UNIVERSITY OF MUMBAI

Bachelor of Engineering

Computer Engineering (Second Year – Sem. III & IV)

Revised course

(REV- 2012) from

Academic Year 2012 -13

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. In order to achieve outcome 1,2,and 3 a major emphasis is planned towards designing Laboratory courses third year onwards. 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

Second Year (Computer) (Semester III)

(REV 2012)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
CSC301	Applied Mathematics III*	4	-	1#	4	-	1	5
CSC 302	Object Oriented Programming Methodolgy*	4	2	-	4	1	-	5
CSC303	Data Structures	4	2	-	4	1	-	5
CSC304	Digital Logic Design and Analysis	3	2	-	3	1	-	4
CSC305	Discrete Structures	4	-	-	4	-	-	4
CSC306	Electronic Circuits and Communication Fundamentals	4	2	-	4	1	-	5
	Total	**23**	**8**	**1**	**23**	**4**	**1**	**28**

Course Code	Course Name	Examination Scheme							
		Internal Assesment							
		Internal Assesment			End Sem Exam	Exam Duration (in Hrs)	TW	Pract / oral	Tot
		Test 1	Test 2	Avg					
CSC301	Applied Mathematics III*	20	20	20	80	03	25!	-	125
CSC302	Object Oriented Programming Methodolgy*	20	20	20	80	03	25	25	150
CSC303	Data Structures	20	20	20	80	03	25	25	150
CSC304	Digital Logic Design and Analysis	20	20	20	80	03	25	-	125
CSC305	Discrete Structures	20	20	20	80	03	-	-	100
CSC306	Electronic Circuits and Communication Fundamentals	20	20	20	80	03	25	25	150
	Total	**-**	**-**	**120**	**480**	**-**	**125**	**75**	**750**

* Common Subjects with IT # Tutorial to be taken class wise ! **Tutorials will be evaluated as Term work**

Program Structure for B.E. Computer Engineering

Second Year (Computer) (Semester IV)

(REV 2012)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
CSC401	Applied Mathematics IV*	4	-	1	4	-	1#	5
CSC402	Analysis of Algorithms	4	2	-	4	1	-	5
CSC403	Computer Organization and Architecture*	4	2	-	4	1	-	5
CSC404	Data Base Management systems	4	2	-	4	1	-	5
CSC405	Theoretical Computer Science	4	-		4	-	-	4
CSC406	Computer Graphics	3	2	-	3	1	-	4
	Total	**23**	**8**	**1**	**23**	**4**	**1**	**28**

Course Code	Course Name	Examination Scheme							
		Internal Assesment							
		Internal Assesment			End Sem Exam	Exam Duration (in Hrs)	TW	Prac / oral	Tot
		Test 1	Test 2	Avg					
CSC401	Applied Mathematics IV*	20	20	20	80	03	25!	-	125
CSC402	Analysis of Algorithms	20	20	20	80	03	25	25	150
CSC403	Computer Organization and Architecture*	20	20	20	80	03	25	25	150
CSC404	Data Base Management systems	20	20	20	80	03	25	25	150
CSC405	Theoretical Computer Science	20	20	20	80	03	-	-	100
CSC406	Computer Graphics	20	20	20	80	03	25	25	150
	Total	**-**	**-**	**120**	**480**	-	**125**	**100**	**825**

* Common Subjects with IT # Tutorial to be taken class wise

! **Tutorials will be evaluated as Term work**

Course Code	Course Name	Credits
CSC301	**Applied Mathaematics III**	05

Objectives:

1) Complex Variable (2) Laplace Transform (3) Fourier Series (4) Discrete Structures (5) Z-transform

These topics involve the study of analytic function and mapping of complex function, Laplace transform, Inverse Laplace transform and application of Laplace transform to solve differential equations, finding Fourier series, Sine and cosine Fourier integral and Z-transform. These topics help them to solve many engineering problems arising in course of their further studies and also while working in the practical life situations.

Outcomes:

Students in this course will apply the Procedure and methods to solve technical problems.

Details of the Syllabus:-

Module	Topics	Hrs
01	**Complex Variable & mapping** 1.1 Functions of a complex variable, Analytic functions, Cauchy-Riemann equations in Cartesian co-ordinates, Polar co-ordinates. 1.2 Harmonic functions, Analytic method and Milne Thomson methods to find f(z), Orthogonal trajectories. 1.3 Conformal Mapping, Linear, Bilinear transformations, Cross ratio, fixed points and standard transformation such as rotation and magnification, invertion, translation.	**(10)**
02	**Laplace Transform** 2.1 Introduction, Definition of Laplace transform, Laplace transform of constant, trigonometrical, exponential functions. 2.2 Important properties of Laplace transform: First shifting theorem, Laplace transform of $L\{t^n f(t)\}$, $L\{ f(t)/t\}$, $L\left\{\frac{d^n f(t)}{dt^n}\right\}$, $L\{\int_0^t f(u)du\}$, L{f(at)} without proof. 2.2Unit step function, Heavi side function, Dirac-delta function, Periodic function and their Laplace transforms, Second shifting theorem. 2.3Inverse Laplace transform with Partial fraction and Convolution theorem (without proof). 2.4 Application to solve initial and boundary value problem involving ordinary differential equations with one dependent variable and constant coefficients.	**(10)**

03	**Fourier series** 3.1 Dirichlet's conditions, Fourier series of periodic functions with period 2π and 2L. 3.2 Fourier series for even and odd functions. 3.3 Half range sine and cosine Fourier series, Parsevel's identities (without proof). 3.4Orthogonal and Ortho-normal functions, Complex form of Fourier series. 3.5 Fourier Integral Representation.	**(10)**
04	**Vector Algebra and Calculus** 4.1 Vector Algebra: Scalar and vector product of three and four Vectors and their properties. 4.2 Vector Calculus: Vector differential operator ∇, Gradient of a scalar point function, Diversions and Curl of Vector point function, $\nabla (u\, v)$, $\nabla.(\phi\bar{u}), \nabla x(\phi\bar{u}), \nabla x(\bar{u}x\bar{v})$. 4.3 Vector Integration: Line integral; conservative vector field,Green's theorem in a plane (Without proof) 4.4 GaussDivergence theorem & Stokes' theorem (Without proof and no problems on verification of above theorems).	**(10)**
05	**Z transform** 5.1 Z-transform of standard functions such as $Z(a^n)$, $Z(n^p)$. 5.2 Properties of Z-transform :Linearity, Change of scale, Shifting property, Multiplication of K, Initial and final value, Convolution theorem (all without proof) 5.3 Inverse Z transform: Binomial Expansion and Method of Partial fraction.	**(8)**

Term work:

Term work shall consist of minimum four SCILAB practicals and six tutorials.

SCILAB practicals	:	10 marks
Tutorials	:	10 marks
Attendance	:	05 marks
Total	**:**	**25 marks**

Text Books:

- Higher Engineering Mathematics by Grewal B. S. 38th edition, Khanna Publication 2005.
- Advanced Engineering Mathematics by Kreyszig E. 9th edition, John Wiley.
- A Text Book of Applied Mathematics Vol. I & II by P.N.Wartilar & J.N.Wartikar, Pune, Vidyarthi Griha Prakashan., Pune.
- Discrete and Combinational Mathematics by Ralph P. Crimaldi, B Y Ramana.

References:

- Advanced Engg. Mathematics by C. Ray Wylie & Louis Barrett.TMH International Edition.
- Mathematical Methods of Science and Engineering by Kanti B. Datta, Cengage Learning.
- Lapplace Treansforms by Murry R. Spieget, Schaun's out line series-McGraw Hill Publication.
- Discrete mathematics by ERIL FOSSETT, Wiley India.

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC302	Object Oriented Programming Methodology (OOPM)*	05

Course Objectives

1. To understand Object oriented concepts like data abstraction, encapsulation, etc.
2. To solve the real world scenarios using top down approach.
3. To understand various Java programming constructs.

Course Outcomes

1. Students will be able to solve computational problems using basic constructs like if-else, control structures, array, strings.
2. Student can understand how to model real world scenario using class diagram.
3. Students will exhibit communication between 2 objects using sequence diagram.
4. Students will be able to implement relationships between classes.
5. Students will be able to demonstrate various collection classes.
6. The students will be able to demonstrate programs on exceptions, multithreading and applets.

Sr. No	Topic	No of Hours
1	Programming Approach from proceduaral to Object Orientation OO methodologies: Grady Booch Methodology of OO development	4
2	OO Concepts: Object, Class, Encapsulation or information hiding, Inheritance, Polymorphism, Message communication, Abstraction, Reuse, Coupling and Cohesion, Sufficiency Completeness and Primitiveness, Meta class	5
3	Object Oriented Programming: Java Evolution: History, How java differs from others Overview of Java language: Introduction, Installing and implementing Java, JVM	3
4	Constants, variables and data types Operators and Expressions Revision of Branching and looping	6
5	Class Object and Method: member, method, Modifier, Selector, constructer, destructor, iterator, State of an object, Method Overloading, Inheritance, Method Overriding ,Final class, abstract class and method	6

6	Classes and Relationships : Implementation of Association and Aggegation using simple scenarios	2
7	Array, String, Vector	6
8	Interfaces : variables in Interfaces, Extending an Interface, Difference between an Abstarct class and an Interface	4
9	Multithread programming	4
10	Grouping of classes for deployment and reuse: Built-in Packages: java.lang: wrapper classes java.util: ArrayList and LinkedList Creating and using User defined packages	3
11	Managing Error and Exception	3
12	Applet programming	2

Suggested list of Programming Assignments /Laboratory Work

Divide laboratory work into 3 parts

A. Basic Java structural components and Conditional and control statements:

- To demonstrate the use of command line argument.
- To demonstrate various ways of accepting data through keyboard.
- To understand the working of an array.
- To understand string class and demonstrate its various functions.

B. Perform following practical on some case study like Banking Application, Library Application etc.

- Find out classes, objects and their properties.
- Create and display objects found in above.
- Add methods to classes and implement.
- Refine above objects by adding constructors and local variables.
- Show communication between the objects by calling instance of one object from another class.
- Find relationships like inheritance, association, aggregation, composition.
- Implement above relationships.

C.

- To implement user defined exceptions in Java.
- Demonstrate the use collection classes like ArrayList/LinkedList/HashSet/TreeSet/Map.

- To illustrate Multithreading in Java.
- Simple programs on Applets and AWT.

TermWork:

Students will submit Term Work in the form of a journal that will include at least 15 programming assignments. Each programming assignment will consist of an algorithm or class diagram/sequence diagram (if applicable), program listing with proper documentation and snapshot of the output.

Practical Examination will be based on the term work and questions will be asked to judge understanding of the assignments at the time of the examination.

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

Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5 (Attendance (theory+practical))

Practical Exam will based on above syllabus

Theory Examination:

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)

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

Text Books:

1. Ralph Bravaco , Shai Simoson , “Java Programing From the Group Up” ,Tata McGraw-Hill
2. Grady Booch, Object Oriented Analysis and Design ;
3. Jaime Nino, Frederick A. Hosch, ‘An introduction to Programming and Object Oriented Design using Java’, Wiley Student Edition.

Reference Books:

1. Java: How to Program, 8/e, Dietal, Dietal, PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education
3. Sachin Malhotra, Saurabh Chaudhary “Programming in Java”, Oxford University Press, 2010

Subject Code	Subject Name	Credits
CSC303	**Data Structures (DS)**	5

Course Objectives

1. To teach efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop application using data structures.
5. To teach the concept of protection and management of data.
6. To improve the logical ability

Course Outcomes

1. Student will be able to choose appropriate data structure as applied to specified problem definition.
2. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Students will be able to apply concepts learned in various domains like DBMS, compiler construction etc.
4. Students will be able to use linear and non-linear data structures like stacks , queues , linked list etc.

Module	Detailed content	Hours
01	**Introduction to Data Structure** Types of Data Structure, Arrays, Strings, Recursion, ADT (Abstract Data type),Concept of Files,Operations with files, types of files	05
Linear Data Structure		
02	**Linked List** Linked List as an ADT, Linked List Vs. Arrays, Memory Allocation & De-allocation for a Linked List, Linked List operations, Types of Linked List, Implementation of Linked List, Application of Linked List- polynomial, sparse matrix.	10
03	**STACK** The Stack as an ADT, Stack operation, Array Representation of Stack, Link Representation of Stack, Application of stack – Recursion, Polish Notation	04
04	**Queues** The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue, Priority Queue, & De-queue, Application of Queues – Johnsons Algorithm, Simulation	05

Non-linear Data Structure		
05	**Trees** Basic trees concept, Binary tree representation,Binary tree operation, Binary tree traversal, Binary search tree implementation, Thread Binary tree, The Huffman Algorithm, Expression tree, Introduction to Multiway search tree and its creation(AVL, B-tree, B+ tree)	10
06	**Graphs** Basic concepts, Graph Representation, Graph traversal (DFS & BFS)	04
Sorting AND Searching		
07	**Sorting :** Sort Concept, Shell Sort, Radix sort, Insertion Sort, Quick Sort, Merge Sort,Heap Sort, **Searching :** List Search,Linear Index Search, Index Sequential Search Hashed List Search, Hashing Methods , Collision Resolution	10

Text Books:

1. Data Structures A Psedocode Approach with C, Richard F. Gilberg & Behrouz A. Forouzan, second edition, CENGAGE Learning.
2. Data Structures using C, Reema Thareja, Oxford University press.
3. Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G. Sorenson

Reference Books:

1. Data Structures Using C & C++, Rajesh K. Shukla, Wiley- India.
2. Data Structures Using C, ISRD Group, Second Edition, Tata McGraw-Hill
3. Data Structure Using C, Balagurusamy
4. C & Data Structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, Dreamtech press.
5. Data Structures, Adapted by: GAV PAI, Schaum's Outlines

Termwork:

Term work should consist of at least 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.
Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5 (Attendance (theory+practical))
Practical exam will be based on the above syllabus.

Theory Examination:

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)

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

Suggested Experiments:

Note: Students are required to complete 12 experiments. The star (*) marks experiments are mandatory.

Linked List
• Implementations of Linked Lists menu driven program. • * Implementation of different operations on linked list – copy, concatenate, split, reverse, count no. of nodes etc • Representation of Sparse matrix using multilinked structure. Implementation of sparse matrix multiplication. • Implementation of polynomials operations (addition, subtraction) using Linked List. • Implementations of Linked Lists menu driven program (stack and queue) • Implementations of Double ended queue using Linked Lists. • Implementation of Priority queue program using Linked Lis
Stack
• Implementations of stack menu driven program • Implementation of multistack in one array. • * Implementations of Infix to Postfix Transformation and its evaluation program. • Implementations of Infix to Prefix Transformation and its evaluation program. • Simulation of recursion
Queue
• Implementations of circular queue menu driven program • * Implementations of double ended queue menu driven program • Implementations of queue menu driven program • Implementation of Priority queue program using array. • Implementation of Johnsons Algorithm • Implementation of Simulation Problem
Tree

- *Implementations of Binary Tree menu driven program
- Implementation of Binary Tree Traversal program.
- *Implementation of construction of expression tree using postfix expression.
- Implementations of Huffman code construction
- Implementations of BST program
- Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.
- Implementations of B-tree menu driven program
- Implementations of B+ tree program
- Implementation of Preorder traversal of a threaded binary tree.
- Implementations of AVL Tree menu driven program

Sorting

- *Implementations of Shell sort, Radix sort and Insertion sort menu driven program
- Implementations of Quick Sort, Merge sort and Heap Sort menu driven program

Searching

- *Implementations of searching methods (Index Sequential, Interpolation Search) menu driven program
- Implementation of hashing functions with different collision resolution techniques

Graph

- * Implementations of Graph menu driven program (DFS & BSF)

Subject Code	Subject Name	Credits
CSC304	Digital Logic Design and Analysis	4

Course Objective:

1. To provide concepts that underpins the disciplines of digital electronics and microprocessor systems.
2. To provide the concept of modeling Combinational and sequential circuits.
3. To provide basic knowledge of how digital building blocks are described in VHDL.

Course Outcomes:

1. Binary and hexadecimal calculations and conversions.
2. Designing of combinational circuits.
3. Design synchronous and asynchronous sequential circuits.
4. Translate real world problems into digital logic formulations.
5. Construct test and debug digital networks using VHDL.
6. Learners will show awareness about TTL and CMOC Logic

Module	Detailed Contents	Hours
1	Number Systems and Codes: Revision of Binary, Octal, Decimal and Hexadecimal number Systems and their conversion, Binary Addition and Subtraction (1's and 2's complement method), Gray Code, BCD Code, Excess-3 code, ASCII Code, Error Detection and Correction Codes.	05
2	Boolean Algebra and Logic Gates: Theorems and Properties of Boolean Algebra, Standard SOP and POS form, Reduction of Boolean functions using Algebric method, K -map method (2,3,4 Variable), and Quine-McClusky Method. NAND-NOR Realization. Basic Digital Circuits: NOT,AND,OR,NAND,NOR,EX-OR,EX-NOR Gates, Logic Families: Terminologies like Propagation Delay, Power Consumption , Fan in and Fan out etc. with respect to TTL and CMOS Logic and comparison.	10
3	Combinational Logic Design: Introduction, Half and Full Adder, Half and Full Subtractor, Four Bit Binary Adder, one digit BCD Adder, Four Bit Binary Subtractor (1's and 2's compliment method), code conversion, Multiplexers and Demultiplexers, Decoders, One bit, Two bit ,4-bit Magnitude Comparator .	08
4	Sequential Logic Design: Concept of Multivibrators: Astable, Monostable and Bistable multivibrators, Flip Flops:SR, D, JK, JK	10

	Master Slave and T Flip Flop, Truth Tables and Excitation Tables, Flip-flop conversion. sequential circuit analysis , construction of state diagrams. Counters: Design of Asynchronous and Synchronous Counters, Modulo Counters, UP- DOWN counter . Shift Registers: SISO, SIPO,PIPO,PISO, Bidirectional Shift Register , Universal Shift Register, Ring and Johnson Counter. Pseudorandom sequence generator.	
5	Functional Simulation , Timing Simulation, Logic synthesis, Introduction to VHDL, Framework of VHDL program(Syntax and programming to be done only during Practicals), Introduction to CPLD and FPGA	03

Text Books:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill.
2. Yarbrough John M. , "Digital Logic Applications and Design ", Cengage Learning
3. J. Bhasker." VHDL Primer", Pearson Education

Reference Books:

1. M. Morris Mano, "Digital Logic and computer Design", PHI.
2. Douglas L. Perry, "VHDL Programming by Example", Tata McGraw Hill.
3. Donald p Leach, Albert Paul Malvino,"Digital principles and Applications",Tata McGraw Hill.

Termwork:

Term work should consist of at least 12 experiments out of which at least 2 to be VHDL based.
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.
Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 05 Marks (Assignment) + 05 (Attendance (theory+practical))

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC305	Discrete Structures	4

Course Objectives

1. To assimilate discrete mathematical concepts.
2. Introducing discrete maths as basic foundation of analysis and applications like communication,

Course Outcomes

1. Ability to reason logically.
2. Ability to understand use of functions, graphs and trees in programming applications.
3. Understand use of groups and codes in Encoding-Decoding.
4. Express recursive functions of other subjects like Data Structures as recurrence relation.

Module	Detailed content	Hours
01	**Set Theory** • Sets, Venn diagrams, Operations on Sets • Laws of set theory, Power set and Products • Partitions of sets, The Principle of Inclusion and Exclusion	05
02	**Logic** • Propositions and logical operations, Truth tables • Equivalence, Implications • Laws of logic, Normal Forms • Predicates and Quantifiers • Mathematical Induction	06
03	**Relations, Digraphs and Lattices** • Relations, Paths and Digraphs • Properties and types of binary relations • Manipulation of relations, Closures, Warshall's algorithm • Equivalence and partial ordered relations • Posets and Hasse diagram • Lattice	08

04	**Functions and Pigeon Hole Principle** • Definition and types of functions: Injective, Surjective and Bijective • Composition, Identity and Inverse • Pigeon-hole principle	**06**
05	**Generating Functions and Recurrence Relations** • Series and Sequences • Generating functions • Recurrence relations • Recursive Functions: Applications of recurrence relations e,g, Factorial, Fibonacci, Binary search, Quick Sort etc.	**06**
06	**Graphs and Subgraphs** • Definitions, Paths and circuits: Eulerian and Hamiltonian • Planer graphs, Graph coloring • Isomorphism of graphs • Subgraphs and Subgraph isomorphism	**06**
07	**Trees** • Trees and weighted trees • Spanning trees and minimum spanning tree • Isomorphism of trees and sub trees • Prefix codes	**05**
08	**Algebraic Structures** • Algebraic structures with one binary operation: semigroup, monoids and groups • Product and quotient of algebraic structures • Isomorphism, Homomorphism and Automorphism • Cyclic groups, Normal subgroups • Codes and group codes	**06**

Text Books:

1. Kenneth H. Rosen. ”Discrete Mathematics and its Applications”, Tata McGraw-Hill.
2. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, “Discrete Mathematical Structures”, Pearson Education.
3. D. S. Malik and M. K. Sen, “Discrete Mathematical Structures”, Thompson.

References:

1. C. L. Liu, D. P. Mohapatra, “Elements of Discrete Mathematics” Tata McGrawHill.
2. J. P. Trembley, R. Manohar “Discrete Mathematical Structures with Applications to Computer Science”, Tata Mcgraw-Hill.
3. Y N Singh, “Discrete Mathematical Structures”, Wiley-India.

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC306	Electronic Circuits and Communication Fundamentals	05

Course Objectives:

1. To develop the knowledge of semiconductor devices and circuits, and explain their use in communication applications.
2. To inculcate circuit analysis capabilities in students.
3. To make students aware of various types of integrated circuits that can be used in computer applications.
4. To make students aware that knowledge gained in electronic devices and circuits is useful in real life applications.

Course Outcomes:

1. Ability to understand and use semiconductor devices in circuits.
2. Ability to analyze the given circuit.
3. Ability to understand field effect devices and carry out their DC analysis.
4. Ability to understand concept of feedback and oscillations.
5. Ability to use oscillators in various applications.
6. Ability to use operational amplifier in various applications.
7. Ability to understand concept of phase lock loop and their use communication applications.
8. Ability to understand fundamental concepts of communication.
9. Ability to apply knowledge of electronic devices and circuits to communication applications.

Module	Detailed content	Hours
01	**Electronic Circuits** • Field effect based devices and circuits: • Junction Field Effect Transistors, JFET Characteristics, • FET amplification and switching, • DC load line and bias point, ate bias, self bias, voltage divider bias, coupling, bypassing and AC load lines, • FET models and parameters, • Common source circuit analysis principle of oscillation, • FET based Hartley and Colpitts Oscillator. • Crystal oscillator • BJT as power amplifier (only class A and C)	12
02	• Operational Amplifier and its applications: • Op-amp parameters and characteristics, • Inverting and Non-inverting amplifier, • Comparator, • Summing Amplifier, • Integrator, • Differentiator, • Zero Crossing Detector. • Phase Lock Loop: • Operating principle of PLL, • Lock range and capture range.	06

03	**Modulation** • Principles of Analog Communication: • Elements of analog communication systems, • Theory of amplitude modulation and types of AM, • Generation of DSB SC using balanced modulator, • Generation of SSB using phase shift method • Theory of FM and PM, • Generation of FM by Armstrong method	12
04	**Demodulation :** • Principle of super heterodyne receiver. • Foster seely detector for FM detection • Application of PLL (IC 565) as FM detector , Frequency translator, Phase shifter, and freq synthesizer	06
05	• Concept of sampling :Sampling Theorem, Types of sampling Quantization , A/D and D/A conversion concept • Pulse Modulation: generation and detection of PAM, PPM, PWM, PCM, DM and ADM.Principle of TDM and FDM.	12

Text Books:

1. David Bell, 'Electronic Devices and Circuits', Oxford, 5th Edition.
2. Wayne Tomasi 'Electronic Communication Systems (fundamentals through advanced)', Pearson Education, 4th Edition.
3. Ramakant A. Gayakwad, 'Op-amp and linear integrated circuits', PHI, 3rd edition.
4. G. Kennedy, B. Davis, S R M Prasanna, 'Electronic Communication Systems', Mc Graw Hill, 5th Edition.

References:

1. Robert Diffenderfer, 'Electronic Devices: Systems & Applications', Cengage Learning, India Edition.
2. K. R. Botkar, 'Integrated Circuits', Khanna Publishers, 9th Edition
3. Donald Neamen, 'Electronic Circuit Analysis and Design', Tata McGraw Hill,2nd Edition.
4. David Bell, 'Electronic Devices and Circuits', Oxford, 5th Edition.
5. Wayne Tomasi 'Electronic Communication Systems (fundamentals through advanced)', Pearson Education, 4th Edition.
6. Ramakant A. Gayakwad, 'Op-amp and linear integrated circuits', PHI, 3rd edition.
7. G. Kennedy, B. Davis, S R M Prasanna, 'Electronic Communication Systems', Mc Graw Hill, 5th Edition.
8. Robert Diffenderfer, 'Electronic Devices: Systems & Applications', Cengage Learning, India Edition.
9. K. R. Botkar, 'Integrated Circuits', Khanna Publishers, 9th Edition
10. Donald Neamen, 'Electronic Circuit Analysis and Design', Tata McGraw Hill,2nd Edition.

Termwork:

Term work should consist of at least 08 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.
Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5 (Attendance (theory+practical))
Oral exam will be based on the above syllabus.

Suggested List of Experiments:

1. Study of various test and measuring instruments
2. Implementation of diode detector
3. Implementation of single stage FET amplifier
4. Implementation of oscillators
5. Implementation of IC 741 based application
6. Implementation of IC741 based active filters
7. Implementation of IC555 based application
8. Troubleshooting of given faults
9. Modulation and demodulation of AM/SSB/FM
10. Study of superheterodyne receiver
11. Generation and detection of PAM/PPM/PWM
12. Generation and detection of PCM/DM/ADM
13. Study of FDM and TDM
14. SPICE based simulations

Important Note:

- **50% experiments from communication and 50% experiments from electronic circuits should be taken.**
- **In theory exam the weightage for marks out of 80 : 35 for Devices and 45 for communications**

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC401	Applied Mathaematics IV *	05

Course Objectives:

This course will present matrix theory, Similar matrices and it's application to find the matrics function. Present methods of computing and using eigen values and eigen vectors. Set up and directly evaluate contour integrals Cauchys integral theorem and formula in basic and extended form. Present Taylor and Laurents series to find singularities zero's and poles also presents residues theory and it's applications. Present theory of probability, Baye's Theorem, Expectation and Moments and it's application. Present probability distribution such as binomial, Poisson and normal distribution with their properties. Present sampling theory and it's application for small and large sample. Present methods of computing optimization using simplex method.

Course Outcomes:

Students in this course will apply the method of solving complex integration and computing residues. Use residues to evaluate various contour integrals. Demonstrate ability to manipulate matrices and compute eigen values and eigenvectors.

Students in this course will apply the Procedure and methods to solve technical problems.

Module 01	**Complex Integration** 1.1 Complex Integration – Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula(without proof) 1.2 Taylor's and Laurent's series (without proof) 1.3 Zeros, poles of f(z), Residues, Cauchy's Residue theorem 1.4 Applications of Residue theorem to evaluate Integrals of the type $\int_0^{2\Pi} f(\sin\theta, \cos\theta)\, d\theta$, $\int_{-\infty}^{\infty} f(x)\, dx$.	**(10)**
02	**Matrices:-** 2.1 Eigen values and eigen vectors 2.2 Cayley-Hamilton theorem(without proof) 2.3 Similar matrices, diagonalisable of matrix. 2.4 Derogatory and non-derogatory matrices ,functions of square matrix.	**(08)**
03	**Correlation** 3.1Scattered diagrams, Karl Pearson's coefficient of correlation, covariance,	**(04)**

	Spearman's Rank correlation. 3.2 Regression Lines.	
04	**Probability** 4.1 Baye's Theorem, 4.2 Random Variables:- discrete & continuous random variables, expectation, Variance, Probability Density Function & Cumulative Density Function. 4.3 Moments, Moment Generating Function. 4.4 Probability distribution: binomial distribution, Poisson & normal distribution. (For detail study)	**(10)**
05	**Sampling theory** 5.1 Test of Hypothesis, Level of significance, Critical region, One Tailed and two Tailed test, Test of significant for Large Samples:-Means of the samples and test of significant of means of two large samples. 5.2 Test of significant of small samples:- Students t- distribution for dependent and independent samples. 5.3 Chi square test:- Test of goodness of fit and independence of attributes, Contingency table.	**(08)**
06	**Mathematical Programming** 6.1 Types of solution, Standard and Canonical form of LPP, Basic and feasible solutions, simplex method. 6.2 Artificial variables, Big –M method (method of penalty). 6.3 Duality, Dual simplex method. 6.4 Non Linear Programming:-Problems with equality constrains and inequality constrains (No formulation, No Graphical method).	**(08)**

Term work:

Term work shall consist of minimum four SCILAB practicals and six tutorials.

SCILAB practicals	:	10 marks
Tutorials	:	10 marks
Attendance	:	05 marks
Total	**:**	**25 marks**

Text Books:

1. Higher Engineering Mathematics by Grewal B. S. 38th edition, Khanna Publication 2005.
2. Operation Research by Hira & Gupta,S Chand.
3. A Text Book of Applied Mathematics Vol. I & II by P.N.Wartilar &
4. J.N.Wartikar, Pune, Vidyarthi Griha Prakashan., Pune.
5. Probability and Statistics for Engineering, Dr. J Ravichandran, Wiley-India.

Reference Books:

1. Probability & Statistics with reliability by Kishor s. Trivedi, Wiley India.
2. Advanced Engg. Mathematics by C. Ray Wylie & Louis Barrett.TMH International Edition.
3. Mathematical Methods of Science and Engineering by Kanti B. Datta, Cengage Learning.
4. Advanced Engineering Mathematics by Kreyszig E. 9th edition, John Wiley.
5. Operations Research by S.D. Sharma Kedar Nath, Ram Nath & Co. Meerat.
6. Engineering optimization (Theory and Practice) by Singiresu S.Rao, New Age International publication.

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC402	Analysis of Algorithm	5

Prequisites : Students should be familiar with Data structure concepts , Discrete structures

Course Objectives:

1. To teach various problem solving strategies..
2. To teach mathematical background for algorithm analysis and implementation of various strategies like divide and conquer, Greedy method, Dynamic programming , Backtracking , branch and bound
3. To teach different string matching algorithms.

Course Outcomes:

1. Ability to select appropriate problem solving strategies.
2. Ability to calculate time complexity and space complexity of an algorithm.
3. Ability to analyze different divide and conquer problems.
4. Ability to analyze different greedy method problems.
5. Ability to analyze different dynamic programming problems.
6. Ability to analyze different backtracking problems.
7. Ability to analyze different string matching algorithms.

Module	Detailed Content	Hrs.
1	**Introduction to analysis of algorithm** • Decision and analysis fundamentals • Performance analysis , space and time complexity • Growth of function – Big –Oh ,Omega , Theta notation • Mathematical background for algorithm analysis • Analysis of selection sort , insertion sort • Randomized algorithms • Recursive algorithms • The substitution method • Recursion tree method • - Master method	**11**
2	**Divide and Conquer** • General method • Binary search • Finding minimum and maximum • Merge sort analysis • Quick sort analysis • Strassen's matrix multiplication • The problem of multiplying long integers	**07**

	• - constructing Tennis tournament	
3	**Greedy Method** • General Method • Knapsack problem • Job sequencing with deadlines • Minimum cost spanning trees-Kruskal and prim's algorithm • Optimal storage on tapes • - Single source shortest path	**07**
4	**Dynamic Programming** • General Method • Multistage graphs • all pair shortest path • single source shortest path • Optimal binary search tree • 0/1 knapsack • Travelling salesman problem • - Flow shop scheduling	**08**
5	**Backtracking** • General Method • 8 queen problem(N-queen problem) • Sum of subsets • - Graph coloring	**05**
6	**String Matching Algorithms** • The naïve string matching Algorithms • The Rabin Karp algorithm • String matching with finite automata • The knuth-Morris-Pratt algorithm • - Longest common subsequence algorithm	**06**
7	**Branch and bound** • General method • 15 puzzle problem • Travelling salesman problem	**04**

Text Books:

1. Ellis horowitz , sartaj Sahni , s. Rajsekaran. "Fundamentals of computer algorithms" University Press.
2. T.H.coreman , C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", 2nd edition , PHI publication 2005.
3. Alfred v. Aho , John E. Hopcroft , Jeffrey D. Ullman , "Data structures and Algorithm" Pearson education , fourth impression 2009

Reference books:

1. Michael Gooddrich & Roberto Tammassia, "Algorithm design foundation, analysis and internet examples", Second edition , wiley student edition.

Suggested Practicals:

Implementations Programing Language must be in 'C' only.

Module no	Module name	Suggested Experiment list
1	**Introduction to analysis of algorithm:**	selection sort insertion sort (for this experiment comparative analysis on the basis of comparison required to sort list is expected for large values of n)
2	**Divide and Conquer**	-binary search -finding minimum and maximum **-Merge sort analysis*** **-Quick sort analysis*** (the above two experiments marked as * should be considered as single experiment. For this experiment comparative analysis on the basis of comparisons required to sort list is expected for large values of n) -Strassen's matrix multiplication -The problem of multiplying long integers **-constructing Tennis tournament***
3	**Greedy Method**	**-Knapsack problem*** -Job sequencing with deadlines **-Minimum cost spanning trees-Kruskal and prim's algorithm*** -Optimal storage on tapes -Single source shortest path
4	**Dynamic Programming**	-Multistage graphs -all pair shortest path -single source shortest path **-Optimal binary search tree*** -0/1 knapsack **-Travelling salesman problem*** -Flow shop scheduling
5	**Backtracking**	**-8 queen problem(N-queen problem)*** -Sum of subsets -Graph coloring -Knapsack problem
6	**String Matching Algorithms**	-The naïve string matching Algorithms -The Rabin Karp algorithm -String matching with finite automata -The knuth-Morris-Pratt algorithm **-Longest common subsequence algorithm***
7	**Branch and bound**	**-15 puzzle problem*** -Travelling salesman problem

Termwork:

Total experiments to be performed are 12 = (9 + 3) 9 Experiments marked * are mandatory.

For additional 3 experiments teacher can choose experiments from **suggested list.**

The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
Termwork: 25 Marks (total marks) = 15 Marks Experiments + 05 Marks Assignment + 5 (Attendance (theory+practical))

Practical Exam will be based on above syllabus

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC403	Computer Organization and Architecture*	05

Course Objectives:

1. To conceptualize the basics of organizational and architectural issues of a digital computer.
2. To analyze performance issues in processor and memory design of a digital computer.
3. To understand various data transfer techniques in digital computer.
4. To analyze processor performance improvement using instruction level parallelism

Course Outcomes:

1. Ability to understand basic structure of computer.
2. Ability to perform computer arithmetic operations.
3. Ability to understand control unit operations.
4. Ability to design memory organization that uses banks for different word size operations.
5. Ability to understand the concept of cache mapping techniques.
6. Ability to understand the concept of I/O organization.
7. Ability to conceptualize instruction level parallelism.

Pre-requistes: Fundamentals of Computer, Digital Logic Circuits, Programming Languages (C, C++, Java)

Module	Detailed Contents	Hours
1	**Overview of Computer Architecture & Organization:** • Introduction of Computer Organization and Architecture. • Basic organization of computer and block level description of the functional units. • Evolution of Computers, Von Neumann model. • Performance measure of Computer Architecture. • Introduction to buses and connecting I/O devices to CPU and Memory, bus structure.	04
2	**Data Representation and Arithmetic Algorithms:** • Number representation: Binary Data representation, two's complement representation and Floating-point representation. IEEE 754 floating point number representation. • Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm.	10

	• Division of integers: Restoring and non-restoring division • Floating point arithmetic: Addition, subtraction	
3	**Processor Organization and Architecture:** • CPU Architecture, Register Organization , Instruction formats, basic instruction cycle. Instruction interpretation and sequencing. • Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations, concepts of nano programming. • Introduction to RISC and CISC architectures and design issues. • Case study on 8085 microprocessor: Features, architecture, pin configuration and addressing modes.	12
4	**Memory Organization:** • Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAM and ROM, Allocation policies, Memory hierarchy and characteristics. • Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory. • Virtual Memory: Concept, Segmentation and Paging , Page replacement policies.	12
5	**I/O Organization and Peripherals:** • Input/output systems, I/O modules and 8089 IO processor. • Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA. • Peripheral Devices: Introduction to peripheral devices, scanner, plotter, joysticks, touch pad.	6
6	**Introduction to parallel processing systems:** • Introduction to parallel processing concepts • Flynn's classifications • pipeline processing • instruction pipelining, • pipeline stages • pipeline hazards.	4

Text Books:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw-Hill.
2. John P. Hayes, “Computer Architecture and Organization”, Third Edition.
3. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.
4. B. Govindarajulu, “Computer Architecture and Organization: Design Principles and Applications”, Second Edition, Tata McGraw-Hill.

Reference Books:

1. Dr. M. Usha, T. S. Srikanth, “Computer System Architecture and Organization”,First Edition, Wiley-India.
2. “Computer Organization” by ISRD Group, Tata McGraw-Hill.
3. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085, Fifth Edition,Penram.

Termwork:

Term work should consist of at least 08 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.
Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5 (Attendance (theory+practical))

oral exam will be based on the above syllabus.

Note:
1. The faculty should conduct eight programming practical / experiments based on the above syllabus including two case studies on recent developments covering the above contents.
All the programs should be implemented in C/C++/Java under Windows or Linux environment.
Experiments can also be conducted using available open source tools.
2. 8085 microprocessor should be included only as a sample case study to visualize the concepts. No questions in University Exams / Class Tests should be asked on 8085 microprocessor.

SUGGESTED LIST OF COA PRACTICAL / EXPERIMENTS

1. To study Full Adder (7483).

2. To study ALU (74181).

3. To study MASM (Micro Assembler).

4. A program for hexadecimal addition and multiplication.

5. A program for binary multiplication.

6. A program for Hamming code generation , detection and correction.

7. A program for Booth's multiplication

8. A program for LRU page replacement algorithm.

9. A program for FIFO page replacement algorithm.

10. A program to simulate the mapping techniques of Cache memory.

10.1 Direct Mapped cache
10.2 Associative Mapped cache
10.3 Set Associative Mapped cache

11. A program to simulate memory allocation policies.

11.1 First-fit algorithm
11.2 Best-fit algorithm

12. A program to implement serial communication (PC - PC communication).

13. A program to implement parallel communication. (PC - Printer communication).

14. A program for printer simulation.

15. A program for keyboard simulation.

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CEC404	Database Management System	05

Course Objectives:

1. Learn and practice data modeling using the entity-relationship and developing database designs.
2. Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3. Apply normalization techniques to normalize the database
4. Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Course Outcomes:

1. The learner will be able:
2. To describe data models and schemas in DBMS
3. To understand the features of database management systems and Relational database.
4. To use SQL- the standard language of relational databases.
5. To understand the functional dependencies and design of the database.
6. To understand the concept of Transaction and Query processing.

Module	Detailed content	Hours
1	**Introduction Database Concepts:** Introduction, Characteristics of databases, File system V/s Database system, Users of Database system, Concerns when using an enterprise database, Data Independence, DBMS system architecture, Database Administrator,	04
2	**Entity–Relationship Data Model :** Introduction, Benefits of Data Modeling, Types of Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Generalization, Specialization and Aggregation, Extended Entity-Relationship (EER) Model.	04
3	**Relational Model and Algebra :** Introduction , Mapping the ER and EER Model to the Relational Model , Data Manipulation , Data Integrity ,Advantages of the Relational Model, Relational Algebra , Relational Algebra Queries, Relational Calculus.	08
4	**Structured Query Language (SQL) :** Overview of SQL , Data Definition Commands, Set operations , aggregate function , null values, , Data Manipulation commands, Data Control commands , Views in SQL, Nested	09

	and complex queries .	
5	**Integrity and Security in Database:** Domain Constraints, Referential integrity, Assertions, Trigger, Security, and authorization in SQL	04
6	**Relational–Database Design :** Design guidelines for relational schema, Function dependencies, Normal Forms- 1NF, 2 NF, 3NF, BCNF and 4NF	06
7	**Transactions Management and Concurrency:** Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Implementation of isolation, Concurrency Control: Lock-based , Timestamp-based , Validation-based protocols, Deadlock handling, Recovery System: Failure Classification, Storage structure, Recovery & atomicity, Log based recovery, Shadow paging.	08
8	**Query Processing and Optimization: Overview** ,Issues in Query Optimization ,Steps in Query Processing , System Catalog or Metadata, Query Parsing , Query Optimization, Access Paths , Query Code Generation , Query Execution , Algorithms for Computing Selection and Projection , Algorithms for Computing a Join , Computing Aggregation Functions , Cost Based Query Optimization .	05

Text Books:

1. G. K. Gupta :"Database Management Systems", McGraw – Hill.
2. Korth, Slberchatz,Sudarshan, :"Database System Concepts", 6th Edition, McGraw – Hill
3. Elmasri and Navathe, " Fundamentals of Database Systems", 5thEdition, PEARSON Education.
4. Peter Rob and Carlos Coronel, " Database Systems Design, Implementation and Management", Thomson Learning, 5th Edition.

Reference Books :

1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g,Black Book, Dreamtech Press Mark L. Gillenson, Paulraj Ponniah, " Introduction to Database Management",Wiley
2. Sharaman Shah ,"Oracle for Professional", SPD.
3. Raghu Ramkrishnan and Johannes Gehrke, " Database Management Systems",TMH
4. Debabrata Sahoo "Database Management Systems" Tata McGraw Hill, Schaum's Outline

Termwork:

Term work should consist of at least 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.
Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5 (Attendance (theory+practical))
practical exam will be based on the above syllabus.

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC405	Theoretical Computer Science	4

Course Objectives:

1. Conceptual understanding of fundamentals of Grammars and languages.
2. Build concepts of theoretical design of basic machine, deterministic and non deterministic machines and pushdown machines.
3. Develop understanding of different types of Turing machines and their use.
4. Understand the concept of Undecidability.

Course Outcomes:

1. Understanding of Power and Limitations of theoretical models of Computation.
2. Ability to compare different types of languages and machines.
3. Ability to match constraints of a language to power of machines.

Module	Detailed content	Hours
01	**Introduction:** • Alphabets, Strings and Languages • Chomskey hierarchy and Grammars. • Finite Automata (FA) and Finite State machine (FSM).	03
02	**Regular Grammar (RG):** • Regular Grammar and Regular Expression (RE): Definition, Equivalence and Conversion from RE to RG and RG to RE. • Equivalence of RG and FA, Converting RG to FA and FA to RG. • Equivalence of RE and FA, Converting RE to FA and FA to RE.	04
03	**Finite Automata:** • Deterministic and Nondeterministic Finite Automata (DFA and NFA): Definitions, Languages, Transitions (Diagrams, Functions and Tables). • Eliminating epsilon-transitions from NFA.	05

	• DFA, NFA: Reductions and Equivalence. • FSM with output: Moore and Mealy machines.	
04	**Regular Language (RL):** • Decision properties: Emptiness, Finiteness and Membership. • Pumping lemma for regular languages and its applications. • Closure properties. • Myhill-Nerode Theorem and An application: Text Search.	**04**
05	**Context Free Grammars (CFG):** • Definition, Sentential forms, Leftmost and Rightmost derivations. • Context Free languages (CFL): Parsing and Ambiguity. • CFLs: Simplification and Applications. • Normal Forms: CNF and GNF. • Pumping lemma for CFLs and its applications. • Closure properties and Kleene's closure.	**06**
06	**Pushdown Automata(PDA):** • Definition, Transitions (Diagrams, Functions and Tables), Graphical Notation and Instantaneous Descriptions. • Language of PDA, Pushdown Stack Machine (PSM) as a machine with stack, Start and Final state of PSM. • PDA/PSM as generator, decider and acceptor of CFG • Deterministic PDA (DPDA) and Multi-stack DPDA.	**08**
07	**Turing Machine (TM):** • Definition, Transitions (Diagrams, Functions and Tables). • Design of TM as generator, decider and acceptor. • Variants of TM: Multitrack, Multitape and Universal TM. • Equivalence of Single and Multi Tape TMs. • Power and Limitations of TMs. • Design of Single and Multi Tape TMs as a computer of simple functions: Unary, Binary (Logical and Arithmetic), String operations (Length, Concat, Match, Substring Check, etc)	**10**

08	**Undecidability and Recursively Enumerable Languages:** • Recursive and Recursively Enumerable Languages. • Properties of Recursive and Recursively Enumerable Languages. • Decidability and Undecidability, Halting Problem, Rice's Theorem, Grebach's Theorem, Post Correspondence Problem, • Context Sensitivity and Linear Bound Automata.	**06**
09	**Comparison of scope of languages and machines:** • Subset and Superset relation between FSM, PSM and TM. • Subset and Superset relation between RL, CFL and Context Sensitive Language.	**02**

Text Books:

1. Michael Sipser, " Theory of Computation", Cengage learning.
2. John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, " Introduction to Automata Theory, Languages and Computation", Pearson Education

References:

1. J. C. Martin, "Introduction to Languages and the Theory of Computation", Tata McGrawHill.
2. Krishnamurthy E. V., "Introductory Theory of Computer Science", East-West Press.
3. Kavi Mahesh, "Theory of Computation: A Problem Solving Approach", Wiley-India.

Theory Examination:

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)

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

Subject Code	Subject Name	Credits
CSC406	Computer Graphics	04

Course Educational Objectives:

1. The main objective is to introduce to the students in the graphics mode, with the help of basic algorithms and methodologies .
2. The objective of the course is to equip students with fundamental knowledge and basic technical competence in the field of computer graphics.
3. Provide an understanding of how a computer draws the fundamental graphics primitives.
4. To learn Computer Graphics methodologies/Algorithms and techniques .
5. To learn Implementation of Computer Graphics Algorithms

Course Outcomes:

Upon successfully completing Fundamentals of Computer graphics course, students will have, at a minimum, the qualities listed in the expected learning outcomes below.

1. Student will have understood basic concepts of computer graphics
2. Acquire knowledge about drawing basic shapes such as lines, circle ellipse, polygon.
3. Shall be able to perform processing of basic shapes by various processing algorithms /techniques.
4. Acquire knowledge about two and three dimensional transformations.
5. Shall be able to apply the transformation algorithms to the basic shapes.
6. Shall have basic knowledge of windowing and clipping.
7. Shall be able to apply various algorithms of clipping.
8. Acquire knowledge about Visible Surface Detection methods
9. Acquire knowledge about Illumination Models and Surface Rendering
10. Acquire knowledge about Color Models

Module	Contents	Hours
1.	**Introduction to Computer Graphics** (a) What is Computer Graphics? (b) Where Computer Generated pictures are used (c) Elements of Pictures created in Computer Graphics (d) Graphics display devices (e) Graphics input primitives and Devices	**(02)**
2.	**Introduction to openGL** (a) Getting started Making pictures	**(02)**

	(b) Drawing basic primitives (c) Simple interaction with mouse and keyboard (**For implementation use openGL programming**)	
3.	**Output Primitives** (a) Points and Lines, Antialiasing (b) Line Drawing algorithms • DDA line drawing algorithm • Bresenham's drawing algorithm • Parallel drawing algorithm (c) Circle and Ellipse generating algorithms • Mid-point Circle algorithm • Mid-point Ellipse algorithm (d) Parametric Cubic Curves • Bezier curves • B-Spline curves	**(06)**
4.	**Filled Area Primitives** (a) Scan line polygon fill algorithm (b) Pattern fill algorithm (c) Inside-Outside Tests (d) Boundary fill algorithms (e) Flood fill algorithms	**(02)**
5.	**2D Geometric Transformations** (a) Basic transformations (b) Matrix representation and Homogeneous Coordinates (c) Composite transformation (d) Other transformations (e) Transformation between coordinated systems	**(04)**
6.	**2D Viewing** (a) Window to Viewport coordinate transformation (b) Clipping operations – Point clipping (c) Line clipping • Cohen – Sutherland line clipping • Liang – Barsky line clipping • Midpoint subdivision (d) Polygon Clipping • Sutherland – Hodgeman polygon clipping • Weiler – Atherton polygon clipping	**(04)**
7.	**3D Geometric Transformations and 3D Viewing** (a) 3D object representation methods B-REP , sweep representations , CSG (b) Basic transformations • Translation • Rotation	**(06)**

	• Scaling (c) Other transformations 1. Reflection 2. Rotation about an arbitrary axis (d) Composite transformations (e) Projections – Parallel and Perspective (f) 3D clipping	
8.	**3D Geometric Transformations and 3D Viewing** (a) Classification of Visible Surface Detection algorithm (b) Back Surface detection method (c) Depth Buffer method (d) Scan line method (e) BSP tree method (f) Area Subdivision method	**(04)**
9.	**Illumination Models and Surface Rendering** (a) Basic Illumination Models (b) Halftone and Dithering techniques (c) Polygon Rendering Constant shading , Goraud Shading , Phong Shading	**(03)**
10.	**11. Fractals** (a) Introduction (b) Fractals and self similarity Successive refinement of curves, Koch curve, Fractional Dimension, (c) String production and peano curves **(For implementation use C Programming)**	**(03)**

The journal should consist of 12 experiments and 3 assignments.

Following is the list of compulsory 10 experiments.

Additional 2 experiments can be implemented relevant to the course

1. Drawing the basic primitives and sierpinsky gasket using openGL*.
2. Create a polyline using mouse interaction using openGL*.
3. Bresenham's line drawing algorithm.
4. Mid-Point ellipse drawing algorithm.
5. Implementing Bezier curve.
6. Scanline fill algorithm.
7. 2D transformations.
8. Any one Line clipping algorithm cohen-sutherland / liang barsky.
9. Polygon Clipping algorithm sutherland hodgeman.
10. Any one Fractal generation (Koch curve / Hilbert curve / peano curves using string production)

***Implementation of experiments 1 and 2 must be in openGL.**
Implementation of experiments 3 to 10 must be done in C language.

Termwork:

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

Term Work: 25 Marks (total marks) = 15 Marks (Experiment) + 5 Marks (Assignment) + 5 (Attendance (theory+practical))

Practical Exam will be based on above syllabus

TEXT BOOKS

1. Donald D. Hearn & M. Pauline Baker, " Computer Graphics-C Version", 2nd Edition, Pearson Education, 2002, ISBN 81-7808-794-4
2. F.S.Hill , Jr. , "Computer Graphics using OpenGL" , second edition PHI publication.
3. James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, "Computer Graphics Principles and Practice, 2nd Edition in C, Audison Wesley, ISBN – 981-235-974-5
4. William M. Newman, Roberet F. Sproull, " Principles of Interactive Computer Graphics", Second Edition, Tata McGraw-Hill Edition

REFERENCE BOOKS

1. Rajesh K. Maurya, "Computer Graphics", 1st Edition, Wiley India Publication ISBN 978-81-265-3100-4.
2. Amarendra N Sinha, Arun D Udai, "Computer Graphics" ISBN 10: 0070034378, ISBN 13: 9780070634374, Tata McGraw-Hill Education, 2007.
3. Peter Shirley, Steve Marschner, A K Peters, "Fundamentals of Computer Graphics", 3rd Edition, A. K. Peters Ltd. , Natick, Massachusetts, Distributed by Shroff Publishers and Dist. Pvt. Ltd.
4. Zhigang Xiang, Roy A Plastock, " Computer Graphics", second edition, Shaum's Outlines, Tat McGraw Hill
5. David F. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publications, 2001, ISBN 0-07-04-7371-4.

Theory Examination:

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)

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

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 objectivesof their own may be added by affiliated Institutes.

The Program outcomes are the skils 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
	Total	**16**	**16**	**-**	**16**	**8**	**-**	**24**

* 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							
		Internal Assesment			End Sem Exam	Exam Duration (in Hrs)	TW	Oral / Pract	Total
		Test 1	Test 2	Avg					
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
	Total	**-**	**-**	80	320		175	150	725

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
	Total	**16**	**16**	**-**	**16**	**8**	**-**	**24**

* Hours shown as Practicals to be taken class wise

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

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
	Total	**16**	**18**	**-**	**16**	**9**	-	**25**

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

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	Tut	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
	Total	**16**	**22**	**-**	**16**	**11**	-	**27**

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

CPE6014 Foreigh Language – French

Elective II Sem 7

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

Elective III - Sem 8

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

Course Code	Course/Subject Name	Credits
CPC501	**Microprocessor**	**5**

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.
01	**Intel 8086/8088 Architecture** 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
02	**Instruction Set and Programming** 2.1 Instruction Set of 8086, Addressing Modes, Assembly Language Programming, Mixed Language Programming with C Language and Assembly Language.	08
03	**System designing with 8086** 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
04	**Intel 80386DX Processor** 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
05	**Pentium Processor** 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.	
06	**SuperSPARC Architecture** 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, 8th 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, 5th Edition, Prentice Hall of India

Course Code	Course/Subject Name	Credits
CPC502	**Operating Systems**	**5**

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.
01	**Introduction** 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
02	**Process Management** 2.1 **Process concept**, 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 **Synchronization:** 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
03	**Deadlock** 3.1 Deadlock Problem, Deadlock Characterization, Deadlock Prevention. Deadlock avoidance Banker's algorithm for single & multiple resources , Deadlock recovery , Deadlock Detection,	04

04	**Memory Management** 4.1 **Memory management strategies:** background , swapping ,contiguous memory allocation, paging , structure of page tables , segmentation 4.2 **Virtual memory management:** Demand paging , copy-on write,Page replacement, FIFO, Optimal, LRU, LRU Approximation,Counting Based, , Allocation of frames , Thrashing	05
05	**File Management** **5.1** Files-System Structure, File System implementation, Directory implementation , Allocation Methods contiguous allocation, linked list allocation, indexed allocations, Free space management. 5.2 **Secondary storage** : structures: Disks Scheduling Algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, Disk Management	06
06	**Input Output Management** 6.1 Overview , I/O Hardware , Application I/O Interface	02
07	**Case Study of UNIX** 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
08	**Case Study of Linux** 8.1 History , Design Principles , Kernel Modules , Process management , Scheduling , Memory management , File Systems , Input and Output , Inter process communication , Network structure , Security	05
09	**Case study: Windows 7** 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 **<u>08</u>** 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	**Structured and Object Oriented Analysis and Design**	**5**

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.
01	**Introduction** 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
02	**System Analysis** 2.1 Business process Reengineering and the Zachman Framework, System Requirement, Stakeholders, Techniques for information gathering, Validating the requirements.	06
03	**Feasibility Analysis** 3.1 Feasibility Analysis, Tests for feasibility, Cost-Benefit Analysis, Feasibility analysis of candidate system. 3.2 The system Proposal.	06
04	**Modeling System Requirements** 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
05	**System Design** 5.1 Moving To Design 5.2 The traditional Approach to design 5.3 The Object-Oriented Approach to design: Use Case REaliztion 5.4 Designing Database, Designing the User Interface, Designing System Interfaces, Controls and security	12
06	**Application Architecture** 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 / alloted project.
2. Develop DFD model (level-0, level-1 DFD and Data dictionary) of tselected / alloted project.
3. Develop UML Use case model for selected / alloted project. .
4. Develop sequence diagram selected / alloted project. .
5. Develop Class diagram selected / alloted project.
6. Develop prototype of your project selected / alloted project.
7. Draw system architecture diagram selected / alloted project.

Text Books:

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

Reference Books:

1. Systems Analysis and Design by Kendall & Kendall, PHI Publication, 7th Edition.
2. Analysis and Design of Information Systems by James a. Senn, 2nd Edition, McGrawHill.
3. Object-Oriented Modeling and Design with UML by Michael Blaha, James Rumbaugh, Pearson Education Publication, 2nd 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, 4th Edition.
6. UML Distilled by Martin Fowler, Pearson Edition, 3rd 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, 2nd Edition.

Course Code	Course/Subject Name	Credits
CPC504	**Computer Networks**	**4+1**

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.
01	**Introduction** 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
02	**Physical Layer** 2.1 Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. 2.2 Unguided media (Wireless Transmission): Radio Waves, Bluetooth, Infrared, Virtual LAN.	06
03	3.1 **Data Link Layer** DDL Design Issues, Functionalities of DLL, Flow control algorithms - Sliding Window, Error Detection & Correction techniques, SDLC, PPP, Framing. 3.2 **MAC Layer** Aloha protocols, Control Access Protocol, Carrier Sense Multiple Access(CSMA), Ethernet, Local Area Networks - Ethernet, Token ring, FDDI.	09
04	**Network layer** 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

05	**Transport Layer** 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
06	**Application Layer** 6.1 DNS, HTTP, E-mail, SMTP, Telnet, FTP, Security-PGP-SSH.	06
07	**Network Management** 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	**Business Communication & Ethics**	**2**

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.
01	**Report Writing** 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
02	**Technical Proposals** 2.1 Objective of technical proposals 2.2 Parts of proposal	02
03	**Introduction to Interpersonal Skills** 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
04	**Meetings and Documentation** 4.1 Strategies for conducting effective meetings 4.2 Notice 4.3 Agenda	02

	4.4 Minutes of the meeting	
05	**Introduction to Corporate Ethics and etiquettes** 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
06	**Employment Skills** 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, 12th 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, 2nd edition
8. Bell . Smith,"Management Communication" Wiley India Edition,3rd 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	**Web Technologies Laboratory**	2

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

05	**Title:** Write an XML file marksheet.xml representing your semester mark sheet**.** **Concept:** Extensible Mark up Language (XML) **Objective:** 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. **Scope:** is to creating an XML file in that it must include basic syntax of an XML doc and DTD for the same.	03
06	**Title:** 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. **Concept:** Server side scripting**,** introduction to PHP **Objective:** this lab gives a basic introduction of to PHP and dynamic programming on the server side. **Scope:** creating a server side script using PHP, decisions, looping **Technology:** PHP, HTML	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	**System Programming Compiler Construction**	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
01	**System Software** 1.1 Concept, introduction to various system programs such as assemblers, loaders , linkers ,macro processors, compilers, interpreters, operating systems, device drivers	01
02	**Assemblers** 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
03	**Macros & Macro processors** 3.1 Macro instructions, Features of Macro facility, Design of 2 pass macroprocessor	04
04	**Loaders and Linkers** 4.1 loader schemes, Design of Absolute loader , Design of Direct linking loader	04
05	**Software Tools** 5.1 Software Tools for Program development, Editors: Types of Editors , Design of Editor ,Debug Monitors	02

06	**Compilers** 5.1 Introduction to Compilers, Phases of a compiler, comparison of compilers and interpreters.	02
07	**Lexical Analysis** 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
08	**Syntax Analysis** 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
09	**Syntax Directed Translation** 9.1 Syntax directed definitions, Inherited and Synthesized attributes, Evaluation order for SDDs , S attributed Definitions , L attributed Definitions	3
10	**Intermediate Code Generation** 10.1 Intermediate languages: declarations, Assignment statements, Boolean expression, case statements, back patching , procedure calls.	04
11	**Code Generation** 11.1 Issues in the design of Code Generator **,** Basic Blocks and Flow graphs, code generation algorithm , DAG representation of Basic Block	04
12	**Code Optimization** 12.1 Principal sources of Optimization, Optimization of Basic Blocks , Loops in Flow graph **,**Peephole Optimization	03
13	**Run Time storage** 11.1 Storage Organization **,** storage allocation strategies, parameter passing , Symbol table , introduction to garbage collection and compaction	04
14	**Compiler-compilers** **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	**Software Engineering**	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
01	**Introduction** 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
02	**Software project scheduling, Control & Monitoring** 2.1 Software estimation – Empirical estimation models – Cost/Effort estimation 2.2 Planning – Work breakdown Structure, Gantt Chart. Discuss schedule and cost slippage.	04
03	**Risk Management** 3.1 Risk Identification, Risk Assessment, Risk Projection, RMMM	04
04	**Software Configuration Management** 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
05	**Software Design Specification** 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.	
06	**Software Quality** 6.1 Software Quality Assurance – Software standards , Quality metrics Software Reliability ,Quality Measurement and Metrics	04
07	**Software Testing** 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
08	**Web Engineering** 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, 2nd 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	**Distributed Databases**	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.
01	**Concept and Overview Distributed Database system** 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
02	**Distributed Database Design** 2.1 Distributed database design concept, objective of Data Distribution, Data Fragmentation, The allocation of fragment , Transparencies in Distributed Database Design	08
03	**Distributed Transaction and concurrency control** 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
04	**Distributed Deadlock and Recovery** 4.1 Introduction to Deadlock, Distributed Deadlock prevention, avoidance, detection and recovery, Two-Phase and Three-Phase Commit Protocol.	06
05	**Distributed query processing and optimization** 5.1 Concept, objective, and phases of distributed query processing; join strategies in fragment relation , Global query optimization	04
06	**Heterogeneous Database** 6.1 Architecture of Heterogeneous Database, Database Integration: Schema Translation and schema Integration, Query processing issues in Heterogeneous database.	06

07	**XML** 7.1 XML for data integration, structure of XML, XML document schema, Querying and Transformation, storage of XML data, XML application.	08

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

TOTAL: ……. (25) Marks.

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”, 6th Edition, Pearson Education India.

Course Code	Course/Subject Name	Credits
CPC604	**Mobile Communication and Computing**	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.
01	**Introduction to Mobile Computing** 1.1 Wireless Communication, Applications, Cellular Systems, Antennas, satellite system, GEO, LEO, MEO, GPRS:-Architecture, Network nodes, GPRS support nodes.	05
02	**GSM cellular telephony-architecture and system aspects** 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
03	**Mobile Network** 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
04	**Third and Fourth Generation Systems** 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

05	**Mobility Management** 5.1 Co- channel Interference, Mobility: Types of Handoffs; Location Management, HLR-VLR scheme, Hierarchical scheme, Predictive Location management schemes, cellular IP, PSTN.	04
06	**Wireless Local Area Networks** 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
07	**Introduction to Android** 7.1 Layers, android components, mapping application to process. Android development basics. Hardware tools, Software tools, Android SDK features	05
08	**Security Issues In Mobile Computing** 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 ", Addision 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 Communcations 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
CPE6011	**Operations Research**	**02**

Outcomes: Learner will be able to

1. model and solve problem using linear programming techniques
2. Implement algebric 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.
01	**What is Operations Research** 1.1 Introduction.	02
02	**Modeling with Linear Programming** 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	**The Simplex Method and Sensitivity Analysis** 3.1 LP Model in Equation Form 3.2 Transition from Graphical to Algebraic Solution 3.3 The Simplex Method 3.3.1 Iterative Nature of the Simplex Method 3.3.2 Computational details of the Simplex algorithm 3.3.3Summary of the Simplex Method 3.4Artificial Starting Solution 3.4.1 M-Method 3.4.2 Two-Phase Method 3.5 Special Cases in the Simplex Method 3.5.1 Degeneracy 3.5.2 Alternative Optima 3.5.3 Unbounded Solution 3.5.4 Infeasible Solution 3.6 Sensitivity Analysis 3.6.1 Graphical Sensitivity Analysis 3.6.2 Algebraic Sensitivity Analysis – Changes in the Right-hand side 3.6.3 Algebraic Sensitivity Analysis – Objective function 3.6.4 Sensitivity Analysis with Tora, Solver, and Ampl 3.7 Computational issues in Linear Programming	06
04	**Duality and Post-Optimal Analysis** 4.1 Definition of the Dual Problem 4.2 Primal-Dual Relationships 4.2.1 Review of Simplex Matrix Operations 4.2.2 Simplex Tableau Layout 4.2.3 Optimal Dual Solution 4.2.4 Simplex Tableau Computations 4.3 Economic Interpretation of Duality 4.3.1 Economic Interpretation of Dual Variables 4.3.2 Economic Interpretation of Dual Constraints 4.4 Additional Simplex Algorithms 4.4.1 Dual Simplex Algorithm 4.4.2 Generalized Simplex Algorithm	05
05	**Transportation Model and Its Variants** 5.1 Definition of the Transportation Model 5.2 Nontraditional Transportation Models 5.3 The Transportation Algorithm 5.3.1 Determination of the Starting Solution 5.3.2 Iterative Computations of the Transportation Algorithm 5.3.3 Simplex Method Explanation of the Method of Multipliers 5.4 The Assignment Model	05

	5.4.1 The Hungarian Method 5.4.2 Simplex Explanation of the Hungarian Method	
06	**Decision Analysis** 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
07	**Stimulation Modeling** 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
08	**Nonlinear Programming Algorithms** 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
09	**Introduction to spreadsheet model**	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 , 3rd edition

Course Code	Course/Subject Name	Credits
CPE6012	**Software Project Management**	**02**

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.

Module	Detailed Contents	Hrs.
01	**An overview of IT Project Management** 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
02	**Conceptualizing and Initializing the IT Project** 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
03	**The Human Side of Project Management** 3.1 Introduction, organization and project planning, the project team, the project environment.	02
04	**Developing the Project Charter and Project Plan** 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
05	**The Scope Management Plan** 5.1 Introduction, scope planning, project scope definition, project scope verification, scope change control.	04
06	**The Project ís Schedule, Budget and Risk Management** 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.	
07	**Allocating Resources to the Project** 7.1 Resource loading, resource leveling, allocating scarce resources to projects and several projects, Goldrattís critical chain.	03
08	**The Project Communication Plan** 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
09	**Managing Change, Resistance and Conflicts**	02
10	**Managing Project Procurement and Outsourcing** 10.1 Introduction, project procurement management, outsourcing.	02
11	**Project Leadership and Ethics** 11.1 Introduction, project leadership, ethics in projects, multicultural projects.	01
12	**The Implementation Plan and Project Closure** 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 used 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, 3rd edition, Wiley India, 2009.

Reference Books:

1. S. J. Mantel, J. R. Meredith and etl.. "Project Management" 1st edition, Wiley India, 2009.
2. John M. Nicholas, "Project Management for Business and Technology", 2nd 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", 2nd edition, Thomson Learning.
5. Hughes and Cornell, "Software Project Management", 3rd edition, Tata McGraw Hill
6. Joseph Phillips, "IT Project Management", 2nd edition, Tata McGraw Hill
7. Robert K. Wyzocki and Rudd McGary, "Effective Project Management", 3rd 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	**Elective – Foreign Language – German**	02

Course Code	Course/Subject Name	Credits
CPE6014	**Elective – Foreign Language – French**	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.
01	Basic Grammar, pronunciation and basic expression	08
02	**Communication** 2.1 Greetings , begining of conversation, Introduction of oneself , numbers , counting and dates	08
03	Reading , Comprehension and writing - (Type of Text) Dialogs, Monologs , Biodata,	05
04	Family Structures Culture Computer and Multimedia Work culture	10
05	**Corporate communication** 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	**Network Programming Laboratory**	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. i. Configuring NIC's IP Address. ii. Determining IP Address and MAC Address using if-config command. iii. Changing IP Addess using ifconfig. iv. Static IP Address and Configuration by Editing. v. Determining IP Address using DHCP. vi. Configuring Hostname in /etc/hosts file.	4
3	Setting up multiple IP Addresses on a single LAN.	2
4	Using netstat and route commands to do the following. i. View current routing table. ii. Add and delete routes. iii. Change default gateway.	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

	i. To install and configure TELNET server. ii. To set up SSH and connect to remote machine.	
8	To configure Linux FTP server using VSFTPD. i. Set up anonymous access of FTP server. ii. Enable individual logins and add FTP users with Read- only access. iii. Transfer Files.	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. Atlease 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

Course Code	Course/Subject Name	Credits
CPC701	**Digital Signal Processing**	5

Objectives:

1. To learn the fundamental concepts of Digital Signal Processing.
2. To explore the properties of DFT in mathematical problem solving.
3. To illustrate FFT calculations mathematically and develop FFT based DSP algorithms.
4. To introduce DSP processor for real time signal processing application

Outcomes: Learner will be able to…

1. To understand the concept of DT Signal and perform signal manipulation
2. To perform analysis of DT system in time domain
3. To develop FFT flow-graph and Fast DSP Algorithms.
4. To design DSP system for Real Time Signal Processing.

Module	Detailed Contents	Hrs.
01	**Discrete Time Signal** 1.1 Introduction to Digital Signal Processing, Discrete Time Signals, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations(shifting, addition, subtraction, multiplication), Classification of Signals, Linear Convolution formulation(without mathematical proof), Circular Convolution formulation(without mathematical proof), Matrix Representation of Circular Convolution, Linear by Circular Convolution. Auto and Cross Correlation formula evaluation,	12
02	**Discrete Time System** 2.1 Introduction to Discrete Time System, Classification of DT Systems (Linear/Non Linear, Causal/Non Causal, Time Invariant/Time Variant Systems, Stable/ Unstable), BIBO Time Domain Stability Criteria. LTI system, Concept of Impulse Response and Step Response. 2.2 Concept of IIR System and FIR System, Output of IIR and FIR DT system using Time Domain Linear Convolution formula Method.	08
03	**Discrete Fourier Transform** 3.1 Introduction to DTFT, DFT, Relation between DFT and DTFT, Properties of DFT without mathematical proof (Scaling and Linearity, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parsevals' Energy Theorem). DFT computation using DFT properties. 3.2 Transfer function of DT System in frequency domain using DFT. Linear and Circular Convolution using DFT. Response of FIR system calculation in frequency domain using DFT.	08
04	**Fast Fourier Transform** 4.1 Radix-2 DIT-FFT algorithm, DIT-FFT Flowgraph for N=4, 6 & 8, Inverse	06

	FFT algorithm. Spectral Analysis using FFT, Comparison of complex and real, multiplication and additions of DFT and FFT.	
05	**DSP Algorithms** 5.1 Carls' Correlation Coefficient Algorithm, Fast Circular Convolution Algorithm, Fast Linear Convolution Algorithm, Linear FIR filtering using Fast Overlap Add Algorithm and Fast Overlap Save Algorithm,	08
06	**DSP Processors and Application of DSP** 6.1 Need for Special architecture of DSP processor, Difference between DSP processor & microprocessor, A general DSP processor TMS320C54XX series, Case study of Real Time DSP applications to Speech Signal Processing and Biomedical Signal Processing.	06

List of Experiments:

Implementation of programs must be either in C or C++ only. Application can be developed using open source simulation software such as Scilab. A List of compulsory eight experiments is given below. Additional experiments within the scope of the syllabus can be added.

1. Sampling and Reconstruction

Aim:

To study sampling and reconstruction of signal

Objective:

Develop a program to sample a continuous time signal and convert it to Discrete Time Signal.

Problem Definition:

1. Sample the input signal and display first 50 samples. Calculate data rate and bit rate.
2. Reconstruct the original signal and display the original and reconstructed signals.
3. Vary the sampling frequency and observe the change in the quality of reconstructed signal.

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2. To perform Discrete Correlation

Aim:

To study mathematical operation Correlation and measure degree of similarity between two signals

Objective:

1. Write a function to find correlation operation.
2. Calculate correlation of a DT signals and verify the results using mathematical formulation.
3. Measure the degree of similarity using Carl's Correlation Coefficient formula in time domain.

Input Specifications:

1. Length of first Signal L and signal values.
2. Length of second Signal M and signal values.

Problem Definition:

1. Find auto correlation of input signal. What is the significance of value of output signal value at n=0?.
2. Find auto correlation of delayed input signal.
3. Find cross correlation of input signal and delayed input signal,
4. Find cross correlation of input signal and scaled delayed input signal.
5. Compare the resultant signals. Give your conclusion.
6. Take two input finite length DT signals and develop a function to find Carl's Correlation Coefficient value. Determine the degree of similarity of two signals from the calculated Carl's Correlation Coefficient value.

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3. To perform Discrete Convolution

Aim:

The aim of this experiment is to study mathematical operation such as Linear convolution, Circular convolution, Linear convolution using circular convolution.

Objective:

1. Develop a function to find Linear Convolution and Circular Convolution
2. Calculate Linear Convolution, Circular Convolution, Linear Convolution using Circular Convolution and verify the results using mathematical formulation.
3. Conclude on aliasing effect in Circular convolution

Input Specifications:

1. Length of first Signal L and signal values.
2. Length of second Signal M and signal values.

Problem Definition:

1. Find Linear Convolution and Circular Convolution of L point sequence x[n] and M point sequence h[n].
2. Find Linear Convolution of L point sequence x[n] and M point sequence h[n] using Circular convolution.
3. Give your conclusion about No of values in linearly convolved signal, and Aliasing effect in Circular Convolution.

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4. To perform Discrete Fourier Transform

Aim:
The aim of this experiment is to study magnitude spectrum of the DT signal.

Objective:
1. Develop a function to perform DFT of N point signal
2. Calculate DFT of a DT signal and Plot spectrum of the signal.
3. Conclude the effect of zero padding on magnitude spectrum.
4. Calculate the number of real multiplications and real additions required to find DFT.

Input Specifications:
1. Length of Signal N
2. Signal values

Problem Definition:
1. Take any four-point sequence x[n].
- Find DFT X[k].
- Compute number of real multiplications and real additions required to find X[k].
- Plot Magnitude Spectrum of the signal.

2. Append the input sequence by four zeros. Find DFT and plot magnitude spectrum. Repeat the same by appending the sequence by eight zeros. Observe and compare the magnitude spectrum. Give your conclusion.

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5. To perform Fast Fourier Transform

Aim:
To implement computationally fast algorithms.

Objective:
1. Develop a program to perform FFT of N point signal.
2. Calculate FFT of a given DT signal and verify the results using mathematical formulation.
3. Illustrate the computational efficiency of FFT.

Input Specifications:
- Length of Signal N
- Signal values

Problem Definition:
Take any eight-point sequence x[n].

- Find FFT X[k].
- Write number of real multiplications and real additions involved in finding X[k].

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6. Filtering of long Data Sequence

Aim:

To perform filtering of Long Data Sequence using Overlap Add Method and Overlap Save Method.

Objective:

Develop a function to implement Fast Overlap Add and Fast Overlap Save Algorithm using FFT.

Input Specifications:

1. Length of long data sequence and signal values.
2. Length of impulse response M and coefficient values of h[n].

Problem Definition:

Find the output of a Discrete Time system using Fast Overlap Add Method OR Fast Overlap Save Method.

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7. Real Time Signal Processing

Aim:

To perform real time signal processing using TMS320 Processor.

Objective:

Study real time signal processing.

Input Specifications:

1. Real Time Speech Signal

Problem Definition:

1) Capture the real time audio signal.
2) Filter it by convolving input signal with the impulse response of FIR filter using Fast Overlap Add filtering Algorithm OR Fast Overlao Save Filtering Algorithm.
3) Observe the quality of output signal.

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8. Application of Digital Signal Processing

Aim:

To implement any Signal Processing operation on one dimensional signal.

Objective:
To develop application of signal processing.

Input Specifications:
One dimensional signal.

Rules:

1. Number of students in one Group : min - 2 max -3

2. Decide one DSP application of your choice. Collect the information related to the application from the published granted patents. Download the related published papers from the standard refereed journals and conferences.

3. Develop a block diagram of the proposed system and flowchart of proposed system algorithm, implement it using Scilab/C, C++ language and obtain the appropriate results.

4. Prepare the three to four pages report on the mini project in IEEE paper format. Report should include Abstract, Introduction, Related Theory, Proposed System Design/Algorithm, Experimentation & Result Analysis, Conclusion, and References.

5.

Term Work:

- Term work shall consist of minimum **<u>08</u>** assignments and course project.
- Journal must include at least 1 assignment on each module and two quiz.
- 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 (Theory+ Practical)……. (05) Marks

TOTAL: ……. (25) Marks.

Text Books :

1. Ashok Ambardar, 'Digital Signal Processing', Cengage Learning, 2007, ISBN : 978-81-315-0179-5.

2. Emmanuel C. Ifeachor, Barrie W. Jervis, “Digital Signal Processing: A Practical Approach”, Pearson Education ISBN 0-201-59619- 9

3. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, ‘Digital Signal Processing’ TataMcgraw Hill Publication First edition (2010). ISBN 978-0-07-066924-6.

4. Avtar Signh, S.Srinivasan,”Digital Signal Processing’, Thomson Brooks/Cole, ISBN : 981-243-254-4

Reference Books :

1. B. Venkatramani, M. Bhaskar ,”Digital Signal Processor’, TataMcGraw Hill, Second Edition, (2001). ISBN : 978-0-07-070256-1.

2. Sanjit Mitra, ‘Digital Signal Processing : A Computer Based Approach’ , TataMcGraw Hill, Third Edition

3. Dr, Shaila Apte, “Digital Signal Processing,”, Wiley India, Second Edition,2013 ISBN : 978-81-2652142-5

4. Proakis Manolakis, ‘Digital Signal Processing : Principles, Algorithms and Applications’ Fourth 2007, Pearson Education, ISBN 81-317-1000-9.

5. Monson H. Hayes, “Schaums Outline of Digital Signal Processing’ McGraw Hill International second edition. ISBN : 978-00-7163509-7

Course Code	Course/Subject Name	Credits
CPC702	**Cryptography and System Security**	5

Objectives:

1. To provide students with contemporary knowledge in Cryptography and Security.
2. To understand how crypto can be used as an effective tools in providing assurance concerning privacy and integrity of information.
3. To provide skills to design security protocols for recognize security problems.

Outcomes: Learner will be able to…

1. Understand the principles and practices of cryptographic techniques.
2. Understand a variety of generic security threats and vulnerabilities, and identify & analyze particular security problems for given application.
3. Appreciate the application of security techniques and technologies in solving real-life security problems in practical systems.
4. Apply appropriate security techniques to solve security problem
5. Design security protocols and methods to solve the specific security problems.
6. Familiar with current research issues and directions of security.

Module	Detailed Contents	Hrs
01	**Introduction** 1.1 Security Attacks, Security Goals, Computer criminals, Methods of defense, Security Services, Security Mechanisms	06
02	**Basics of Cryptography** 2.1 Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers.	06
03	**Secret Key Cryptography** 3.1 Data Encryption Standard(DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, International Data Encryption algorithm, Blowfish, CAST-128.	06
04	**Public Key Cryptography** 4.1 Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange	04
05	**Cryptographic Hash Functions** 5.1 Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Authentication Protocols, Digital Signature Standards.	06
06	**Authentication Applications** 6.1 Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME.	06

07	**7.1 Program Security** Secure programs, Nonmalicious Program Errors, Malicious Software – Types, Viruses, Virus Countermeasures, Worms, Targeted Malicious Code, Controls against Program Threats. **7.2 Operating System Security** Memory and Address protection, File Protection Mechanism, User Authentication. **7.3 Database Security** Security Requirement, Reliability and Integrity, Sensitive data, Inference, Multilevel Databases **7.4 IDS and Firewalls** Intruders, Intrusion Detection, Password Management, Firewalls-Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted systems.	08
08	**8.1 IP Security** Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange, Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment. **8.2 Non-cryptographic protocol Vulnerabilities** DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities-Phishing, Buffer Overflow, Format String Attacks, SQL Injection.	06

Term Work:

Term work should consist of at least 10experiments, 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.
The distribution of marks for term work shall be as follows:

- Laboratory work (experiments): ……..…….. (15) Marks.
- Assignment:……..…… (05) Marks.
- Attendance (Theory+ Practical)……. (05) Marks

TOTAL: ……. (25) Marks.

Practical/Oral examination:

Practical Exam will be based on above syllabus.

Syllabus for Practical

Suggested topics for experiment but not limited to:

1. RSA and MD5 algorithms.
2. Packet Analyzer.

3. IPSec
4. Spoofing
5. PGP(Pretty Good Privacy)
6. Port Scanning
7. Vulnerability scanner
8. Buffer Overflow
9. Intrusion Detection System
10. Password cracking
11. Firewall
12. SSL

Theory Examination:

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)

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

Text Books:

1. Cryptography and Network Security: Principles and Practice 5th edition, William Stallings, Pearson.
2. Network Security and Cryptography 2nd edition, Bernard Menezes, Cengage Learning.
3. Cryptography and Network, 2nd edition, Behrouz A Fourouzan, Debdeep Mukhopadhyay, TMH.

Reference Books:

1. Cryptography and Network Security by Behrouz A. Forouzan, TMH
2. Security in Computing by Charles P. Pfleeger, Pearson Education.
3. Computer Security Art and Science by Matt Bishop, Addison-Wesley.

Course Code	Course/Subject Name	Credits
CPC703	**Artificial Intelligence**	5

Objectives:

1. To conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2. To make students understand and Explore the mechanism of mind that enable intelligent thought and action.
3. To make students understand advanced representation formalism and search techniques.
4. To make students understand how to deal with uncertain and incomplete information.

Outcomes: Learner will be able to

1. Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
2. Ability to choose an appropriate problem solving method and knowledge representation technique.
3. Ability to analyze the strength and weaknesses of AI approaches to knowledge– intensive problem solving.
4. Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
5. Ability to design and develop the AI applications in real world scenario.

Module	Detailed Contents	Hrs
01	**Introduction to Artificial Intelligence** 1.1 Introduction , History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI.	04
02	**Intelligent Agents** 2.1 Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.	04
03	**Problem solving** 3.1 Solving problem by Searching : Problem Solving Agent, Formulating Problems, Example Problems. 3.2 Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS) , Depth Limited Search, Depth First Iterative Deepening(DFID), Informed Search Methods: Greedy best first Search ,A* Search , Memory bounded heuristic Search. 3.3 Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search,	14

	Genetic algorithms. 3.4 Adversarial Search: Games, Optimal strategies, The minimax algorithm , Alpha-Beta Pruning.	
04	**Knowledge and Reasoning** 4.1 Knowledge based Agents, The Wumpus World, The Propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining. 4.2 Knowledge Engineering in First-Order Logic, Unification, Resolution, Introduction to logic programming (PROLOG). 4.3 **Uncertain Knowledge and Reasoning:** Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Inference in belief network.	12
05	**Planning and Learning** 5.1The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning. 5.2 Learning: Forms of Learning, Inductive Learning, Learning Decision Tree. 5.3 Expert System: Introduction, Phases in building Expert Systems, ES Architecture, ES vs Traditional System.	10
06	**Applications** 6.1 Natural Language Processing(NLP), Expert Systems.	04

Term Work:

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

- Laboratory work (experiments/case studies): …….. (15) Marks.
- Assignment:……..…… (05) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

There will be at least two assignments covering the above syllabus.

Practical/Oral examination:

Practical examination based on the above syllabus will be conducted.

List of AI Practical / Experiments

All the programs should be implemented in C/C++/Java/Prolog under Windows or Linux environment. Experiments can also be conducted using available open source tools.

1. One case study on NLP/Expert system based papers published in IEEE/ACM/Springer or any prominent journal.

2. Program on uninformed and informed search methods.

3. Program on Local Search Algorithm.

4. Program on Optimization problem.

5. Program on adversarial search.

6. Program on Wumpus world.

7. Program on unification.

8. Program on Decision Tree.

Any other practical covering the syllabus topics and subtopics can be conducted.

Reference Books (Practicals):

1. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight "Artificial Intelligence "Third Edition
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. Han Kamber, “Data Mining Concepts and Techniques”, Morgann Kaufmann Publishers.

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach “Second Edition" Pearson Education.
2. Saroj Kaushik “Artificial Intelligence” , Cengage Learning.
3. George F Luger “Artificial Intelligence” Low Price Edition , Pearson Education., Fourth edition.

Reference Books:

1. Ivan Bratko “PROLOG Programming for Artificial Intelligence”, Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight “Artificial Intelligence” Third Edition
3. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989.
4. Hagan, Demuth, Beale, “Neural Network Design” CENGAGE Learning, India Edition.
5. Patrick Henry Winston , “Artificial Intelligence”, Addison-Wesley, Third Edition.
6. Han Kamber, “Data Mining Concepts and Techniques”, Morgann Kaufmann Publishers.
7. N.P.Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press.

Course Code	Course/Subject Name	Credits
CPE7021	**Advanced Algorithms**	5

Objectives:

1. To teach fundamentals of analysis of algorithm at depth
2. To provide in depth study of advanced data structures and its uses
3. To teach analysis of problems from different domains

Outcomes: Learner will be able to…

1. Identify and use suitable data structures for given problem from different domains
2. Appreciate the role of Graph algorithms in solving variety of problems
3. Appreciate the role of Optimization by using linear programing
4. Analyze the various algorithms from different domains

Module	Detailed Contents	Hrs
01	**Introduction** 1.1 Asymptotic notations Big O, Big Θ,Big Ω,o ,ω notations ,Proofs of master theorem, applying theorem to solve problems	03
02	**Advanced Data Structures** 2.1 Red-Black Trees: properties of red-black trees , Insertions , Deletions 2.2 B-Trees and its operations 2.3 Binomial Heaps: Binomial trees and binomial heaps, Operation on Binomial heaps	09
03	**Dynamic Programing** 3.1 matrix chain multiplication, cutting rod problem and its analysis	06
04	**Graph algorithms** 4.1 Bellman ford algorithm, Dijkstra algorithm, Johnson's All pair shortest path algorithm for sparse graphs	06
05	**Maximum Flow** 5.1 Flow networks , the ford Fulkerson method ,max bipartite matching , push Relabel Algorithm , The relabel to front algorithm	08
06	**Linear Programing** 6.1 Standard and slack forms, Formulating problems as linear programs, simplex algorithm, Duality, Initial basic feasible solution	08
07	**Computational Ggeometry** 7.1 Line Segment properties, Determining whether any pair of segment intersects, finding the convex hull, Finding the closest pair of points.	08

Term Work:

Term work should consist of at least 6 experiments, 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.

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

- Laboratory work (experiments): ……..…….. (15) Marks.
- Assignment:……..…… (05) Marks.
- Attendance (Theory+ Practical)……. (05) Marks

TOTAL: ……. (25) Marks.

Practical/Oral examination:

Oral examination based on above syllabus will be conducted

Syllabus for Practical

Suggested topics for experiment but not limited to:

1. Red – black trees and its various operations
2. Binomial Heaps and its various operations
3. Dynamic programing: matrix chain multiplication , cutting rod example
4. Bellman ford , Johnson's algorithm for sparse graphs
5. Ford Fulkerson algorithm , push relabel to front methods
6. Finding closest pair of points, Determining the convex hull
7. Implementation of Simplex algorithm

Text Books:

1. T.H. Coreman , C.E. Leiserson, R.L. Rivest, and C. Stein, "Introduction to algorithms",2nd edition , PHI publication 2005
2. Ellis Horowitz , Sartaj Sahni , S. Rajsekaran. "Fundamentals of computer algorithms" University press

Course Code	Course/Subject Name	Credits
CPE7023	**Image Processing**	5

Objectives:

1. To learn the fundamental concepts of Digital Image Processing and Video Processing .
2. To understand basic image enhancement and segmentation techniques.
3. To illustrate Image Transform calculations mathematically and develop fast transform algorithm
4. To learn Image Compression and Decompression Techniques

Outcomes: Learner will be able to…

1. Understand the concept of Digital Image and Video Image.
2. Explain image enhancement and Segmentation technique.
3. Develop fast image transform flowgraph
4. Solve Image compression and decompression techniques
5. Perform Binary Image Processing Operations

Module	Detailed Contents	Hrs.
01	**Digital Image and Video Fundamentals** 1.1 Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization, Representation of Digital Image, Connectivity, Image File Formats : BMP, TIFF and JPEG. Colour Models (RGB, HSI, YUV) Introduction to Digital Video, Chroma Sub-sampling, CCIR standards for Digital Video	06
02	**Image Enhancement** 2.1 Gray Level Transformations, Zero Memory Point Operations, Histogram Processing, Neighbourhood Processing, Spatial Filtering, Smoothing and Sharpening Filters. Homomorphic Filtering	09
03	**Image Segmentation and Representation** 3.1 Detection of Discontinuities, Edge Linking using Hough Transform, Thresholding, Region based Segmentation, Split and Merge Technique, Image Representation and Description, Chain Code, Polygonal Representation, Shape Number, Moments.	09
04	**Image Transform** 4.1 Introduction to Unitary Transform, Discrete Fourier Transform(DFT), Properties of DFT, Fast Fourier Transform(FFT), Discrete Hadamard Transform(DHT), Fast Hadamard Transform(FHT), Discrete Cosine Transform(DCT), Discrete Wavelet Transform(DWT),	09
05	**Image Compression** 5.1 Introduction, Redundancy, Fidelity Criteria, 5.2 Lossless Compression Techniques : Run Length Coding, Arithmetic Coding, Huffman Coding, Differential PCM,	09

	5.3 Lossy Compression Techniques: Improved Gray Scale Quantization, Vector Quantization, JPEG, MPEG-1.	
06	**Binary Image Processing** 6.1 Binary Morphological Operators, Hit-or-Miss Transformation, Boundary Extraction, Region Filling, Thinning and Thickening, Connected Component Labeling, Iterative Algorithm and Classical Algorithm	06

Term Work:

Term work should consist of at least 08 experiments.
Journal must include at least 1 assignment on each module and two quiz.
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 (Theory+ Practical)……. (05) Marks

TOTAL: ……. (25) Marks.

Practical/Oral examination:

Oral exam will be based on the above syllabus

Practicals

Implementation of programs must be either in C or C++ only. A List of experiments is given below. Input can be Monochrome OR Colour Image. Additional experiments within the scope of the syllabus can be added.

1. Image Enhancement [Any two techniques]
   (1) using Zero Memory Point Operations.
   (2) using Histogram Processing Technique
   (3) using Spatial Filtering [Smoothing Filters/ Sharpening Filters]
   (4) using Homomorphic Filtering

2. Image Segmentation [Any two techniques]
(1) Horizontal and Vertical Line Detection
(2) Edge Detection
(3) Split and Merge Technique
(4) Edge Linking using Hough Transform

3. Image Compression and De-compression [Any two techniques]
(1) Arithmetic Coding and Decoding
(2) Huffman Coding and Decoding
(3) IGS Quantization/ Vector Quantization based Compression and De-compression
(4) Transform based Image Compression and De-compression [FFT/ FHT/DCT/ DWT]

4. Binary Image Processing [Any two techniques]
   (1) Opening followed by Closing
   (2) Hit or Miss Transform
   (3) Thinning/Thickening/ Region Fillling / Boundary Extraction
   (4) Connected Component Algorithm

Text Books :

1. Rafel C. Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Asia, Third Edition, 2009,

2. S. Jayaraman, E.Esakkirajan and T.Veerkumar, "Digital Image Processing" TataMcGraw Hill Education Private Ltd, 2009,

3. Anil K. Jain, "Fundamentals and Digital Image Processing", Prentice Hall of India Private Ltd, Third Edition

4. S. Sridhar, "Digital Image Processing", Oxford University Press, Second Edition, 2012.

5. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison Wesley, 1993.

Reference Books:

1. Dwayne Phillps, "Image Processing in C", BPB Publication, 2006

2. B. Chandra and D.Dutta Majumder, "Digital Image Processing and Analysis", Prentice Hall of India Private Ltd, 2011

3. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", Prentice Hall of India Private Ltd, Third Edition

4. Fred Halshall, "Multimedia Communications: Applications, Networks Protocols and Standards,", Pearson Education 2001

5. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Pearson Education, Limited, 2011

Course Code	Course/Subject Name	Credits
CPE7024	**Software Architecture**	5

Outcomes:

Software architecture is foundational to the development of large, practical software-intensive applications.

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

- Visualize the architectural concepts in development of large, practical software-intensive applications.
- Rather than focusing on one method, notation, tool, or process, this new course widely surveys software architecture techniques, enabling us to choose the right tool for the job at hand.

Module	Detailed Contents	Hrs.
01	**Basic Concepts** 1.1 Concepts of Software Architecture 1.2 Models. 1.3 Processes. 1.4 Stakeholders	03
02	**Designing Architectures** 2.1 The Design Process. 2.2 Architectural Conception. 2.3 Refined Experience in Action: Styles and Architectural Patterns. 2.4 Architectural Conception in Absence of Experience.	02
03	**Connectors** 3.1 Connectors in Action: A Motivating Example. 3.2 Connector Foundations. 3.3 Connector Roles. 3.4 Connector Types and Their Variation Dimensions. 3.5 Example Connectors.	06
04	**Modeling** 4.1 Modeling Concepts. 4.2 Ambiguity, Accuracy, and Precision. 4.3 Complex Modeling: Mixed Content and Multiple Views. 4.4 Evaluating Modeling Techniques. 4.5 Specific Modeling Techniques.	04
05	**Analysis** 5.1 Analysis Goals. 5.2 Scope of Analysis. 5.3 Architectural Concern being Analyzed. 5.4 Level of Formality of Architectural Models.	08

	5.5 Type of Analysis. 5.6 Analysis Techniques.	
06	**Implementation and Deployment** 6.1 Concepts. 6.2 Existing Frameworks. 6.3 Software Architecture and Deployment. 6.4 Software Architecture and Mobility.	04
07	**Conventional Architectural styles** 7.1 Pipes and Filters 7.2 Event- based, Implicit Invocation 7.3 Layered systems 7.4 Repositories 7.5 Interpreters 7.6 Process control	05
08	**Applied Architectures and Styles** 8.1 Distributed and Networked Architectures. 8.2 Architectures for Network-Based Applications. 8.3 Decentralized Architectures. 8.4 Service-Oriented Architectures and Web Services.	08
09	**Designing for Non-Functional Properties** 9.1 Efficiency. 9.2 Complexity. 9.3 Scalability and Heterogeneity. 9.4 Adaptability. 9.5 Dependability.	04
10	**Domain-Specific Software Engineering** 10.1 Domain-Specific Software Engineering in a Nutshell. 10.2 Domain-Specific Software Architecture. 10.3 DSSAs, Product Lines, and Architectural Styles.	04

Term Work:

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

- Laboratory work (experiments):…….. (20) Marks.
- Attendence:……..…… (05) Marks.

TOTAL: ……. (25) Marks.

Practical/Oral examination:

An Oral examination is to be conducted based on the above syllabus

Topics For Experiment:

1. Modeling using xADL
2. Analysis - Case study
3. Visualization using xADL 2.0
4. Integrate software components using a middleware
5. Use middleware to implement connectors
6. Wrapper to connect two applications with different architectures
7. Creating web service
8. Architecture for any specific domain

Books:

Text Books:

1. "Software Architecture: Foundations, Theory, and Practice" by Richard N. Taylor, Nenad Medvidovic, Eric Dashofy, ISBN: 978-0-470-16774-8
2. M. Shaw: Software Architecture Perspectives on an Emerging Discipline, Prentice-Hall.
3. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, Pearson.

References:

1. "Pattern Oriented Software Architecture" by Frank Buchnan et al, Wiley India.
2. "The Art of Software Architecture" by Stephen T. Albin.

Course Code	Course/Subject Name	Credits
CPE7025	**Soft Computing**	5

Objectives:

1. To Conceptualize the working of human brain using ANN.
2. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
3. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
4. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.

Outcomes: Learner will be able to…

1. Ability to analyze and appreciate the applications which can use fuzzy logic.
2. Ability to design inference systems.
3. Ability to understand the difference between learning and programming and explore practical applications of Neural Networks (NN).
4. Ability to appreciate the importance of optimizations and its use in computer engineering fields and other domains.
5. Students would understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications.

Module	Detailed Contents	Hours
01	**Introduction to Soft Computing** 1.1 Soft computing Constituents, Characteristics of Neuro Computing and Soft Computing, Difference between Hard Computing and Soft Computing, Concepts of Learning and Adaptation.	**04**
02	**Neural Networks** **2.1 Basics of Neural Networks:** Introduction to Neural Networks, Biological Neural Networks, McCulloch Pitt model, **2.2 Supervised Learning algorithms:** Perceptron (Single Layer, Multi layer), Linear separability, Delta learning rule, Back Propagation algorithm, **2.3 Un-Supervised Learning algorithms:** Hebbian Learning, Winner take all, Self Organizing Maps, Learning Vector Quantization.	**14**

03	**Fuzzy Set Theory** 3.1 Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Properties of membership function, Fuzzy extension principle, Fuzzy Systems- fuzzification, defuzzification and fuzzy controllers.	**14**
04	**Hybrid system** 4.1 Introduction to Hybrid Systems, Adaptive Neuro Fuzzy Inference System(ANFIS).	**04**
05	**Introduction to Optimization Techniques** **5.1 Derivative based optimization**- Steepest Descent, Newton method. **5.2 Derivative free optimization**- Introduction to Evolutionary Concepts.	**06**
06	**Genetic Algorithms and its applications:** 6.1 Inheritance Operators, Cross over types, inversion and Deletion, Mutation Operator, Bit-wise Operators, Convergence of GA, Applications of GA.	**06**

Term Work:

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

- Laboratory work (experiments/case studies): …….. (15) Marks.
- Assignments:…….…… (05) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

Practical/Oral examination:

Oral examination will be based on the above syllabus.

PRACTICALS:

All the programs should be implemented in C/C++/Java/MATLAB under Windows or Linux environment. Experiments can also be conducted using available open source tools like OCTAVE and SCILAB

LIST OF SC PRACTICAL / EXPERIMENTS

1. One case study on Fuzzy/Neural/GA based papers published in IEEE/ACM/Springer or any prominent journal.

2. To implement Fuzzy Sets.

3. To implement Fuzzy Relations.
4. To implement Fuzzy Controllers.
5. To implement Basic Neural Network learning rules.
6. To implement any Supervised Learning algorithm.
7. To implement any Unsupervised Learning algorithm.
8. To implement a simple application using Genetic Algorithm.

Any other practical covering the syllabus topics and subtopics can be conducted.

Reference Books (for practicals) :

1. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
2. S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI Learning.
3. Hagan, Demuth, Beale,"Neural Network Design" CENGAGE Learning, India Edition.
4. Satish Kumar, “Neural Networks –A classroom approach”, Second Edition,TMH Publication.

Text Books:

1. Timothy J.Ross "Fuzzy Logic With Engineering Applications" Wiley.
2. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
3. S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI Learning.
4. J.-S.R.Jang "Neuro-Fuzzy and Soft Computing" PHI 2003.
5. Jacek.M.Zurada "Introduction to Artificial Neural Sytems" Jaico Publishing House.

Reference Books:

1. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill.
2. Zimmermann H.S "Fuzzy Set Theory and its Applications" Kluwer Academic Publishers.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. Hagan, Demuth, Beale, "Neural Network Design" CENGAGE Learning, India Edition.

Course Code	Course/Subject Name	Credits
CPE7026	**Enterprise Resource Planning and Supply Chain Management (ERP & SCM)**	5

Objectives:

1. To understand the technical aspects of ERP and SCM systems.
2. To understand the steps and activities in the ERP and SCM life cycle.
3. To identify and describe typical functionality in an ERP and SCM system.
4. To understand tools and methodology used for designing ERP and SCM for an Enterprise.

Outcomes: Learner will be able to…

1. To conceptualize the basic structure of ERP and SCM
2. To identify implementation strategy used for ERP and SCM.
3. To apply design principles for various business module in ERP and SCM.
4. To apply different emerging technologies for implementation of ERP and SCM.

Module	Detailed Contents	Hours
Enterprise Resource Planning		
01	**Introduction** 1.1 What is an Enterprize, Introduction to ERP, Need for ERP, Structure of ERP, Scope and Benefits, Typical business processes.	02
02	**ERP and Technology** 2.1 ERP and related technologies, Business Intelligence, E-business and E-commerce, Business Process Reengineering,	04
03	**ERP and Implementation** 3.1 ERP implementation and strategy, Implementation Life cycle, Pre-implementation task, requirement definition , implementation methodology.	06
04	**ERP Business Modules** 4.1 Modules: Finance, manufacturing, human resources, quality management, material management, marketing. Sales distribution and service.	08
05	**Extended ERP** 5.1 Enterprise application Integration (EAI), open source ERP, cloud ERP.	04
Supply Chain Management (SCM)		
06	**Introduction and strategic decisions in SCM**	08

	6.1 Introduction to SCM, Generic Types of supply chain, Major Drivers of Supply chain, Strategic decisions in SCM, Business Strategy, CRM strategy, SRM strategy, SCOR model.	
07	**Information Technology in SCM** 7.1 Types of IT Solutions like Electronic Data Inter change (EDI), Intranet/ Extranet, Data Mining/ Data Warehousing and Data Marts, E-Commerce, E- Procurement, Bar coding, RFID, QR code.	06
08	**Mathematical modelling for SCM** 8.1 Introduction, Considerations in modelling SCM systems, Structuring the logistics chain, overview of models: models on transportation problem, assignment problem, vehicle routing problem, Model for vendor analysis, Make versus buy model.	06
09	**Agile Supply Chain** 9.1 Introduction, Characteristics of Agile Supply Chain, Achieving Agility in Supply Chain.	02
10	**Cases of Supply Chain** 10.1 Cases of Supply Chain like, News Paper Supply Chain, Book Publishing, Mumbai Dabbawala, Disaster management, Organic Food, Fast Food.	02

Term Work:

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

- Mini project:…….…… (20) Marks.
- Attendance ……...……. (05) Marks

TOTAL: ……. (25) Marks.

Practical/Oral examination:

Oral examination will be based on the above syllabus.

The lab will be conducted on mini project which may be conducted on the following:

1) Simulating business processes of an Enterprise.
2) Designing a web portal for an Enterprise using E-business Models.
3) E-procurement model.
4) Open source ERP
5) Cloud ERP
6) Business process agility
7) SCM model.
8) Implementing Business Intelligence
9) Any other relevant topics covering the syllabus.

Text Books:

1. Enterprise Resource Planning : concepts & practices, by V.K. Garg & N.K. Venkatakrishnan ; PHI.
2. Supply Chain Management Theories & Practices: R. P. Mohanty, S. G. Deshmukh, - Dreamtech Press.
3. ERP Demystified: II Edition, by Alexis Leon,McGraw Hill .
4. Enterprise wide resource planning: Theory & practice: by Rahul Altekar,PHI.

Reference Books:

1. ERP to E^2 ERP: A Case study approach, by Sandeep Desai, Abhishek Srivastava, PHI.

2. Managerial Issues of ERP system, by David Olson, McGraw Hill.

Course Code	Course/Subject Name	Credits
CPE7022	**Computer Simulation and Modeling**	5

Course Objectives:

This course presents an introduction to discrete event simulation systems. Emphasis of the course will be on modeling and the use of simulation languages/software to solve real world problems in the manufacturing as well as services sectors. The course discusses the modeling techniques of entities, queues, resources and entity transfers in discrete event environment. The course will teach the students the necessary skills to formulate and build valid models, implement the model, perform simulation analysis of the system and analyze results properly. The "theory" of simulation involves probability and statistics, thus a good background in probability and statistics is a required prerequisite

Course Outcomes:

1. Apply simulation concepts to achieve in business, science, engineering, industry and services goals
2. Demonstrate formulation and modeling skills.
3. Perform a simulation using spreadsheets as well as simulation language/package
4. Generate pseudorandom numbers using the Linear Congruential Method
5. Evaluate the quality of a pseudorandom number generator using statistical tests
6. Analyze and fit the collected data to different distributions

Module	Detailed Contents	Hours
Computer Simulation and Modeling		
01	Introduction to Simulation. Simulation Examples. General Principles	15
02	Statistical Models in simulation. Queuing Models	08
03	Random Number Generation. Testing random numbers (Refer to Third edition) Random Variate Generation: Inverse transform technique, Direct Transformation for the Normal Distribution, Convolution Method, Acceptance-Rejection Technique (only Poisson Distribution).	09

04	Analysis of simulation data : Input Modeling ,Verification, Calibration and Validation of Simulation , Models , Estimation of absolute performance.	12
05	Application : Case study on 1. Processor and Memory simulation 2. Manufacturing & Material handling	04

Text Books:

Discrete Event System Simulation; Third Edition, Jerry Banks, John Carson, Barry Nelson, and David M. Nicol, Prentice-Hall

Discrete Event System Simulation; Fifth Edition, Jerry Banks, John Carson, Barry Nelson, and David M. Nicol, Prentice-Hall

References:

4. System Modeling & Analysis; Averill M Law, 4th Edition TMH.
5. Principles of Modeling and Simulation; Banks C M , Sokolowski J A; Wiley
6. System Simulation ; Geoffrey Gordon ; EEE
7. System Simulation with Digital Computer; Narsing Deo, PHI

Term work:

Laboratory work: 10 marks

Mini Simulation Project presentation: 10 marks

Attendance : 5 marks

Suggested Practical List (If Any):

Perform simulation exercises given in the text book (third edition) using spreadsheets and/or simulation language/package

5. Queue- single server, multi-server, classic case- dump truck
6. Inventory – Lead time=0, lead time fixed, lead time probabilistic
7. Reliability problem
8. Tutorials on statistical models
9. Random number generate and test
10. Goodness of fit test
11. Output analysis – Point estimate and Confidence Interval

Simulation: Real World Examples – can be in the field of business, transportation, medical, computing, manufacturing and material handling- Presentation to be taken.

Practical/Oral examination:

Oral examination will be based on the above syllabus.

Course Code	Course/Subject Name	Credits
CPL701	**Network threats and attacks Laboratory**	02

Outcomes: After completion of this Laboratory course learner will be able To

1. Use network-based tools for network analysis
2. Use techniques for Network scaning
3. Identify network vulnerability
4. Use tools to simulate intrusion detection system
5. To understand and install a firewall

Module	Detailed Contents
01	**1.1 Title:** Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars. **Objective:** Objective of this module to how to gather information about the networks by using different n/w reconnaissance tools. **Scope:** Network analysis using network based tools **Technology**: Networking
02	**2.1 Title:** Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. You should be able to use the tools to do the following 1. Observer performance in promiscuous as well as non-promiscous mode. 2. Show that packets can be traced based on different filters. **Objective:** Objective of this module is to observer the performanance in promiscuous & non-promiscous mode & to find the packets based on different filters. **Scope:** Packet grapping, message and protocol analysis **Technology:** Networking
03	**3.1 Title:** Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc. **Objective:** objective of this module to learn nmap installation & use this to scan different ports. **Scope:** used for ip spoofing and port scanning **Technology**: Networking

04	**4.1 Title:** Detect ARP spoofing using open source tool ARPWATCH. **Objective:** Objective of the module to find ARP spoofing using open source. **Scope**: Ip spoofing using arp packaging tool **Technology:** Networking
05	**5.1 Title:** Use the Nessus tool to scan the network for vulnerabilities. **Objective:** Objective of the module is scan system and network analysis. **Scope:** It used for system analysis, security and process analysis **Technology:** Networking
06	**6.1 Title:** Implement a code to simulate buffer overflow attack. **Objective:** Objective of the module Is to check buffer overflow in an NS2 environment **Scope:** It uses to analyse memory overflow attack **Technology**: Networking
07	**7.1 Title:** Set up IPSEC under LINUX **Objective:** Objective of the module for implementing security vulnerabilities **Scope:** to study different ipsec tools. **Technology**: Networking
08	**8.1 Title:** Install IDS (e.g. SNORT) and study the logs. **Objective:** Simulate intrusion detection system using tools such as snort **Scope:** It is used for intrusion detection system vulnerability scans **Technology:** Networking
09	**9.1 Title:** Use of iptables in linux to create firewalls. **Objective:** To study how to create and destroy firewall security parameters. **Scope:** system security and network security **Technology**: Networking
10	**10.1 Title:** Mini project **Objective:** To implement Networking concepts

	Scope: To understand Network & system tools **Technology:** Networking

Term Work:

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

- Lab Assignments:..... (10)
- Mini project:…….…… (10) Marks.
- Attendance ……...……. (05) Marks

TOTAL: ……. (25) Marks.

Oral examination:

Oral examination is to be conducted by pair of internal and external examiners based on above syllabus and the mini projects done.

References:

1. Network Security Assessment by Chris McNab, O'Reilly
2. Network Security Hacks, Andrew Lockhart, O'Reilly
3. The Web Application Hacker's Handbook 2nd Edition by Dafydd Stuttard & Marcus Pinto,Wiley Publication(2014).
4. Securing the Virtual Environment by Davi Ottenheimer & Matthew Wallace,Willey Publication(2012).

Course Code	Course/Subject Name	Credits
CPC801	**Data Warehousing and Mining**	5

Objectives:

1. To study the methodology of engineering legacy databases for data warehousing and data mining to derive business rules for decision support systems.
2. To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.

Outcomes: Learner will be able to…

1. Enable students to understand and implement classical algorithms in data mining and data warehousing; students will be able to assess the strengths and weaknesses of the algorithms, identify the application area of algorithms, and apply them.
2. Students would learn data mining techniques as well as methods in integrating and interpreting the data sets and improving effectiveness, efficiency and quality for data analysis.

Module	Detailed Contents	Hrs.
01	**Introduction to Data Warehousing** 1.1 The Need for Data Warehousing; Increasing Demand for Strategic Information; Inability of Past Decision Support System; Operational V/s Decisional Support System; Data Warehouse Defined; Benefits of Data Warehousing ;Features of a Data Warehouse; The Information Flow Mechanism; Role of Metadata; Classification of Metadata; Data Warehouse Architecture; Different Types of Architecture; Data Warehouse and Data Marts; Data Warehousing Design Strategies.	04
02	**Dimensional Modeling** 2.1 Data Warehouse Modeling Vs Operational Database Modeling; Dimensional Model Vs ER Model; Features of a Good Dimensional Model; The Star Schema; How Does a Query Execute? The Snowflake Schema; Fact Tables and Dimension Tables; The Factless Fact Table; Updates To Dimension Tables: Slowly Changing Dimensions, Type 1 Changes, Type 2 Changes, Type 3 Changes, Large Dimension Tables, Rapidly Changing or Large Slowly Changing Dimensions, Junk Dimensions, Keys in the Data Warehouse Schema, Primary Keys, Surrogate Keys & Foreign Keys; Aggregate Tables; Fact Constellation Schema or Families of Star.	06
03	**ETL Process** 3.1 Challenges in ETL Functions; Data Extraction; Identification of Data Sources; Extracting Data: Immediate Data Extraction, Deferred Data Extraction; Data Transformation: Tasks Involved in Data Transformation, Data Loading: Techniques of Data Loading, Loading the Fact Tables and Dimension Tables Data Quality; Issues in Data Cleansing.	06
04	**Online Analytical Processing (OLAP)**	04

	4.1 Need for Online Analytical Processing; OLTP V/s OLAP; OLAP and Multidimensional Analysis; Hypercubes; OLAP Operations in Multidimensional Data Model; OLAP Models: MOLAP, ROLAP, HOLAP, DOLAP;	
05	**Introduction to data mining** 5.1 What is Data Mining; Knowledge Discovery in Database (KDD), What can be Data to be Mined, Related Concept to Data Mining, Data Mining Technique, Application and Issues in Data Mining	02
06	**Data Exploration** 6.1 Types of Attributes; Statistical Description of Data; Data Visualization; Measuring similarity and dissimilarity.	02
07	**Data Preprocessing** 7.1 Why Preprocessing? Data Cleaning; Data Integration; Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation.	04
08	**Classification** 8.1 Basic Concepts; **Classification methods:** 1. Decision Tree Induction: Attribute Selection Measures, Tree pruning. 2. Bayesian Classification: Naïve Bayes' Classifier. **8.2 Prediction**: Structure of regression models; Simple linear regression, Multiple linear regression. **8.3 Model Evaluation & Selection: A**ccuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap; Comparing Classifier performance using ROC Curves. **8.4 Combining Classifiers**: Bagging, Boosting, Random Forests.	06
09	**Clustering** 9.1 What is clustering? Types of data, Partitioning Methods (K-Means, K-Medoids) Hierarchical Methods(Agglomerative , Divisive, BRICH), Density-Based Methods (DBSCAN, OPTICS)	06
10	**Mining Frequent Pattern and Association Rule** 10.1 Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rules; Frequent Pattern Mining, Efficient and Scalable Frequent Itemset Mining Methods, The Apriori Algorithm for finding Frequent Itemsets Using Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, A pattern growth approach for mining Frequent Itemsets; Mining Frequent itemsets using vertical data formats; Mining closed and maximal patterns; Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules; From Association Mining to Correlation Analysis, Pattern Evaluation Measures; Introduction to Constraint-Based Association Mining.	08

Term Work:

Term work should consist of at least of the following:

1. One case study given to a group of 3 /4 students of a data mart/ data warehouse.
    a. Write Detail Statement Problem and creation of dimensional modeling (creation star and snowflake schema)
    b. Implementation of all dimension table and fact table
    c. Implementation of OLAP operations.

2. Implementation of classifier like Decision tree, Naïve Bayes, Random Forest using any languages like Java

3. Use WEKA to implement like Decision tree, Naïve Bayes, Random Forest

4. Implementation of clustering algorithm like K-means, K- Medoids, Agglomerative, Divisive using languages any like Java, C# , etc.

5. Use WEKA to implement the following Clustering Algorithms – K-means, Agglomerative, Divisive.

6. Implementation Association Mining like Apriori, FPM using languages like Java, C#, etc.

7. Use WEKA to implement Association Mining like Apriori, FPM.

8. Use R tool to implement Clustering/Association Rule/ Classification Algorithms.

9. Detailed study of any one BI tool like Oracle BI, SPSS, Clementine, and XLMiner etc. (paper Assignment)

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project

Practical/Oral examination:

An oral exam will be held based on the above syllabus

Text Books:

1) Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3nd Edition

2) Paulraj Ponniah, “Data Warehousing: Fundamentals for IT Professionals”, Wiley India
3) Reema Theraja “Data warehousing”, Oxford University Press.
4) M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education

Reference Books:

1) Randall Matignon, "Data Mining using SAS enterprise miner ", Wiley Student edition.
2) Alex Berson , S. J. Smith, “Data Warehousing, Data Mining & OLAP” , McGraw Hill.
3) Vikram Pudi & Radha Krishna, “Data Mining”, Oxford Higher Education.
4) Daniel Larose, “Data Mining Methods and Models”, Wiley India.

Course Code	Course/Subject Name	Credits
CPC802	**Human Machine Interaction**	5

Objectives:

1. To stress the importance of a good interface design.
2. To understand the importance of human psychology in designing good interfaces.
3. To motivate students to apply HMI in their day – to – day activities.
4. To bring out the creativity in each student – build innovative applications that are user friendly.
5. To encourage students to indulge into research in Machine Interface Design.

Outcomes: Learner will be able to…

1. To design user centric interfaces.
2. To design innovative and user friendly interfaces.
3. To apply HMI in their day-to-day activities.
4. To criticise existing interface designs, and improve them.
5. To Design application for social and technical task.

Module	Detailed Contents	Hrs.
01	**Introduction** 1.1 Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields. 1.2 The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error;	10
02	**Understanding goal directed design** 2.1 Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels; Understanding users; Modeling users – personas and goals.	08
03	**GUI** 3.1 benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; General design principles.	08
04	**Design guidelines** 4.1 perception, Gesalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.	08
05	**Interaction styles** 5.1 menus; windows; device based controls, screen based controls;.	06
06	**Communication** 6.1 text messages; feedback and guidance; graphics, icons and images; colours.	08

Term Work:

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

- Laboratory work (experiments/case studies): …….. (15) Marks.
- Assignment:…..…… (05) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project

Practical/Oral examination:

Oral examination will be based on the above syllabus.

Laboratory:

Students are free to choose any tool that they feel appropriate for a given experiment. Each experiment will involve research about a certain category of people, and then developing an appropriate interface.

Students are expected to perform at least eight experiments from the given list.

LIST OF HMI PRACTICAL / EXPERIMENTS

1. Know your client –

   a. Children (4-5 years of age): An application to teach math.

   b. Teenagers: Design a digital diary for young teens to help them overcome various social pressures they deal with during their teen years. The diary should also be like a self help tool which would help them deal with incidents like bullying, peer pressure, etc.. This is an open project and you can think in any direction to make the children sail through their teen years while trying to discover life around them.

   c. Older generation: Folks from the older generation has been very wary of using their credit card on the Internet. They have various concerns when it comes to paying their bills. Also because of their old age, it will be beneficial for them to use the internet and pay their phone, electricity, gas, etc. bills

   d. Rural people: ATVM for train ticketing in rural area

2. Understand the trouble of interacting with machines - Redesign interfaces of home appliances like microwave oven, land-line phone, fully automatic washing machine.

3. Learn HCI design principles – heuristic evaluation: Identify 5 different websites catering to one specific goal (eg. Goal – on-line shopping and 5 different websites – ebay, amazon, flipkart, zovi, myntra) and perform a competitive analysis on them to understand how each one caters to the goal, the interactions and flow of the payment system and prepare a report on the same..

4. Learn the importance of menus and navigation – website redesign: News websites like CNN are always cluttered with information. It takes the user a few minutes to find his way through and maybe more minutes to look for some specific information. Redesign the news websites to make it look less cluttered, provide relevant information (a person sitting in Russia should not get US news as top news), intelligently dig information that he might be interested in based on his searches on the web.

5. Learn the importance of connecting humans – service design : How often have you found yourself waiting at the airport for a flight that is delayed or you've missed it and the next one is 4 hours from now, or waiting for a connecting flight? Design an experience for passengers to deal with the long waiting hours.

6. Learn the use of statistical graphics – expense tracker: Matt is a young engineer who just finished his summer internship at a leading Software Company in the United States. He has never been independent in handling his own finances and after this internship his father has asked him to start managing his money on his own. He is looking for a tool/app/software that would help him budget his finances, create goals and track them, categorize and track his credit card spending and also get insights on the various types of categories he's spending on. Design a tool/app/software that would help Matt manage his personal finances given the above requirement.

7. Learn the importance of graphics – way finding: Design a map for someone who is new to the city/town/village and is trying to understand how to commute from one place to another (inspired by New York Subway Maps, London Subway Maps)

8. Icon designing: Choose a unique domain, design a few icons and show how it can be accommodated on an interface.

9. Understand the need of colors and animation – web site for an artist: A celebrity in some form of art like music, dance, painting, martial arts, etc (not actors). This site will be used to display his works and should portray his character.

10. Understand the various input methods available for interaction – concept generation: Study the various technologies for typing – standard keyboards QWERTY, T9 (predictive text), multi-touch (SYWPE, etc.), gestures and brainstorm on the various ways in which you could improve one of the existing technologies. You could choose any of the different input types.

11. Any other new relevant topics covering the above syllabus.

Text Books:

1. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale “Human Computer Interaction”, Prentice Hall.
2. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication.
4. Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.
5. Donald A. Normann, “Design of everyday things”, Basic Books; Reprint edition 2002.

Reference Books:

1. Donald A. Norman, “The design of everyday things”, Basic books.
2. Rogers Sharp Preece, “Interaction Design:Beyond Human Computer Interaction”, Wiley.
3. Guy A. Boy “The Handbook of Human Machine Interaction”, Ashgate publishing Ltd.

Course Code	Course/Subject Name	Credits
CPC803	**Parallel and Distributed Systems**	5

Objectives:

1. To provide students with contemporary knowledge in parallel and distributed systems
2. To equip students with skills to analyze and design parallel and distributed applications.
3. To provide master skills to measure the performance of parallel and distributed algorithms

Outcomes: Learner will be able to…

1. Apply the principles and concept in analyzing and designing the parallel and distributed system
2. Reason about ways to parallelize problems.
3. Gain an appreciation on the challenges and opportunities faced by parallel and distributed systems.
4. Understand the middleware technologies that support distributed applications such as RPC, RMI and object based middleware.
5. Improve the performance and reliability of distributed and parallel programs.

Module	Detailed Contents	Hrs.
01	**Introduction** 1.1 Parallel Computing, Parallel Architecture, Architectural Classification Scheme, Performance of Parallel Computers, Performance Metrics for Processors, Parallel Programming Models, Parallel Algorithms.	06
02	**Pipeline Processing** 2.1 Introduction, Pipeline Performance, Arithmetic Pipelines, Pipelined Instruction Processing, Pipeline Stage Design, Hazards, Dynamic Instruction Scheduling,	06
03	**Synchronous Parallel Processing** 3.1 Introduction, Example-SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, Data Mapping and memory in array processors, Case studies of SIMD parallel Processors	06
04	**Introduction to Distributed Systems** 4.1 Definition, Issues, Goals, Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept, Models of Middleware, Services offered by middleware, Client Server model.	06
05	**Communication** 5.1 Layered Protocols, Remote Procedure Call, Remote Object Invocation, Message Oriented Communication, Stream Oriented Communication	04
06	**Resource and Process Management** 6.1 Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration	06
07	**Synchronization**	08

	7.1 Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure, Non Token based Algorithms: Lamport Algorithm, Ricart–Agrawala's Algorithm, Maekawa's Algorithm 7.2 Token Based Algorithms: Suzuki-Kasami's Broardcast Algorithms, Singhal's Heurastic Algorithm, Raymond's Tree based Algorithm, Comparative Performance Analysis.	
08	**Consistency and Replication** 8.1 Introduction, Data-Centric and Client-Centric Consistency Models, Replica Management. **Distributed File Systems** 8.2 Introduction, good features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Network File System(NFS), Andrew File System(AFS), Hadoop Distributed File System and Map Reduce.	06

Term Work:

Term work should consist of at least 10 experiments, 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.

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

- Laboratory work (experiments): …….. (15) Marks.
- Assignments: …… (05) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project

Practical/Oral examination:

Oral Examination will be based on above syllabus

Syllabus for Practical

Suggested topics for experiment but not limited to:

1. Load Balancing Algorithm.
2. Scalability in Distributed Environment
3. Client/server using RPC/RMI.
4. Inter-process communication
5. Election Algorithm.
6. Distributed Deadlock.
7. Name Resolution protocol.
8. Clock Synchronization algorithms.
9. Mutual Exclusion Algorithm.
10. Group Communication.
11. CORBA architecture.
12. Parallel Algorithms.
13. Message Passing Interface.

Text Books

1. M.R. Bhujade, “Parallel Computing”, 2nd edition, New Age International Publishers 2009.
2. Andrew S. Tanenbaum and Maarten Van Steen, “Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education, Inc., 2007, ISBN: 0-13-239227-5.

Reference Books

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems: Concepts and Design” (4th Edition), Addison Wesley/Pearson Education.
2. Pradeep K Sinha, “Distributed Operating Systems : Concepts and design”, IEEE computer society press

Course Code	Course/Subject Name	Credits
CPE8031	**Elective-III Machine Learning**	5

Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with support vector machine and Dimensionality reduction Techniques.

Outcomes: Learner will be able to…

1. Ability to analyze and appreciate the applications which can use Machine Learning Techniques.
2. Ability to understand regression, classification, clustering methods.
3. Ability to understand the difference between supervised and unsupervised learning methods.
4. Ability to appreciate Dimensionality reduction techniques.
5. Students would understand the working of Reinforcement learning.

Module	Detailed Contents	Hrs.
01	**Introduction to Machine Learning** 1.1 What is Machine Learning?, Key Terminology, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, How to choose the right algorithm, Steps in developing a Machine Learning Application.	06
02	**Learning with Regression** 2.1 Linear Regression, Logistic Regression.	04
03	**Learning with trees** 3.1 Using Decision Trees, Constructing Decision Trees, Classification and Regression Trees (CART).	08
04	**Support Vector Machines(SVM)** 4.1 Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions.	06
05	**Learning with Classification** 5.1 Rule based classification, classification by backpropoagation, Bayesian Belief networks, Hidden Markov Models.	06
06	**Dimensionality Reduction** 6.1 Dimensionality Reduction Techniques, Principal Component Analysis, Independent Component Analysis.	06
07	**Learning with Clustering** 7.1 K-means clustering, Hierarchical clustering, Expectation Maximization	06

	Algorithm, Supervised learning after clustering, Radial Basis functions.	
08	**Reinforcement Learning** 8.1 Introduction, Elements of Reinforcement Learning, Model based learning, Temporal Difference Learning, Generalization, Partially Observable States.	06

Term Work:

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

- Laboratory work (experiments): ……..…….. (15) Marks.
- Assignments:……..…… (05) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project

Practical/Oral examination:

Oral examination will be based on the above syllabus.

LIST OF ML PRACTICAL / EXPERIMENTS

1. To implement Linear Regression

2. To implement Logistic Regression

3. To implement ID3.

4. To implement Support Vector Machine.

5. To implement Bayesian Classification.

6. To implement K-Nearest Neighbour.

7. To implement k-means Clustering.

8. To implement Agglomerative Clustering.

Any other practical covering the syllabus topics and subtopics can be conducted.

Text Books:

1. Peter Harrington “Machine Learning In Action”, DreamTech Press
2. Ethem Alpaydın, “Introduction to Machine Learning”, MIT Press
3. Tom M.Mitchell “Machine Learning” McGraw Hill
4. Stephen Marsland, “Machine Learning An Algorithmic Perspective” CRC Press

Reference Books:

1. William W.Hsieh, “Machine Learning Mehods in the Environmental Sciences”, Cambridge
2. Han Kamber, “Data Mining Concepts and Techniques”, Morgann Kaufmann Publishers
3. Margaret.H.Dunham, “Data Mining Introductory and Advanced Topics”, Pearson Education

Course Code	Course/Subject Name	Credits
CPE8032	**Elective-III Embedded Systems**	5

Objectives:

1. Develop, among students, an understanding of the technologies behind the embedded computing systems; and to differentiate between such technologies.
2. Make aware of the capabilities and limitations of the various hardware or software components.
3. Evaluate design tradeoffs between different technology choices.
4. Complete or partial design of such embedded systems

Outcomes: Learner will be able to…

1. Describe the special requirements that are imposed on embedded systems
2. Describe the key properties of microprocessor and digital signal processor
3. Sketch a design of an embedded system around a microprocessor or DSP
4. Explain how microprocessor, memory, peripheral components and buses interact in an embedded system
5. Evaluate how architectural and implementation decisions influence performance and power dissipation
6. Produce efficient code for embedded systems
7. Point out the role of the compiler in the embedded system design process
8. Define the properties of a real-time operating system
9. Estimate the requirement for additional hardware for optimized performance
10. Understand and distinguish between the RISC and the Advanced RISC architecture
11. Utilize embedded systems to perform operations such as signal processing in real time
12. Develop drivers for external peripheral devices as per requirement.

Module	Detailed Contents	Hrs.
01	**Introduction to computational technologies** 1.1 Review of computation technologies (ARM, RISC, CISC, PLD, SOC), architecture, event managers, hardware multipliers, pipelining. Hardware/Software co-design. Embedded systems architecture and design process.	08
02	**Program Design and Analysis** 2.1 Integrated Development Environment (IDE), assembler, linking and loading. Program-level performance analysis and optimization, energy and power analysis and program size optimization, program validation and testing. Embedded Linux, kernel architecture, GNU cross platform tool chain. Programming with Linux environment.	08
03	**Process Models and Product development life cycle management** 3.1 State machine models: finite-state machines (FSM), finite-state machines with data-path model (FSMD), hierarchical/concurrent state machine	08

	model (HCFSM), program-state machine model (PSM), concurrent process model. Unified Modeling Language (UML), applications of UML in embedded systems. IP-cores, design process model. Hardware software co-design, embedded product development life cycle management.	
04	**High Performance 32-bit RISC Architecture** 4.1 ARM processor family, ARM architecture, instruction set, addressing modes, operating modes, interrupt structure, and internal peripherals. ARM coprocessors, ARM Cortex-M3.	08
05	**Processes and Operating Systems** 5.1 Introduction to Embedded Operating System, multiple tasks and multiple processes. Multi rate systems, preemptive real-time operating systems, priority-based scheduling, inter-process communication mechanisms. Operating system performance and optimization strategies. Examples of real-time operating systems.	08
06	**Real-time Digital Signal Processing (DSP)** 6.1 Introduction to Real-time simulation, numerical solution of the mathematical model of physical system. DSP on ARM, SIMD techniques. Correlation, Convolution, DFT, FIR filter and IIR Filter implementation on ARM. Open Multimedia Applications Platform (OMAP)	08

Term Work:

Term work should consist of at least 10 practicals and one mini project. Objective type term work test shall be conducted with a weightage of 10 marks.

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

- Laboratory work (experiments/projects): …….…….. (10) Marks.
- Mini project: …… (10) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

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

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project

Practical/Oral examination:

Oral examination will be based on the above syllabus.

List of Experiments:

Topic-1: Troubleshooting Tools [Any One]

In-Circuit Emulator (ICE) and In-Circuit Debugger (ICD), Logic Analyzer, Spectrum Analyzer, Pattern generator and Digital Storage Oscilloscope.

Topic -2: ARM Processors & Interfaces [Any Four]

LEDs and Keyboard Interface, LCD Interface, Counting external events with on chip counters, Real Time Clock (RTC), Pulse Width Modulation (PWM), Relay and Buzzer Control for alarm events, Stepper Motor Control , On chip ADC/DAC SPI / I2C / UART Interface, Bluetooth/Zig-bee interface.

Topic-3: Real-time Signal Processing ARM-DSP [Any Two]

Real-time physical model simulation, Correlation, convolution, DFT, FIR or IIR design, Real-time DAS and GUI using PC and ARM, Design with Programmable Logic Devices (CPLD/FPGA).

Topic-4: Device Driver Development [Any One]

Drivers for CAN, Drivers for USB, Drivers for Ethernet, SVGA, Drivers for Graphics TFT LCD.

Topic-5: Real Time Operating System (RTOS) [Any Two]

RTLinux , MicroC/OS_II, VxWorks, WIN CE, QNX, Palm OS, Symbian OS, Android OS or equivalent OS.

Text Books:

1. Embedded Systems an Integrated Approach – Lyla B Das, Pearson
2. Computers as Components – Marilyn Wolf, Third Edition Elsevier
3. Embedded Systems Design: A Unified Hardware/Software Introduction – Frank Vahid and Tony Givargis, John Wiley & Sons
4. An Embedded Software Primer – David E. Simon – Pearson Education Sough Asia
5. ARM System Developer's Guide Designing and Optimizing System Software – Andrew N. Sloss, Dominic Sysmes and Chris Wright – Elsevier Inc.

Reference Books:

1. Embedded Systems, Architecture, Programming and Design – Raj Kamal – Tata McGraw Hill
2. Embedded Linux – Hollabaugh, Pearson Education

3. Embedded Realtime Systems Programming – Sriram V Iyer, Pankaj Gupta – Tata McGRaw Hill.
4. Fundamentals of Microcontrollers and Applications in Embedded Systems – Ramesh Gaonkar – Penram International Publishing (India) Pvt. Ltd.
5. Embedded / Real-Time Systems: Concepts, Design & Programming – Dr. K. V. K. K. Prasad – Dreamtech Press, India.

Course Code	Course/Subject Name	Credits
CPE8033	**Elective-III Adhoc Wireless Networks**	5

Objectives:

1. To Identify the major issues associated with ad-hoc networks
2. To identify the requirements for protocols for wireless ad-hoc networks as compared to the protocols existing for wired network.
3. To explore current ad-hoc technologies by researching key areas such as algorithms, protocols, hardware, and applications.
4. To Provide hands-on experience through real-world programming projects
5. To provide advanced in –depth networking materials to graduate students in networking research.

Outcomes: Learner will be able to…

1. Define characteristics and features of Adhoc Networks
2. Appreciate the designing of MAC protocol for Adhoc networks
3. Implement few protocols
4. Apply security principles for routing

Module	Detailed Contents	Hrs.
01	**Introduction** 1.1 Introduction to wireless Networks. Characteristics of Wireless channel, Issues in Ad hoc wireless networks, Adhoc Mobility Models:- Indoor and outdoor models. 1.2 Adhoc Networks: Introduction to adhoc networks – definition, characteristics features, applications.	04
02	**MAC Layer** 2.1 MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals and Classification of a MAC protocol, Contention based protocols with reservation mechanisms. 2.2 Scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15, 802.16, HIPERLAN.	10
03	**Network Layer** 3.1 Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table driven routing protocol, On-demand routing protocol. 3.2 Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.	10
04	**Transport Layer** 4.1 Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless	07

	Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.	
05	**Security** 5.1 Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.	07
06	**QoS** 6.1 Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.	07

Term Work:

- Term work should consist of at least 12 experiments.
- Journal must include at least 2 assignments.
- The final certification and acceptance of term work indicates that performance in laboratory work is satisfactory and minimum passing marks may be given 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.

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project

Practical/Oral examination:

oral examination based on above syllabus will be conducted

Suggested Practicals for Adhoc Wireless

1. Installation of NS2 in Ubuntu 12.04 Linux.
2. Build and exchange data in simple infrastructure and Adhoc network by using personal computer and Android based mobile.
3. Develop sample wireless network in which

   a. implement AODV and AOMDV protocol

b. Calculate the time to receive reply from the receiver using NS2.
c. Generate graphs which show the transmission time for packet.

4. Implement wireless network. Capture data frame and identify fields using NS2.
5. Configure Wireless Access Point (WAP) and build different networks.
6. Implement Mobile device as a wireless access point.
7. Communicate between two different networks which has following specifications:
   a. One network has Class A network with “Tora protocol”
   b. Second has Class B network “AODV protocol”

Practical exam will be based on the above syllabus.

Text Books:

1. Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and protocols”, 2nd edition, Pearson Education, 2007
2. Charles E. Perkins, “Adhoc Networking”, Addison – Wesley, 2000
3. C. K. Toh,”Adhoc Mobile Wireless Networks”, Pearson Education, 2002

Reference Books:

1. Matthew Gast, “802.11 Wireless Networks: The Definitive Guide”, 2nd Edition, O'Reilly Media, April 2005.
2. Stefano Basagni, Marco Conti, Silvia Giordan and Ivan Stojmenovic, “Mobile Adhoc Networking”, Wiley-IEEE Press, 2004.
3. Mohammad Ilyas, “The handbook of Adhoc Wireless Networks”, CRC Press, 2002

Course Code	Course/Subject Name	Credits
CPE8034	**Elective-III Digital Forensics**	5

Objectives:

1. To focus on the procedures for identification, preservation, and extraction of electronic evidence, auditing and investigation of network and host system intrusions, analysis and documentation of information gathered, and preparation of expert testimonial evidence.
2. To provide hands on experience on various forensic tools and resources for system administrators and information system security officers.

Module	Detailed Contents	Hrs.
01	**Introduction:** 1.1 Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident.	09
02	**Initial Response and forensic duplication** 2.1 Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system - Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. 2.2 Duplicate/Qualified Forensic Duplicate of a Hard Drive.	08
03	**Preserving and Recovering Digital Evidence** 3.1 File Systems: FAT, NTFS - Forensic Analysis of File Systems - Storage Fundamentals: Storage Layer, Hard Drives Evidence Handling: Types of Evidence, Challenges in evidence handling, Overview of evidence handling procedure.	09
04	**Network Forensics** 4.1 Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing- Internet Fraud.	07
05	**System investigation** 5.1 Data Analysis Techniques - Investigating Live Systems (Windows & Unix) Investigating 5.2 Hacker Tools - Ethical Issues – Cybercrime.	08
06	**Bodies of law** 6.1 Constitutional law, Criminal law, Civil law, Administrative regulations, Levels of law: Local laws, State laws, Federal laws, International laws , Levels of culpability: Intent, Knowledge, Recklessness, Negligence Level and burden of proof : Criminal versus civil cases ,Vicarious liability, Laws related to computers: CFAA, DMCA, CAN Spam, etc.	07

Term Work:

- Term work should consist of at least 12 experiments.
- Journal must include at least 2 assignments.
- The final certification and acceptance of term work indicates that performance in laboratory work is satisfactory and minimum passing marks may be given 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.

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project.

Practical/Oral examination:

Oral exam will be based on the above syllabus.

Text Books:

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGrawHill, 2006
2. Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001

References:

1. Skoudis. E., Perlman. R. Counter Hack: A Step-by-Step Guide to Computer Attacks and Effective Defenses.Prentice Hall Professional Technical Reference. 2001
2. Norbert Zaenglein, "Disk Detective: Secret You Must Know to Recover Information From a Computer", Paladin Press, 2000
3. Bill Nelson, Amelia Philips and Christopher Steuart, “Guide to computer forensics investigation “Course technology, 4th edition

Course Code	Course/Subject Name	Credits
CPE8035	**Elective III - Big Data Analytics**	5

Objectives:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.
3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Outcomes: Learner will be able to…

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Module	Detailed Contents	Hrs.
01	**Introduction to Big Data** 1.1 Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.	03
02	**Introduction to Hadoop** 2.1 What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Physical Architecture; Hadoop limitations.	03
03	**NoSQL** 3.1 What is NoSQL? NoSQL business drivers; NoSQL case studies; 3.2 NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns; 3.3 Using NoSQL to manage big data: What is a big data NoSQL solution? Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; Four ways that NoSQL systems handle big data problems	04
04	**MapReduce and the New Software Stack** **4.1 Distributed File Systems :** Physical Organization of Compute Nodes, Large-Scale File-System Organization. **4.2 MapReduce:** The Map Tasks, Grouping by Key, The Reduce Tasks,	06

	Combiners, Details of MapReduce Execution, Coping With Node Failures. **4.3 Algorithms Using MapReduce**: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step.	
05	**Finding Similar Items** 5.1 Applications of Near-Neighbor Search, Jaccard Similarity of Sets, Similarity of Documents, Collaborative Filtering as a Similar-Sets Problem . 5.2 **Distance Measures:** Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance.	03
06	**Mining Data Streams** **6.1 The Stream Data Model**: A Data-Stream-Management System, Examples of Stream Sources, Stream Querie, Issues in Stream Processing. **6.2 Sampling Data in a Stream** : Obtaining a Representative Sample , The General Sampling Problem, Varying the Sample Size. **6.3 Filtering Streams**: The Bloom Filter, Analysis. **6.4 Counting Distinct Elements in a Stream** The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . **6.5 Counting Ones in a Window**: The Cost of Exact Counts, The Datar-Gionis-Indyk-Motwani Algorithm, Query Answering in the DGIM Algorithm, Decaying Windows.	06
07	**Link Analysis** 7.1 PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Use of Combiners to Consolidate the Result Vector. 7.2 Topic sensitive Page Rank, link Spam, Hubs and Authorities.	05
08	**Frequent Itemsets** **8.1 Handling Larger Datasets in Main Memory** Algorithm of Park, Chen, and Yu, The Multistage Algorithm, The Multihash Algorithm. **8.2 The SON Algorithm and MapReduce** **8.3 Counting Frequent Items in a Stream** Sampling Methods for Streams, Frequent Itemsets in Decaying Windows	05
09	**Clustering** 9.1 CURE Algorithm, Stream-Computing , A Stream-Clustering Algorithm, Initializing & Merging Buckets, Answering Queries	05

10	**Recommendation Systems** 10.1 A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering.	04
11	**Mining Social-Network Graphs** 11.1 Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, SimRank, Counting triangles using Map-Reduce	04

Term Work:

Assign a case study for group of 2/3 students and each group to perform the following experiments on their case-study; Each group should perform the exercises on a large dataset created by them.

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

- Programming Exercises: ……..….. (10) Marks.
- Mini project: …… (10) Marks.
- Attendance ……. (05) Marks

TOTAL: ……. (25) Marks.

Internal Assessment:

Internal Assessment consists of two tests. Test 1, an Institution level central test, is for 20 marks and is to be based on a minimum of 40% of the syllabus. Test 2 is also for 20 marks and is to be based on the remaining syllabus. Test 2 may be either a class test or assignment on live problems or course project.

Practical/Oral examination:

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

Suggested Practical List: Students will perform at least 8 programming exercises and implement one mini-project. The students can work in groups of 2/3.

1. Study of Hadoop ecosystem
2. programming exercises on Hadoop
3. programming exercises in No SQL
4. Implementing simple algorithms in Map- Reduce (3) - Matrix multiplication, Aggregates, joins, sorting, searching etc.
5. Implementing any one Frequent Itemset algorithm using Map-Reduce
6. Implementing any one Clustering algorithm using Map-Reduce
7. Implementing any one data streaming algorithm using Map-Reduce
8. Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web)

a. Twitter data analysis
b. Fraud Detection
c. Text Mining etc.

Text Books:

1. Anand Rajaraman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press,
2. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly "Making Sense of NoSQL" – A guide for managers and the rest of us, Manning Press.

References:

1. Bill Franks **, "**Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley
2. Chuck Lam, "Hadoop in Action", Dreamtech Press

Course Code	Course/Subject Name	Credits
CPL801	**Cloud Computing Laboratory**	1

Outcomes: Learner will be able to…

1. Appreciate cloud architecture
2. Create and run virtual machines on open source OS
3. implement Infrastructure , storage as a Service**.**
4. Install and appreciate security features for cloud

Module	Detailed Contents	Lab Session
01	**Title:** Study of Cloud Computing & Architecture. **Concept:** Cloud Computing & Architecture. **Objective:** Objective of this module is to provide students an overview of the Cloud Computing and Architecture and different types of Cloud Computing **Scope:** Cloud Computing & Architecture Types of Cloud Computing . **Technology:** ---	**01**
02	**Title:** Virtualization in Cloud. **Concept:** Virtualization **Objective:** In this module students will learn, Virtualization Basics, Objectives of Virtualization, and Benefits of Virtualization in cloud. **Scope:** Creating and running virtual machines on open source OS. **Technology:** KVM, VMware.	**02**
03	**Title:** Study and implementation of Infrastructure as a Service . **Concept:** Infrastructure as a Service**.** **Objective:** In this module student will learn Infrastructure as a Service and implement it by using OpenStack. **Scope:** Installing OpenStack and use it as Infrastructure as a Service . **Technology:** Quanta Plus /Aptana /Kompozer	**02**
04	**Title:** Study and installation of Storage as Service.	**02**

	Concept: Storage as Service (SaaS) **Objective:** is that, students must be able to understand the concept of SaaS , and how it is implemented using ownCloud which gives universal access to files through a web interface. **Scope:** is to installation and understanding features of ownCloud as SaaS**.** **Technology:** ownCloud	
05	**Title:** Implementation of identity management. **Concept:** Identity Management in cloud **Objective:** this lab gives an introduction about identity management in cloud and simulate it by using OpenStack **Scope:** installing and using identity management feature of OpenStack **Technology:** OpenStack	**02**
06	**Title:** Write a program for web feed. **Concept:** Web feed and RSS **Objective:** this lab is to understand the concept of form and control validation **Scope:** Write a program for web feed **Technology:** PHP, HTML	**02**
07	**Title:** Study and implementation of Single-Sing-On. **Concept:** Single Sing On (SSO),openID **Objective:** is to understand the concept of access control in cloud and single sing on (SSO), Use SSO and advantages of it, and also students should able to implementation of it. **Scope:** installing and using JOSSO **Technology:** JOSSO	**02**
08	**Title:** Securing Servers in Cloud. **Concept:** Cloud Security **Objective:** is to understand how to secure web server, how to secure data directory and introduction to encryption for own cloud.	**02**

	Scope: Installing and using security feature of ownCloud **Technology:** ownCloud	
09	**Title:** User Management in Cloud. **Concept:** Administrative features of Cloud Managenet ,User Management **Objective:** is to understand how to create, manage user and group of users accounts. **Scope:** Installing and using Administrative features of ownCloud **Technology:** ownCloud	**02**
10	**Title:** Case study on Amazon EC2. **Concept:** Amazon EC2 **Objective:** in this module students will learn about Amazon EC2. Amazon Elastic Compute Cloud is a central part of Amazon.com's cloud computing platform, Amazon Web Services. EC2 allows users to rent virtual computers on which to run their own computer applications	**01**
11	**Title:** Case study on Microsoft azure. **Concept:** Microsoft Azure **Objective:** students will learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, for building, deploying and managing applications and services through a global network of Microsoft-managed datacenters. How it work, different services provided by it. **Technology:** Microsoft azure	**01**
12	**Title:** Mini project. **Concept:** using different features of cloud computing creating own cloud for institute, organization etc. **Objective:** is student must be able to create own cloud using different features which are learned in previous practices. **Scope:** creating a cloud like social site for institute. **Technology:** any open system used for cloud	**05**

Term Work:

- Term work should consist of at least 6 experiments and a mini project.
- Journal must include at least 2 assignments.
- The final certification and acceptance of term work indicates that performance in laboratory work is satisfactory and minimum passing marks may be given in term work.

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

- Laboratory work (experiments): …….. (15) Marks.
- Mini project presentation: …… (05) Marks.
- Attendance ……. (05) Marks

TOTAL: …… (25) Marks.

Text Books:

1. Enterprise Cloud Computing by Gautam Shroff, Cambridge,2010
2. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley - India, 2010 , ISBN:978-0-470-58987-8
3. Getting Started with OwnCloud by Aditya Patawar , Packt Publishing Ltd, 2013
4. www.openstack.org

Course Code	Course/Subject Name	Credits
CP701 / CP802	**Project I/ II**	**3 / 6**

Guidelines for Project

- Students should do literature survey/visit industry/analyze current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem.
- Students should attempt solution to the problem by experimental/simulation methods.
- The solution to be validated with proper justification and report to be compiled in standard format.

Guidelines for Assessment of Project I

- Project I should be assessed based on following points
  - Quality of problem selected
  - Clarity of Problem definition and Feasibility of problem solution
  - Relevance to the specialization
  - Clarity of objective and scope
  - Breadth and depth of literature survey
- Project I should be assessed through a presentation by the student project group to a panel of Internal examiners appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Project II

- Project II should be assessed based on following points
  - Quality of problem selected
  - Clarity of Problem definition and Feasibility of problem solution
  - Relevance to the specialization / Industrial trends
  - Clarity of objective and scope
  - Quality of work attempted
  - Validation of results
  - Quality of Written and Oral Presentation
- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Project II should be assessed through a presentation by the student project group to a panel of Internal and External Examiners approved by the University of Mumbai
- Students should be motivated to publish a paper based on the work in Conferences/students competitions