator tool to simulate mobile network.
4. Implement small android based applications.

Module	Detailed Contents	Hrs.
<b>01</b>	<b>Introduction to Mobile Computing</b> 1.1 Wireless Communication, Applications, Cellular Systems, Antennas, satellite system, GEO, LEO, MEO, GPRS:-Architecture, Network nodes, GPRS support nodes.	05
<b>02</b>	<b>GSM cellular telephony-architecture and system aspects</b> 2.1 Introduction, Basic GSM architecture, Basic radio transmission parameters of the GSM system, Logical channel description, GSM time hierarchy, GSM burst structures, Description of the call set-up procedure, Handover, Ensuring privacy and authentication of a user, Modifications and derivatives of GSM	08
<b>03</b>	<b>Mobile Network</b> 3.1 Mobile IP, IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Optimization, Reverse Tunneling, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission.	06
<b>04</b>	<b>Third and Fourth Generation Systems</b> 4.1 W-CDMA, CDMA 2000; Improvements on Core Networks; Quality of Services in 3G ; Wireless Local Loop; Wireless Local Loop Architecture; Deployment Issues; TR-45 Service Description; Wireless Local Loop technologies. TETRA, UMTS and IMT-2000;UMTS Basic Architecture, UTRA FDD mode, UTRA TDD mode, 4G Architecture, Comparison between 3G and 4G.	06

<b>05</b>	<b>Mobility Management</b> 5.1 Co- channel Interference, Mobility: Types of Handoffs; Location Management, HLR-VLR scheme, Hierarchical scheme, Predictive Location management schemes, cellular IP, PSTN.	04
<b>06</b>	<b>Wireless Local Area Networks</b> 6.1 Introduction, Types of WLANs, Hidden station problem, HIPERLAN Type 1: HIPERLAN/1 MAC sublayer, HIPERLAN/1 CAC layer, HIPERLAN/1 physical layer. IEEE 802.11 WLAN standards: IEEE 802.11 physical layer, IEEE 802.11 MAC sublayer. IEEE 802.11 and HIPERLAN standards for 5 GHz band: HIPERLAN/2 physical layer, HIPERLAN /2 data link control layer. Bluetooth: Introduction, User Scenario, Architecture, protocol.	08
<b>07</b>	<b>Introduction to Android</b> 7.1 Layers, android components, mapping application to process. Android development basics. Hardware tools, Software tools, Android SDK features	05
<b>08</b>	<b>Security Issues In Mobile Computing</b> 8.1 Security Issues, Authentication, Encryption, Cryptographic Tools: Hash, Message Authentication Code (MAC), Digital Signature, Certificate. Secure Socket Layer (SSL). Characteristics of SIM, Equipment Identification.	06

### Term Work:

Term work shall consist of minimum assignments and course project. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): ..... (20) Marks.
- Attendance ..... (05) Marks
- TOTAL: ..... (25) Marks.**

### Practical/Oral examination:

Practical exam will be held based on the above syllabus.

### Suggested Laboratory Exercises of Mobile Computing:

1. Setup & Configuration of Wireless Access Point (AP)
2. Implementation of WLAN : Ad Hoc & Infrastructure Mode
3. Implementation of Bluetooth Protocol and Applications
4. GSM modem study (Android based mobile) and SMS client-server application
5. Implementation of Mobile Network using Network Simulator (NS2)
6. Mobile Internet and WML
7. J2ME Program for Mobile Node Discovery

8. Mobile protocol study using GNS3.
9. Design and Program Income Tax and Loan EMI Calculator for Mobile Phones.
10. Wireless Network Security: kismet and Netstumbler

### **Text Books:**

1. Jochen Schilller ,”Mobile Communication “, Addison wisely,Pearson Education
2. Krzysztof Wesolowski, “Mobile Communication Systems”, Wiley publication
3. W. Frank Ableson,Robi sen, Chris King, “ Android IN ACTION “, Third Edition, Dreamtech Press
4. Mobile Computing By Rajkamal (Oxford).

### **Reference Book:**

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober, “Principles of Mobile Computing”, Springer
2. Rappaort, “Wireless Communications Principles and Practices”
3. Yi Bang Lin, “Wireless and Mobile Network Architecture”, John Wiley
4. P. Nicopolitidis, “Wireless Networks”, John Wiley
5. K. Pahlavan, P.Krishnamurthy, “Principles of Wireless Networks”
6. Introduction to Wireless Telecommunication System and Networks by Mullet (Cengage Learning).
7. Beginning for Android 4 Application Development By Wei- Meng Lee, Wiley –India Edition.

Course Code	Course/Subject Name	Credits
<b>CPE6011</b>	<b>Operations Research</b>	<b>02</b>

**Outcomes:** Learner will be able to

1. model and solve problem using linear programming techniques
2. Implement algebraic solution using simplex method
3. Define transportation model and apply transportation algorithm in a known situation.
4. Use montecarlo simulation technique.
5. Use the spreadsheet as a tool effectively for OR topics

Module	Detailed Contents	Hrs.
<b>01</b>	<b>What is Operations Research</b> 1.1 Introduction.	02
<b>02</b>	<b>Modeling with Linear Programming</b> 2.1 Two-Variable LP Model 2.2 Graphical LP Solution 2.2.1 Solution of a Maximization Model 2.2.2 Solution of a Minimization Model 2.3 Computer Solution with Solver and AMPL 2.3.1 LP solution with Excel Solver 2.3.2 LP Solution with AMPL 2.4 Linear Programming Applications 2.4.1 Investment 2.4.2 Product Planning and Inventory Control 2.4.3 Manpower Planning 2.4.4 Urban Development Planning 2.4.5 Blending and Refining 2.4.6 Additional LP Applications	07

03	<p><b>The Simplex Method and Sensitivity Analysis</b></p> <ul style="list-style-type: none"> <li>3.1 LP Model in Equation Form</li> <li>3.2 Transition from Graphical to Algebraic Solution</li> <li>3.3 The Simplex Method <ul style="list-style-type: none"> <li>3.3.1 Iterative Nature of the Simplex Method</li> <li>3.3.2 Computational details of the Simplex algorithm</li> <li>3.3.3 Summary of the Simplex Method</li> </ul> </li> <li>3.4 Artificial Starting Solution <ul style="list-style-type: none"> <li>3.4.1 M-Method</li> <li>3.4.2 Two-Phase Method</li> </ul> </li> <li>3.5 Special Cases in the Simplex Method <ul style="list-style-type: none"> <li>3.5.1 Degeneracy</li> <li>3.5.2 Alternative Optima</li> <li>3.5.3 Unbounded Solution</li> <li>3.5.4 Infeasible Solution</li> </ul> </li> <li>3.6 Sensitivity Analysis <ul style="list-style-type: none"> <li>3.6.1 Graphical Sensitivity Analysis</li> <li>3.6.2 Algebraic Sensitivity Analysis – Changes in the Right-hand side</li> <li>3.6.3 Algebraic Sensitivity Analysis – Objective function</li> <li>3.6.4 Sensitivity Analysis with Tora, Solver, and Ampl</li> </ul> </li> <li>3.7 Computational issues in Linear Programming</li> </ul>	06
04	<p><b>Duality and Post-Optimal Analysis</b></p> <ul style="list-style-type: none"> <li>4.1 Definition of the Dual Problem</li> <li>4.2 Primal-Dual Relationships <ul style="list-style-type: none"> <li>4.2.1 Review of Simplex Matrix Operations</li> <li>4.2.2 Simplex Tableau Layout</li> <li>4.2.3 Optimal Dual Solution</li> <li>4.2.4 Simplex Tableau Computations</li> </ul> </li> <li>4.3 Economic Interpretation of Duality <ul style="list-style-type: none"> <li>4.3.1 Economic Interpretation of Dual Variables</li> <li>4.3.2 Economic Interpretation of Dual Constraints</li> </ul> </li> <li>4.4 Additional Simplex Algorithms <ul style="list-style-type: none"> <li>4.4.1 Dual Simplex Algorithm</li> <li>4.4.2 Generalized Simplex Algorithm</li> </ul> </li> </ul>	05
05	<p><b>Transportation Model and Its Variants</b></p> <ul style="list-style-type: none"> <li>5.1 Definition of the Transportation Model</li> <li>5.2 Nontraditional Transportation Models</li> <li>5.3 The Transportation Algorithm <ul style="list-style-type: none"> <li>5.3.1 Determination of the Starting Solution</li> <li>5.3.2 Iterative Computations of the Transportation Algorithm</li> <li>5.3.3 Simplex Method Explanation of the Method of Multipliers</li> </ul> </li> <li>5.4 The Assignment Model</li> </ul>	05



	5.4.1 The Hungarian Method 5.4.2 Simplex Explanation of the Hungarian Method	
<b>06</b>	<b>Decision Analysis</b> 6.1 Decision Making under Certainty – Analytic Hierarchy Process (AHP) 6.2 Decision Making under Risk 6.2.1 Decision Tree-Based Expected Value Criterion 6.2.2 Variants of the Expected Value Criterion 6.3 Decision under Uncertainty	03
<b>07</b>	<b>Stimulation Modeling</b> 7.1 Monte Carlo Simulation 7.2 Types of Simulation 7.3 Elements of Discrete Event Simulation 7.3.1 Generic Definition of Events 7.3.2 Sampling from Probability Distributions	02
<b>08</b>	<b>Nonlinear Programming Algorithms</b> 8.1 Unconstrained Algorithms 8.1.1 Direct Search Method 8.1.2 Gradient Method 8.2 Constrained Algorithms 8.2.1 Separable Programming 8.2.2 Quadratic Programming	03
<b>09</b>	<b>Introduction to spreadsheet model</b>	02

### List of Assignment:

Atleast **15** assignments based on the above syllabus; Assignments to also include progams wherever applicable.

### Term Work:

The distribution of marks for term work shall be as follows:

- Laboratory work (assignments): ..... (25) Marks.
- Case Study Presentations (to be done during semester):... (15) Marks.
- Attendance ..... (10) Marks
- TOTAL: ..... (50) Marks.**

The final certification and acceptance of term work ensures the satisfactory performance of work assigned and minimum passing in the term work.

### References:

1. Taha, Hamdy A. “Operations Research” Pearson, 2011.
2. N.D. Vhora “Quantitative Techniques in Management” TMH , 3<sup>rd</sup> edition

Course Code	Course/Subject Name	Credits
<b>CPE6012</b>	<b>Software Project Management</b>	<b>02</b>

**Outcomes:** Learner will be able to...

1. Learner will be able to define characteristics of a project,
2. Learner will be able to appreciate project management principles, risk in environment and the management challenges for effective project management.
3. Learner will be able to apply the project management principles across all phases of a project.
4. Learner will be able to demonstrate use of tools and techniques for the management of a project plan, monitor and controlling a project schedule and budget, tracking project progress.

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs.</b>
<b>01</b>	<b>An overview of IT Project Management</b> 1.1 Introduction, the state of IT project management, context of project management, need of project management, project goals, project life cycle and IT development, extreme project management, PMBOK.	02
<b>02</b>	<b>Conceptualizing and Initializing the IT Project</b> 2.1 An information technology project methodology (ITPM), project feasibility, request for proposal (RFP), the business case, project selection and approval, project contracting, IT governance and the project office.	04
<b>03</b>	<b>The Human Side of Project Management</b> 3.1 Introduction, organization and project planning, the project team, the project environment.	02
<b>04</b>	<b>Developing the Project Charter and Project Plan</b> 4.1 Introduction, project management process, project integration management, the project charter, project planning framework, the contents of a project plan, the planning process. 4.2 The Work Breakdown Structure (WBS), the linear responsibility chart, multidisciplinary teams.	04
<b>05</b>	<b>The Scope Management Plan</b> 5.1 Introduction, scope planning, project scope definition, project scope verification, scope change control.	04
<b>06</b>	<b>The Project is Schedule, Budget and Risk Management</b> 6.1 Introduction, developing the project schedule, project management	08

	software tools, methods of budgeting, developing the project budget, improving cost estimates, finalizing the project schedule and budget. 6.2 IT project risk management planning process, identifying IT project risks, risk analysis and assessment, risk strategies, risk monitoring, and control, risk responses and evaluation.	
<b>07</b>	<b>Allocating Resources to the Project</b> 7.1 Resource loading, resource leveling, allocating scarce resources to projects and several projects, Goldratt's critical chain.	03
<b>08</b>	<b>The Project Communication Plan</b> 8.1 Introduction, monitoring and controlling the project, the project communications plan, project metric, project control, designing the control system, the plan-monitor-control cycle, data collection and reporting, reporting performance and progress, information distribution.	02
<b>09</b>	<b>Managing Change, Resistance and Conflicts</b>	02
<b>10</b>	<b>Managing Project Procurement and Outsourcing</b> 10.1 Introduction, project procurement management, outsourcing.	02
<b>11</b>	<b>Project Leadership and Ethics</b> 11.1 Introduction, project leadership, ethics in projects, multicultural projects.	01
<b>12</b>	<b>The Implementation Plan and Project Closure</b> 12.1 Introduction, project implementation, administrative closure, project evaluation, project audit.	02

### Term Work:

Term work shall consist of at least **10** assignments covering all topics and course project by using appropriate tool. The distribution of marks for term work shall be as follows:

1. Assignments: ..... (25) Marks.
  2. Case study presentations (**to be done during semester**):..... (15)
  3. Attendance:..... (10)
- TOTAL: ..... (50)Marks.**

The final certification and acceptance of TW ensures the satisfactory Performance of laboratory Work and Minimum Passing in the term work.

## **Suggested Assignment List**

In practical, a group of maximum three students should be formed. Each group is supposed to complete all lab experiments on the case study given by the subject teacher. In lab experiments students can use the tools like MsWord to prepare document whereas MsProject to preparing WBS, N/w diagram, PERT, CPM, Variance analysis etc.

1. Project and System's Management
2. Feasibility study document
3. Project Proposal
4. Project Planning
5. Activity Planning
6. Analyzing the project network diagram
7. Cost estimation and budgeting
8. Risk management
9. Performance analysis of project
10. Project evaluation and closure

### **Text Book:**

1. "Information Technology Project Management", Jack T. Marchewka, 3<sup>rd</sup> edition, Wiley India, 2009.

### **Reference Books:**

1. S. J. Mantel, J. R. Meredith and etl.. "Project Management" 1<sup>st</sup> edition, Wiley India, 2009.
2. John M. Nicholas, "Project Management for Business and Technology", 2<sup>nd</sup> edition, Pearson Education.
3. Joel Henry, "Software Project Management, A real-world guide to success", Pearson Education, 2008.
4. Gido and Clements, "Successful Project Management", 2<sup>nd</sup> edition, Thomson Learning.
5. Hughes and Cornell, "Software Project Management", 3<sup>rd</sup> edition, Tata McGraw Hill
6. Joseph Phillips, "IT Project Management", 2<sup>nd</sup> edition, Tata McGraw Hill
7. Robert K. Wyzocki and Rudd McGary, "Effective Project Management", 3<sup>rd</sup> edition, Wiley
8. Brown, K.A. Project Management, McGraw Hill, 2002.
9. E-Book – Project Management Body of Knowledge.
10. Dinsmore, P. C. (Ed.). (1993) The AMA Handbook of Project Management. AMACOM

Course Code	Course/Subject Name	Credits
CPE6013	<b>Elective – Foreign Language – German</b>	02

Course Code	Course/Subject Name	Credits
CPE6014	<b>Elective – Foreign Language – French</b>	02

**Objectives:**

1. To introduce German language in a holistic manner. The texts and exercises are aimed at developing the students' skills of reading, writing, listening and speaking. The course is divided into units with a thematic and grammatical progression. Scenarios from everyday life and formulated in a manner suitable and especially interesting for beginners. However since most of the students would want to do this course for professional advancement this course scenarios from the professional life are introduced in simple but engaging manner.

**Outcomes:** Learner will be able to...

1. read and understand simple German / French text
2. Describe basic family structure , culture and work culture
3. Draft e-mails and create simple presentations

Module	Detailed Contents	Hrs.
<b>01</b>	Basic Grammar, pronunciation and basic expression	08
<b>02</b>	<b>Communication</b> 2.1 Greetings , begining of conversation, Introduction of oneself , numbers , counting and dates	08
<b>03</b>	Reading , Comprehension and writing - ( Type of Text) Dialogs, Monologs , Biodata,	05
<b>04</b>	Family Structures Culture Computer and Multimedia Work culture	10
<b>05</b>	<b>Corporate communication</b> 5.1 Emails , Technical Reports , Making presentations	05

## **Term Work:**

Term work shall consist of minimum **10** assignments of different difficulty level based on above syllabus.  
The distribution of marks for term work shall be as follows:

- Laboratory work (assignments): ..... (25) Marks.
- Presentation:.....(15) Marks.
- Attendance ..... (10) Marks
- TOTAL: ..... (50) Marks.**

## **References:**

### **For German**

1. German Conversation Demystified with Two Audio CDs / Edition by Ed Swick
1. German Conversational: Learn to Speak and Understand French with Pimsleur Language Programs Audio CD – Audiobook by Pimsleur

### **For French**

2. French Conversational: Learn to Speak and Understand French with Pimsleur Language Programs Audio CD – Audiobook by Pimsleur

Subject Code	Subject Name	Credits
CPL605	<b>Network Programming Laboratory</b>	02

Laboratory Course Outcomes:

Learner will be able to :

1. Configure Linux Network
2. View and edit routing tables
3. Configure Linux Router
4. Configure Linux FTP server
5. Install and Configure DNS server
6. Install and configure web server

Module	Detailed content	Hours
1	Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.	2
2	Linux Network Configuration. <ol style="list-style-type: none"> <li>i. Configuring NIC's IP Address.</li> <li>ii. Determining IP Address and MAC Address using if-config command.</li> <li>iii. Changing IP Address using ifconfig.</li> <li>iv. Static IP Address and Configuration by Editing.</li> <li>v. Determining IP Address using DHCP.</li> <li>vi. Configuring Hostname in /etc/hosts file.</li> </ol>	4
3	Setting up multiple IP Addresses on a single LAN.	2
4	Using netstat and route commands to do the following. <ol style="list-style-type: none"> <li>i. View current routing table.</li> <li>ii. Add and delete routes.</li> <li>iii. Change default gateway.</li> </ol>	2
5	Using GUI configuration Tools to add /configure Ethernet Card.	2
6	Configuring Linux as a router by enabling IP Forwarding.	2
7	Configuring remote login Services, telnet & ssh.	2

	<ul style="list-style-type: none"> <li>i. To install and configure TELNET server.</li> <li>ii. To set up SSH and connect to remote machine.</li> </ul>	
8	To configure Linux FTP server using VSFTPD. <ul style="list-style-type: none"> <li>i. Set up anonymous access of FTP server.</li> <li>ii. Enable individual logins and add FTP users with Read-only access.</li> <li>iii. Transfer Files.</li> </ul>	2
9	To install and configure DNS server.	2
10	To install and configure Web server.	2
11	Design TCP iterative Client and Server application to reverse the given input sentence.	2
12	Design TCP concurrent Client and Server application to reverse the given input sentence.	2
13	Design TCP Client and Server application to transfer file.	2
14	Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".	2
15	Design a TCP concurrent Server to echo given set of sentences using Poll functions.	2
16	Design UDP Client and Server application to reverse the given input sentence.	2
17	Design UDP Client Server to transfer a file.	2
18	Design using Poll Client Server application to multiplex TCP and UDP requests for 60converting a given text into upper case.	2
19	Design a RPC application to add and subtract a given pair of integers.	2
20	Program to determine the host ByteOrder	2
21	Program to set and get socket options	2

**Format of Laboratory Course:**

The format for the Laboratory Course is

1. Atleast 8 small experiments based on above syllabus
2. One group Miniproject

A group of 3 students ; 4 Batches per class.

The scope of the miniproject should be such that it completes in 15 hours of actual working.

**Termwork Assessment:**

Laboratory Experiment: 10

Mini Project presentation : 10

Attendance : 05

**End Semester Examination:**

Oral examination is to be conducted by pair of internal and external examiners