SEMESTER – III

Digital Electronics
Code: ESC-301
Contact: 3L

Name of the Course:	**Digital Electronics**		
Course Code: ESC-301	Semester: III		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.		
2	To prepare students to perform the analysis and design of various digital electronic circuits		
Pre-Requisite:			
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,.		
2	Basic concept of the working of P-N diodes, Schottky diodes,		
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback		

Unit	Content	Hrs/Unit	Marks/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable&MonostableMultivibrators;Schimtt Trigger circuits, 555 Timer.	9	
2	Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic	11	

	expressions by algebraic method. Combinational circuits - Adder and Subtractor circuits (half & full adder &subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator		
3	Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronousand Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter	10	
4.	A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6	

Text book and Reference books:

1. Microelectronics Engineering –Sedra& Smith-Oxford.
2. Principles of Electronic Devices & circuits—B L Thereja&Sedha—S Chand
3. Digital Electronics – Kharate – Oxford
4. Digital Electronics – Logic & Systems by J.Bigmell&R.Donovan; Cambridge Learning.
5. Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP
6. Electronic Devices & Circuit Theory – Boyelstad&Nashelsky - PHI
7. Bell-Linear IC & OP AMP—Oxford
8. P.Raja- Digital Electronics- Scitech Publications
9. Morries Mano- Digital Logic Design- PHI
10. R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
11. H.Taub&D.Shilling, Digital Integrated Electronics- McGraw Hill.
12. D.RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
13. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
14. J.Bignell&R.Donovan-Digital Electronics-5/e- Cenage Learning.
15. Leach &Malvino—Digital Principles & Application, 5/e, McGraw Hill
16. Floyed& Jain- Digital Fundamentals-Pearson.

Course Outcomes:

On completion of the course students will be able to

ESC-301.1 Realize the basic operations of different analog components.

ESC-301.2 Realize basic gate operations and laws Boolean algebra.

ESC-301.3 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

Data Structure & Algorithm
Code: PCC-IT301
Contacts: 3L

Name of the Course:	**Data Structure & Algorithm**		
Course Code: PCC-IT 301	Semester: III		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical:		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	To learn the basics of abstract data types.		
2	To learn the principles of linear and nonlinear data structures.		
3	To build an application using sorting and searching		
Pre-Requisite:			
1	CS 201 (Basic Computation and Principles of C		
2	M101 & M201 (Mathematics), basics of set theory		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data StructureOperations: insertion, deletion, traversal etc.; Analysis of an Algorithm, AsymptoticNotations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis.	10	
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexityanalysis, Applications of Stacks: Expression Conversion and evaluation – correspondingalgorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, CircularQueue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	9	

3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of severaloperations: Traversing, Searching, Insertion into, Deletion from linked list; Linkedrepresentation of Stack and Queue, Header nodes, Doubly linked list: operations on it andalgorithmic analysis; Circular Linked Lists: all operations their algorithms and thecomplexity analysis.	10	
	Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded BinaryTree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and theiralgorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree:definitions, algorithms and analysis		
4.	Sorting and Hashing: Objective and properties of different sorting algorithms:Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort;Performance and Comparison among all the methods, Hashing.Graph: BasicTerminologies and Representations, Graph search and traversal algorithms and complexity analysis.	9	

Text book and Reference books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by ReemaThareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

Course Outcomes:

On completion of the course students will be able to

PCC-IT301.1 Differentiate how the choices of data structure & algorithm methods impact the performance of program.

PCC-IT301.2Solve problems based upon different data structure & also write programs.

PCC-IT301.3Identify appropriate data structure & algorithmic methods in solving problem.

PCC-IT301.4Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

PCC-IT301.5Compare and contrast the benefits of dynamic and static data structures implementations.

Signals & Systems
Code: ESC302
Contacts: 3L

Name of the Course:	**Signals & Systems**	
Course Code: ESC-302	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Signals and Systems :** Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.Examples.	3	
2	**Behavior of continuous and discrete-time LTI systems (8 hours)** Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	8	

3	**Fourier, Laplace and z- Transforms** Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of	10	
	system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.		
4.	The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	9	

Text book and Reference books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, " Signalsand systems", Prentice Hall India,1997.
2. J. G. Proakis and D. G. Manolakis, " Digital Signal Processing: Principles, Algorithms, and Applications" , Pearson,2006.
3. H. P. Hsu, " Signals and systems", Schaum'sseries, McGraw Hill Education,2010.
4. S. Haykinand B. V. Veen, " Signals and Systems", John Wiley and Sons,2007.
5. A. V. Oppenheim and R. W. Schafer, " Discrete-Time Signal Processing", Prentice Hall,2009.
6. M. J. Robert " Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, " LinearSystems and Signals", Oxford University Press,2009.
8. A. V. Oppenheim and R. W. Schafer, " Discrete-Time Signal Processing", Prentice Hall,2009.
9. M. J. Robert " Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
10. B. P. Lathi, " LinearSystems and Signals", Oxford University Press,2009.

Course Outcomes:

- On completion of the course students will be able to
- Understand the concepts of continuous time and discrete time systems.
- Analyse systems in complex frequency domain.
- Understand sampling theorem and its implications.
- Understand the concepts of continuous time and discrete time systems.

Mathematics-III (Differential Calculus)
Code: BSC-301
Contacts: 2L

Name of the Course:	**Mathematics-III (Differential Calculus)**		
Course Code: BSC-301	Semester: III		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:2 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	2		
Objective:			
1	To know Convergence of sequence and series		
2	To know Limit, continuity and partial derivatives, Chain rule, Implicit function		
3	To know First Order Differential Equation, Exact, Linear and Bernoulli's equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph		
Pre-Requisite:			
1	Concept Linear Algebra Determinant and its properties (up to third order)		
2	Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric		

Unit	Content	Hrs/Unit	Marks/Unit
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	8	
2	Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7	
3	Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems.	8	

4.	First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. [5L] Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L]	9	
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8	

Text book and Reference books:

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
3. Co-ordinate Geometry, S. L. Loney
4. Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
5. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
6. Advanced Engineering Mathematics, E Kreyszig,

Course Outcomes:

On completion of the course students will be able to

BSC-301.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives.

BSC-301.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

BSC-301.3 Use tree and graph algorithms to solve problems

BSC-301.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

Biology

Code: BSC 302
Contacts: 3L

Name of the Course:	**Biology**	
Course Code: BSC-302	Semester: III	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3hrs./week		Mid Semester exam: 15
Tutorial:		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Objective:	
1	Bring out the fundamental differences between science and engineering
2	Discuss how biological observations of 18th Century that lead to major discoveries
Pre-Requisite:	
1	Basic knowledge of Physics ,Chemistry and mathematics

Unit	Content	Hrs/Unit	Marks/Unit
1	To convey that Biology is as important a scientific discipline as Mathematics,Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th	2	
	Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.		

2	Theunderlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus	3	
3	To convey that "Genetics is to biology what Newton's laws are to PhysicalSciences"Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Conceptof mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4	
4.	Biomolecules:To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discussabout sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.	4	
5	Enzymes**:** To convey that without catalysis life would not have existed on earth	4	

	Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parametersto understand biology? RNA catalysis.		
6	Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	4	
7	Macromolecular analysis**:** How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5	
8	Metabolism**:** The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of $K_{eq}$and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4	
9	MicrobiologyConcept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3	

Text books/ reference books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman andcompany, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers

Course Outcomes:

On completion of the course students will be able to

BSC-302.1 Describe how biological observations of 18th Century that lead to major discoveries.

BSC-302.2 Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological

BSC-302.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring

BSC-302.4 Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine

BSC-302.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-302.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-302.7 Analyse biological processes at the reductionistic level

BSC-302.8 Apply thermodynamic principles to biological systems.

BSC-302.9 Identify and classify microorganisms.

Digital Electronics LabCode: ESC-391
Contacts: 4

Name of the Course:	**Digital Electronics Lab**
Course Code: ESC-391	Semester: III
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Outcomes:	
1	ESC-301.1
2	ESC-301.2
3	ESC-301.3
Pre-Requisite:	
Pre-requisites as in ESC-301	

Laboratory Experiments:	
Analog Electronics	
1	Design a Class A amplifier
2	Design a Phase-Shift Oscillator
3	Design of a Schmitt Trigger using 555 timer
Digital Electronics	
4	Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
5	Construction of simple Decoder & Multiplexer circuits using logic gates.
6	Realization of RS / JK / D flip flops using logic gates
7	Design of Shift Register using J-K / D Flip Flop
8	Realization of Synchronous Up/Down counter
9	Design of MOD- N Counter
10	Study of DAC

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Data Structure & Algorithm Lab
Code: PCC-IT391
Contacts: 4

Name of the Course:	**Data Structure & Algorithm Lab**
Course Code: PCC-IT391	Semester: III
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Outcomes:	
1	PCC-IT301.1
2	PCC- IT 301.2
3	PCC- IT 301.3
4	PCC- IT 301.4
5	PCC- IT 301.5
Pre-Requisite:	
Pre-requisites as in PCC- IT 301	

Laboratory Experiments:	
Linear Data Structure	
1	Implementation of array operations
2	Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
3	Merging Problem:Evaluation of expressions operations on Multiple stacks &queues:
4	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks &queuesusing linked lists
5	Polynomial addition, Polynomial multiplication
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Threaded binary tree traversal. AVL tree implementation
8	Application of Trees. Application of sorting and searching algorithms
9	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

IT Workshop (Sci Lab/MATLAB/Python/R)
Code: PCC-IT 302
Contacts: 4P

Name of the Course:	**IT Workshop**
Course Code: PCC-IT 302	Semester: III
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Outcomes:	
1	To master an understanding of scripting & the contributions of scripting languages
2	Design real life problems and think creatively about solutions
3	Apply a solution in a program using R/Matlab/Python.
4	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.
Pre-Requisite:	
1.	Knowledge of Programming Logic
2.	Experience with a high level language (C/C++,) is suggested.
3.	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Practical Syllabus

Programming in R

1.Introduction to mechanism for statistics, data analysis, and machine learning; Introduction of R Programming, How to install and run R, Use of R help files, R Sessions, R Objects – Vectors, Attributes, Matrices, Array, Class, List, Data Frames etc.Operators in R.

2. R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, R-Vector Function, Recursive Function in R.

3.R Packages (Install and Use), Input/Output Features in R, Reading or Writing in File. Data Manipulation in R.Rearranging data, Random Number and Simulation, Statistical methods like min, max, median, mean, length, Linear Regression, Normal Distribution, Decision tree

4.Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions – Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.

Programming in Matlab

Introduction
Why MATLAB?,History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB

Basics
Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables

Programming-I
Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept

Programming-II
Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file

Conditional statements and Loop

Relational and Logical Operators, If-else statements, Switch-case statements,Forloop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database

2D Plotting
In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface

3D Plotting
Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics

Programming with Python

Introduction
History,Features,Setting up path,Working with Python,BasicSyntax,Variable and Data Types, Operator

Conditional Statements
If,If- else,Nested if-else,Looping,For,While, Nested loops

Control Statements
Break, Continue, Pass

String Manipulation
Accessing Strings, Basic Operations, String slices, Function and Methods

Lists
Introduction, Accessing list, Operations, Working with lists, Function and Methods

Tuple

Introduction,Accessingtuples,Operations,Working,Functions and Methods

Dictionaries
Introduction, Accessing values in dictionaries, Working with dictionaries,Properties

Functions
Defining a function,Calling a function,Types of functions,FunctionArguments,Anonymousfunctions,Global and local variables

Modules
Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions

Exception Handling
Exception, Exception Handling,Except clause, Try?finally clause, User Defined Exceptions.

Laboratory Experiments:	
1	Practical Assignments related with implementation of PCC-CS393

Discrete Mathematics
Code: PCC-IT401
Contacts: 3L+1T

Name of the Course:	**Discrete Mathematics**		
Course Code: PCC-IT401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hour/week		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	4		
Objective:			
1	Use mathematically correct terminology and notation.		
2	Construct correct direct and indirect proofs.		
3	To know Syntax, Semantics, Validity and Satisfiability,Graphs and Trees		
4	Use counterexamples. Apply logical reasoning to solve a variety of problems.		
Pre-Requisite:			
1	Some concepts from basic math – algebra, geometry, pre-calculus		

Unit	Content	Hrs/Unit	Marks/Unit
1	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, BinaryRelation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum andProduct of Functions, Bijective functions, Inverse and Composite Function, Size of a Set,Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument andThe Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursivedefinition, The Division algorithm: Prime Numbers, The Greatest Common Divisor:Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	8	
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation andcombination	5	

3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives andTruth Tables, Logical Equivalence: The Laws of Logic, Logical	8	
	Implication, Rules ofInference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methodsand Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof ofNecessity and Sufficiency.		
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation,Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures,Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, NormalSubgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domainand Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra,Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	7	
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle,Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring mapsand Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph,definition properties and Example, rooted trees, trees and sorting, weighted trees and prefixcodes, Bi-connected component and Articulation Points, Shortest distances.	8	

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
10. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
11. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed.,

Addison-Wesley, 1994.
12. N. Deo, Graph Theory, Prentice Hall of India, 1974.
13. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
14. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.
15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

Course Outcome(s)

On completion of the course students will be able to

PCC- IT 401.1 Express a logic sentence in terms of predicates, quantifiers, and logicalconnectives

PCC- IT 401.2 Derive the solution for a given problem using deductive logic and prove the solutionbased on logical inference

PCC- IT 401.3Classify its algebraic structure for a given a mathematical problem,

PCC- IT 401.4Evaluate Boolean functions and simplify expressions using the properties of Booleanalgebra

PCC- IT 401.5Develop the given problem as graph networks and solve with techniques of graph theory.

Computer Organization & Architecture
Code: PCC-IT402
Contacts: 3L

Name of the Course:	**Computer Organization & Architecture**	
Course Code:PCC-IT402	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical:		End Semester Exam:70 Marks
Credit Points:	3	
Objective:		
1	To learn the basics of stored program concepts.	
2	To learn the principles of pipelining	
3	To learn mechanism of data storage	

4	To distinguish between the concepts of serial, parallel, pipeline architecture.
Pre-Requisite:	
1	Basic Structure of Computers, Functional units, software, performance issues software, machine instructions
2	RAM, ROM, Memory management

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards,techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)	12	
2	Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)	8	
3	Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIWprocessor architectures. Array and vector processors. (6L)	6	
4.	Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Clustercomputers. (8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)	7	

Text/Reference Books:

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A QuantitativeApproach", Morgan Kauffman, 2011.
4. W. Stallings, "Computer organization", PHI, 1987.
5. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
6. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
7. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family",Prentice Hall India, 1986.
8. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.

9. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
10. P. Able, "8086 Assembly Language Programming", Prentice Hall India6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.

Course Outcomes:

On completion of the course students will be able to

PCC- IT 402.1 Learn pipelining concepts with a prior knowledge of stored program methods

PCC- IT 402.2 Learn about memory hierarchy and mapping techniques.

PCC- IT 402.3 Study of parallel architecture and interconnection network

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Formal Language & Automata Theory
Code: PCC-IT403
Contacts: 3L

Name of the Course:	**Formal Language & Automata Theory**	
Course Code:PCC-IT403	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Objective:	
1	Be able to construct finite state machines and the equivalent regular expressions.
2	Be able to prove the equivalence of languages described by finite state machines and regular expressions
3	Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
4	Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines
Pre-Requisite:	
1	Grammar and its classification (Context Free Grammar)

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	6	

2	Regular languages and finite automata: Regular expressions andlanguages, deterministic finite automata (DFA) and equivalence with regular expressions,nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars andequivalence with finite automata, properties of regular languages, pumping lemma	7	
	forregular languages, minimization of finite automata)		
3	Context-free languages and pushdownautomata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibachnormal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG,parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministicpushdown automata, closure properties of CFLs.	6	
4.	Context-sensitive languages:Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6	
5	Turing machines: The basic model for Turing machines (TM), Turingrecognizable(recursively enumerable) and Turing-decidable (recursive) languages and theirclosure properties, variants of Turing machines, nondeterministic TMs and equivalence withdeterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators	6	
6	Undecidability: Church-Turing thesis, universal Turing machine, theuniversal and diagonalization languages, reduction between languages and Rice s theorem,undecidable problems about languages	6	

Text books/ reference books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to AutomataTheory, Languages, and Computation, Pearson Education Asia.
2.Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory ofComputation, Pearson Education Asia.
3.Dexter C. Kozen, Automata and Computability, Undergraduate Texts in ComputerScience, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.

Course Outcomes:

On completion of the course students will be able to

PCC- IT 403.1 Write a formal notation for strings, languages and machines.

PCC- IT 403.2 Design finite automata to accept a set of strings of a language.

PCC- IT 403.3 For a given language determine whether the given language is regular ornot.

PCC- IT 403.4 Design context free grammars to generate strings of context free language.

PCC- IT 403.5 Determine equivalence of languages accepted by Push Down Automataand languagesgenerated by context free grammars

PCC- IT 403.6 Write the hierarchy of formal languages, grammars and machines.

PCC- IT 403.7 Distinguish between computability and non-computability and Decidability and undecidability

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Economics for Engineers (Humanities-II)
Code: HSMC-401
Contacts: 3L

Name of the Course:	**Economics for Engineers (Humanities-II)**	
Course Code: HSMC-401	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Objective:	
1	Understand the role and scope of Engineering Economics and the process of economic decision making
2	Understand the different concepts of cost and different cost estimation techniques
3	Familiarization with the concepts of cash flow, time value of money and different interest formulas
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics
7	Introduction to basic concepts of Accounting and Financial Management
Pre-Requisite:	
1	Mathematics

Unit	Content	Hrs/Unit	Marks/Unit
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per- Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement& Learning	9	
	Curve, Benefits.		
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. 4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.	9	
3	5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. 6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. 7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.	9	

4.	8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. 9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	9	

Text book and Reference books:

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,DavidB.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.PaneerSeelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Course Outcome:

On completion of the course students will be able to

HSMC-401.1 Make different economic decisions and estimate engineering costs by applying different cost estimation models.

HSMC-401.2 Create cash flow diagrams for different situations and use different interest formulae to solve associated problems.

HSMC-401.3 Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc.

HSMC-401.4 Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation.

HSMC-401.5 Understand the concepts of depreciation and replacement analysis and solve associated problems.

HSMC-401.6 Understand the process of inflation and use different price indices to adjust for its effect.

HSMC-401.7 Apply the various concepts of Accounting like balance sheet and ratio analysis.

HSMC-401.8 Understand the scope of Finance and the role of financial planning and management.

Environmental Sciences
Code:MC-401
Contacts:1L

Name of the Course:	**Environmental Sciences**		
Course Code: MC-401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:1hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	0		
Objective:			
1	Be able to understand the natural environment and its relationships with human activities.		
2	Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.		
3	Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.		
4	Be able to solve scientific problem-solving related to air, water, noise & land pollution		
Pre-Requisite:			
1	Basic knowledge of Environmental science		

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L) Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function.(1L) Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)	6	

2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur].(1L) Biodiversity- types, importance, Endemic species,	6	
	Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)		
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model[Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level,agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog.Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification.(1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP.cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement	11	

	with brief reference). (1L)		
4.	Hydrosphere, Hydrological cycle and Natural water.Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application,heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river	9	
	[deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor,Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)		
5	Lithosphere; Internal structure of earth, rock and soil (1L) Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)	3	

6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, *L*10 (18hr Index) ,*n Ld*.Noise pollution control. (1L)	3	
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	2	

Text books/ reference books:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,1991.
2. De, A. K., "Environmental Chemistry", New Age International

Course Outcomes:

On completion of the course students will be able to

MC-401.1To understand the natural environment and its relationships with human activities.

MC-401.2To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-401.3To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-401.4Acquire skills for scientific problem-solving related to air, water, noise& land pollution.

Communication Engineering
Code: PCC-IT404
Contacts: 3L

Name of the Course:	**Communication Engineering**
Course Code: PCC-IT404	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To comprehend basics of communication system
2	To apply the basic concept of PCM systems and baseband transmission schemes
3	To develop a fundamental understanding on Communication Systems with emphasis on analog modulation techniques and noise performance

4	To analyze, evaluate and produce spectral characteristics of band pass signaling schemes
5	To understand the key modules of digital communication systems with emphasis on digital modulation techniques
6	To get introduced to the basics of Spread Spectrum Modulation
7	To asses noise issues

Unit	Content	Hrs/Unit	Marks/Unit
1	Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR Analog-to-Digital Conversion. (Basic ideas in brief) :Details: Introduction to Base Band transmission & Modulation (basic concept); Elements of Communication systems (mention of transmitter, receiver and channel); origin of noise and its effect, Importance of SNR in system design; Basic principles of Linear Modulation (Amplitude Modulation); Basic principles of Linear Modulator & Demodulator circuits (Amplitude Modulation); Basic principles of Non-linear modulation (Angle Modulation - FM, PM); Basic principles of Non- linear modulator (Angle Modulation – FM, PM) & Demodulator circuits; Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing; Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM; Basic concept of Pulse Code Modulation, Block diagram of PCM; Multiplexing - TDM, FDM;	14	
2	Digital Transmission: Details: Concept of Quantisation & Quantisation error, Uniform Quantiser; Non-uniform Quantiser, A-law & law companding (mention only); Encoding, Coding efficiency; Line coding & properties, NRZ & RZ, AMI, Manchester coding PCM, DPCM; Baseband Pulse Transmission, Matched filter (mention of its importance and basic concept only), Error rate due to noise; ISI, Raised cosine function, Nyquist criterion for distortion-less base-band binary transmission, Eye pattern, Signal power in binary digital signals.	10	
3	Digital Carrier Modulation & Demodulation Techniques: Details: Bit rate, Baud rate; Information capacity, Shanon's limit; M-ary encoding, Introduction to the different digital modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK; Introduction to QAM, mention of 8QAM, 16 QAM without elaboration; Delta modulation, Adaptive delta modulation (basic concept and importance only, no details; Introduction to	12	
	the concept of DPCM, Delta Modulation, Adaptive Delta modulation and their relevance; Spread Spectrum Modulation - concept only, Introduction to different digital modulator like ASK, FSK, PSK, BPSK, QPSK, 8 BPSK, 16 BPSK modulator & Demodulator; Introduction to QAM, 8QAM, 16 QAM, Delta & Adaptive delta Modulator and Demodulator.		

Text books/ reference books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Publishedby Wiley India.
2. Modern Digital & Analog Communication Systems, B.P. Lathi, 3rd Edn, OxfordUniversity Press, Chennai, 1998.
3. Data Communication and Networking by Behrouz A. Forouzan, Published by TataMcGraw-Hill
4. Principle of Communication Systems by Herbert Taub and D.L.Schilling
5. J. G. Proakis, "Digital Communication", Tata McGraw – Hill, (4/e), 2001.

Course Outcomes

On completion of the course students will be able to

CO	STATEMENT
1	To understand the fundamentals of radio communication system and analog modulation and demodulation techniques applying the basic knowledge of signals and systems and will be able to understand the concept of Frequency modulation.
2	To apply the basic knowledge of electronic circuits and understands the effect of Noise incommunication system and noise performance of AM & FM systems
3	To understand TDM and Pulse Modulation techniques and baseband transmission schemes
4	To apply the knowledge of statistical theory of communication and signals and system and to explainand evaluate the performance of digital communication system in the presence of noise
5	To describe and analyze the digital communication system with spread spectrum modulation.
6	To design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for analog & digital modulators and demodulators using hardware components andcommunication systems using CAD tool.

PRACTICAL SYLLABUS
Semester IV

Communication Engineering Lab
Code: PCC-IT494
Contacts: 4P

Name of the Course:	**Communication Engineering Lab**
Course Code: PCC-IT494	Semester: IV
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Objectives:	
1	To visualize the effects of sampling
2	To implement AM & FM modulation and demodulation
3	To implement PAM, PWM and PPM schemes
Pre-Requisite:	

1	Knowledge in Fourier Analysis and Basic Electronics
Laboratory Experiments:	
1	Design and Generation of Amplitude Modulation
2	Design and Generation of Amplitude Demodulation using Envelope Detection
3	Design and Generation of Narrow Band Frequency Modulation (NBFM) signal
4	Design and Generation of Wide Band Frequency Modulation (WBFM) signal
5	Design and Generation of Frequency Demodulation
6	Design and Generation of PAM, PWM and PPM signal

Any experiment specially designed based on the theory syllabus will be followed (Detailed instructions for Laboratory Manual to be followed for further guidance)

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

CO	STATEMENT
1	Understand the generation of AM signals and its performance
2	Study the amplitude demodulation techniques
3	Understand the generation of FM signals and its performance
4	Study the frequency demodulation techniques
5	Perform signal sampling by determining the sampling rates for baseband signals& to generate digital modulation signals for PAM
6	Understand the generation of PWM & PPM schemes and estimate their outputperformance

Computer Organization & Architecture Lab
Code: PCC-IT492
Contacts: 4

Name of the Course:	**Computer Architecture Lab**
Course Code: PCC-IT492	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Outcomes:	
1	PCC- IT 402.1
2	PCC- IT 402.2

3	PCC- IT 402.3
Pre-Requisite:	
1	The hardware based design has been done in 1.the Analog& Digital Electronics laboratory
2	Computer Organisation laboratory
Laboratory Experiments:	
1	HDL introduction.
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division
4	8-bit Register design
5	Memory unit design and perform memory operations.
6	8-bit simple ALU design
7	8-bit simple CPU design
8	Interfacing of CPU and Memory.

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Semester-V

Design and Analysis of Algorithms
Code: PCC-IT 501
Contacts: 3L

Name of the Course:	**Design and Analysis of Algorithms**	
Course Code: PCC-IT 501	Semester: V	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical:		End Semester Exam:70 Marks
Credit Points:	3	
Objective:		
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them	
2	Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.	
Pre-Requisite:		
1	To know data-structure and basic programming ability	

Unit	Content	Hrs/Unit	Marks/Unit

4.	of Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems andReduction techniques.	10	
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problemsbeyond NP – P SPACE	4	
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis ofcomplexity bounds – best, average and worst- case behavior; Performance measurements ofAlgorithm, Time and space trade-offs, Analysis of recursive algorithms throughrecurrence relations: Substitution method, Recursion tree method and Masters' theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy,Dynamic Programming, Branchand-Bound and Backtracking methodologies for the design of algorithms; Illustrationsof these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.	8	
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and BreadthFirst Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree,Topological sorting, Network Flow Algorithm.	6	
	Tractable and Intractable Problems: Computability		

Text books/ reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson,Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,Reading, MA

Course Outcomes

On completion of the course students will be able to

PCC- IT 501.1 For a given algorithms analyze worst-case running times of algorithmsbased onasymptotic analysis and justify the correctness of algorithms.

PCC- IT 501.2 Describe the greedy paradigm and explain when an algorithmic designsituation callsfor it. For a given problem develop the greedy algorithms.

PCC- IT 501.3 Describe the divide-and-conquer paradigm and explain when an

algorithmic designsituation calls for it. Synthesize divide-and-conquer algorithms. Derive and solverecurrence relation.

PCC- IT 501.4 Describe the dynamic-programming paradigm and explain when an algorithmicdesign situation calls for it. For a given problems of dynamic-programming and

PCC- IT 501.5 develop the dynamic programming algorithms, and analyze it to determineitscomputational complexity.

PCC- IT 501,6 For a given model engineering problem model it using graph and write thecorresponding algorithm to solve the problems.

PCC- IT 501.7 Explain the ways to analyze randomized algorithms (expected runningtime,probability of error).

PCC- IT 501.8 Explain what an approximation algorithm is. Compute the approximationfactorof an approximation algorithm (PTAS and FPTAS).

Design & Analysis Algorithm Lab
Code: PCC-IT591

Contact: 4

Name of the Course:	**Design & Analysis Algorithm Lab**
Course Code: PCC-IT591	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Outcomes:	
1	PCC- IT 501.1
2	PCC- IT 501.2
3	PCC- IT 501.3
Pre-Requisite:	
Pre-Requisite as in : PCC- IT 501	

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	

11	Implement Breadth First Search (BFS) Implement Depth First Search (DFS)

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Database Management Systems
Code: PCC-IT502
Contact: 3L

Name of the Course:	**Database Management Systems**		
Course Code: PCC-IT502	Semester: V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand the different issues involved in the design and implementation of a database system.		
2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models		
3	To understand and use data manipulation language to query, update, and manage a		
	database		
4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.		
5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.		
6	To understand the different issues involved in the design and implementation of a database system.		

Unit	Content	Hrs/Unit	Marks/Unit

1	**Database system architecture:** Data Abstraction, Data Independence,Data Definition Language(DDL),Data Manipulation Language(DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	9	
2	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign. **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	13	
3	**Storage strategies**: Indices, B-trees, hashing.	3	
4.	**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	5	
5	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	3	
6	**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	3	

Text book and Reference books:

1."Database System Concepts" , 6th Edition by Abraham Silberschatz, Henry

F. Korth, S. Sudarshan,McGraw-Hill.
2."Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer SciencePress.
3."Fundamentals of Database Systems" , 5th Edition by R. Elmasri and S. Navathe,
4.PearsonEducation "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Course Outcomes:

On completion of the course students will be able to

1. For a given query write relational algebra expressions for that query and optimize the developedexpressions
2. For a given specification of the requirement design the databases using E R method andnormalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, andDB2.
4. For a given query optimize its execution using Query optimizationalgorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, anddurability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Database Management System Lab
Code: PCC-IT592
Contacts: 4P

Name of the Course:	**Database Management System Lab**
Course Code: PCC-IT592	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Laboratory Experiments:
Structured Query Language **1. Creating Database** • Creating a Database • Creating a Table • Specifying Relational Data Types

- Specifying Constraints
- Creating Indexes

2. Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

3. Retrieving Data from a Database

1. The SELECT statement
2. Using the WHERE clause
3. Using Logical Operators in the WHERE clause
4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

Clause

5. Using Aggregate Functions
6. Combining Tables Using JOINS
7. Subqueries

4. Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Operating Systems
Code: PCC-IT503
Contacts: 3L

Name of the Course:	**Operating Systems**	
Course Code: PCC-IT503	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical:		End Semester Exam :70 Marks
Credit Points:	3	
Objective:		
1	To learn the mechanisms of OS to handle processes and threads and their communication	

2	To learn the mechanisms involved in memory management in contemporary OS
3	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4	To know the components and management aspects of concurrency management
Pre-Requisite:	
1	Computer Organization &Architecture

Unit	Content	Hrs/Unit	Marks/ Unit
1	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	3	
2	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms:	10	
	Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.		
3.	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problemetc.	5	
4.	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	5	

5.	**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).	8	
6.	**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms **File Management**: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency andperformance. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	6	

Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:

On completion of the course students will be able to

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.
4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Object Oriented Programming
Code: PCC-IT504
Contacts: 3L

Name of the Course:	**Computer Organization**	
Course Code: PCC-IT504	Semester: V	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical:		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	8	
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.	8	
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	6	

4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	6	
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	6	

Text book and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Outcomes:

On completion of the course students will be able to

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B. Tech. In Information Technology (In-house)
(Effective from academic session 2020-21)

Introduction to Industrial Management (Humanities III)
Code: HSMC-501
Contacts: 3L

Name of the Course:	**Introduction to Industrial Management (Humanities III)**	
Course Code: HSMC-501	Semester: V	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** System- concept, definition, types, parameters, variables and behavior. 1.2 Management – definition and functions. 1.3 Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. 1.4 Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. 1.5 Organizational culture and climate –	6	
	meaning, differences and factors affecting them. 1.6 Moral-factors affecting moral. 1.7 Relationship between moral and productivity. 1.8 Job satisfaction- factors influencing job satisfaction. 1.9 Important provisions of factory act and labor laws.		

2	**Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):** 2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. 2.3 Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). 2.4 Determination of critical path on network. 2.5 Floats, its types and determination of floats. 2.6 Crashing of network, updating and its applications.	8	
3	**Materials Management:** 3.1 Material management-definition, functions, importance, relationship with other departments. 3.2 Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. 3.3 Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. 3.4 Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. 3.5 Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis.	6	
	v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.		

4	**Production planning and Control (PPC):** 4.1 Types and examples of production. 4.2 PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. 4.3 Scheduling- meaning and need for productivity and utilisation. 4.4 Gantt chart- Format and method to prepare. 4.5 Critical ratio scheduling-method and numeric examples. 4.6 Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. 4.7 Bottlenecking- meaning, effect and ways to reduce.	8	
5	**Value Analysis (VA) and Cost Control:** 5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. 5.3 DARSIRI method of VA. 5.4 Case study of VA-at least two. 5.5 Waste-types, sources and ways to reduce them. 5.6 Cost control-methods and important guide lines.	4	
6	**Recent Trends in IM:** 6.1 ERP (Enterprise resource planning) - concept, features and applications. 6.2 Important features of MS Project. 6.3 Logistics- concept, need and benefits. 6.4 Just in Time (JIT)-concept and benefits. 6.5 Supply chain management-concept and benefits.	4	

Text book and Reference books:

1. L.S.Srinath– "CPM & PERT principles and Applications".
2. Buffa – "Modern Production Management".
3. N. Nair – "Materials Management".
4. O. P. Khanna – " Industrial Engineering & Management".
5. Mikes – "Value Analysis".

Course Outcomes:

On completion of the course students will be able to

1. Interpret given organization structure, culture, climate and major provisions of factory

acts and laws.
2. Explain material requirement planning and store keeping procedure.
3. Plot and analyze inventory control models and techniques.
4. Prepare and analyze CPM and PERT for given activities.
5. List and explain PPC functions.

Human Computer Interaction
Code: PEC-IT501A
Contacts: 3L

Name of the Course:	**Human Computer Interaction**	
Course Code: PEC-IT501A	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Objective:	
1	Learn the foundations of Human Computer Interaction
2	Be familiar with the design technologies for individuals and persons with disabilities
3	Be aware of mobile Human Computer interaction
4	Learn the guidelines for user interface.
Pre-Requisite:	
1	Computer Organization &Architecture

Unit	Content	Hrs/Unit	Marks/ Unit
1	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9	
2	Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	11	

3.	Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	8	
4.	Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8	
5.	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8	
6.	Recent Trends: Speech Recognition and Translation, Multimodal System	3	

Text book and Reference books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security,
Addison Wesley.

Course Outcomes:

On completion of the course students will be able to

1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

Advanced Computer Architecture
Code: PEC-IT501B

Contacts: 3L

Name of the Course:	**Advanced Computer Architecture**	
Course Code: PEC-IT501B	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/ Unit
1	Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis (3L) Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models (3L)	6	
2.	Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow (3L) Network topologies-Static, Dynamic, Types of Networks (3L) RISC vs. CISC, Memory Hierarchy, Virtual Memory (4L)	10	
3	Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. (4L) Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message- passing (4L) Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining (4L)	12	
4	Array Processors- Structure, Algorithms (3L) Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations (4L) Parallel Programming Models, Languages, Compilers (4L)	11	

Text book and Reference books:

1. Computer Architecture and Parallel Processing- Kai Hwang and A. .Brigggs International Edition, McGraw Hill
2. Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson
3. Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

Computer Graphics
Code: PEC-IT501D
Contacts: 3L

Name of the Course:	**Computer Graphics**	
Course Code: PEC-IT501D	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/ Unit
1	**Introduction to computer graphics & graphics systems [6L**]: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. **Scan conversion [8L]:** Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.	14	
2	**2D transformation & viewing [15L]:** Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method 3D transformation & viewing [5L]: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.	20	

3.	**Curves [3L]:** Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. **Hidden surfaces [3L]:** Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame	6	
	methods , fractal - geometry. **Color & shading models [2L]:** Light & color model; interpolative shading model; Texture. **Introduction to Ray-tracing: [3L]** Human vision and color, Lighting, Reflection and transmission models.		

Text book and Reference books:

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

Constitution of India
Code: MC-IT501
Contacts: 3L

Name of the Course:	**Constitution of India**	
Course Code: MC-IT501	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		
Credit Points:	1	

Unit	Content	Hrs/Unit	Marks/ Unit
1	**Introduction:** Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	3	

2	**Union Government and its Administration :** Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha	6	
3.	**State Government and its Administration Governor:** Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	6	
4.	**Local Administration District's Administration head:** Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO	8	
	Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy		
5.	**Election Commission Election Commission:** Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

Text book and Reference books:

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti

Object Oriented Programming Lab
Code: PCC-IT594
Contacts: 4P

Name of the Course:	Object Oriented Programming Lab
Course Code: PCC-IT594	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Laboratory Experiments:
1. Assignments on class, constructor, overloading, inheritance, overriding 2. Assignments on wrapper class, arrays 3. Assignments on developing interfaces- multiple inheritance, extending interfaces 4. Assignments on creating and accessing packages 5. Assignments on multithreaded programming 6. Assignments on applet programming **Note: Use Java for programming**

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Operating System Lab
Code: PCC-IT593
Contacts: 4P

Name of the Course:	Operating System Lab
Course Code: PCC-IT593	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory:	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Laboratory Experiments:

1 1. **Managing Unix/Linux Operating System [8P]:**
Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions,
commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and
methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password
security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and
permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.
2. **Process [4P]**: starting new process, replacing a process image, duplicating a process image, waiting for a process,
zombie process.
3. **Signal [4P]**: signal handling, sending signals, signal interface, signal sets.

4. **Semaphore [6P]**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads [6P]**: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit,
pthread_attr_init, pthread_cancel)
6. **Inter-process communication [6P]**: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO),
message passing & shared memory(IPC version V).

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

SEMESTER-VI (Third Year)

Software Engineering
Code: PCC-IT601

Contacts: 3L

Name of the Course:	**Software Engineering**	
Course Code: **PCC-IT601**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: -		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	This course introduces the concepts and methods required for the construction of large software intensive systems	
2	It aims to develop a broad understanding of the discipline of software engineering.	
3	It seeks to complement this with a detailed knowledge of techniques for theanalysis and design of complex software intensive systems.	
4	It aims to set these techniques in an appropriate engineering and management context.	
5	It provides a brief account of associated professional and legal issues	
Pre-Requisites:		
1	Basic knowledge of Data structure, database and programming	

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.	6	
2	System Design – Context diagram and DFD, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.	6	
3	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.	10	
4	Software Project Management – Project Scheduling,	4	

	Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.		
5	Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram.	10	

Text book and Reference books:

1. Pressman, Software Engineering : A practitioner's approach– (TMH
2. Pankaj Jalote, Software Engineering- (Wiley-India)
3. Rajib Mall, Software Engineering- (PHI)
4. Agarwal and Agarwal, Software Engineering – (PHI)
5. Sommerville, Software Engineering – Pearson
6. Martin L. Shooman, Software Engineering – TMH

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify software Engineering problem specification, performance, maintenance and quality requirements
2	Select modern engineering tools necessary for software project management, time management and software reuse.
3	Analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project.
4	Distinguish different testing strategies and it's working.
5	Design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
6	Develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.

Software Engineering
LabCode: PCC-IT691

Contacts: 4P

Name of the Course:	**Software Engineering Lab**
Course Code: **PCC-IT691**	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective	
1	To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web

2	To present case studies to demonstrate the practical applications of different concepts
3	To provide a scope to the students where they can solve small, real life problems
Laboratory Experiments:	
1.	Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
2.	Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
3	Data Modeling – Use work products – data dictionary.
4	Software Designing - Develop use case diagrams and activity diagrams, build andtest class diagrams, sequence diagrams and add interface to class diagrams.
5	Prototype model – Develop the prototype of the product. The SRS and prototype model should be submitted for end

Any experiment specially designed based on the theory syllabus will be followed (Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	To handle software development models through rational method.
2	To prepare SRS document, design document, test cases and software configuration management and risk management related document
3	To Develop function oriented and object oriented software design using tools like rational rose.
4	To perform unit testing and integration testing.
5	To apply various white box and black box testing techniques.
6	Able to Plan a software engineering process life cycle.

Computer Networks
Code: PCC-IT602

Contacts: 3L

Name of the Course:	**Computer Networks**	
Course Code: **PCC-IT602**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: -		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	To develop an understanding of modern network architectures from a designand performance perspective.	

2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs)
3	To provide an opportunity to do network programming
4	To provide a WLAN measurement ideas
Pre-Requisites:	
1	Basic knowledge of fundamentals of computers

Unit	Content	Hrs/Unit	Marks/Unit
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum	8	
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA	6	
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols	8	
4	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	7	
5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	7	

Text book and Reference books:

1. "Computer Networks", by Andrew S. Tanenbaum, David J.Wetherall, Pearson Education, 5th ed., ISBN 978-81-317-8757-1
2. "Data Communications and Networking", by Behrouz A. Forouzan, McGraw Hill Education, 5th ed., ISBN 978-1-25-906475-3.
3. "Computer Networks", by Peterson, Davie 5th ed., Elsevier.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Explain the basics of computer networking, different network model and architecture
2	Analyze different networking functions and features for identifying optimal solutions
3	Apply different networking concepts for implementing network solution
4	Evaluate and implement routing algorithms for implanting solution for the real life problems
5	Develop implement model of fault tolerant computer networks

Computer Networking Lab
Code: PEC-IT692

Contacts: 4P

Name of the Course:	**Computer Networking Lab**
Course Code:**PEC-IT692**	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objectives:	
1	To learn about simulation tools
2	To study networking device, command and configuration
3	Study of IP addresses
4	To learn configure of the network topology using Packet tracer software
5	To learn about socket programming
Pre-Requisite:	
1	Knowledge of C programming
Laboratory Experiments:	

1) Cisco Packet Tracer installation.
2) To study basic networking devices, commands and configuration
3) Familiarization with
   a) Networking cables (CAT5, UTP)
   b) Connectors (RJ45, T-connector)
   c) Hubs, Switches
4) Simulation of basic Networking Commands
5) Understanding of IP addresses and subnet mask
6) Configuration of the network topology using packet tracer software
7) TCP/UDP Socket Programming
   a) Simple, TCP based, UDP based
   b) Implementation of a Prototype Multithreaded Server

Any experiment specially designed based on the theory syllabus will be followed

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understanding of network simulation tool
2	Ability to understanding the networking device, network command and configuration
3	Ability to simulate network topology using packet tracer software
4	The ability to do socket programming

Compiler Design
Code: PEC-T601A

Contacts: 3L

Name of the Course:	**Compiler Design**	
Course Code: **PEC-IT601A**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: -		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	To understand and list the different stages in the process of compilation.
2	Identify different methods of lexical analysis
3	Design top-down and bottom-up parsers
4	Identify synthesized and inherited attributes
5	Develop syntax directed translation schemes
6	Develop algorithms to generate code for a target machine
Pre-Requisites:	
1	Basic knowledge of data structure and programming

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Compiling** Compilers, Analysis of the source program, The phasesof the compiler, Cousins of the compiler	2	
2	**Lexical Analysis** The role of the lexical analyzer, Tokens, Patterns,Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).	5	

3	**Syntax Analysis** The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.	6	
4	**Syntax directed translation** Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	**Type checking** Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	2	
6	**Run time environments** Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5	
7	**Intermediate code generation** Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples)	4	
8	**Code optimization** Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.	4	
9	**Code generations** Issues in the design of code generator, a simple code generator, Register allocation & assignment	3	

Text book and Reference books:

1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” - PHI.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the fundamental idea of compiler and the constituent as well as the different phases of designing a compiler with compile time error handling.
2	Understand a given grammar specification to develop the lexical analyzer

3	To compare syntactic and semantic analysis process of designing compilers.
4	Design a given parser specification design top-down and bottom-up parsers
5	Develop syntax directed translation schemes and the intermediate code generation principles
6	Apply optimization algorithms to generate code for a target machine

Compiler Design Lab
Code: PEC-IT691A

Contacts: 4P

Name of the Course:	**Compiler Design Lab**	
Course Code:**PEC-IT691A**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme:		
Theory: -	Continuous Internal Assessment	
Tutorial: NIL	External Assesement:60	
Practical: 4 hrs./week	Distribution of marks:40	
Credit Points:	2	
Objectives:		
1	To be exposed to compiler writing tools.	
2	To learn to implement the different Phases of compiler	
3	To familiar with control flow and data flow analysis	
4	To learn simple optimization techniques	
Pre-Requisite:		
1	Knowledge of C programming	
Laboratory Experiments:		
1. Implementation of Symbol Table 2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.) 3. Implementation of Lexical Analyzer using Lex Tool 4. Generate YACC specification for a few syntactic categories. a) Program to recognize a valid arithmetic expression that uses operator +, – , * and /. b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits. c) Implementation of Calculator using LEX and YACC		

5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies (Heap,Stack,Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.
11. Implementation of Simple Code Optimization Techniques (Constant Folding., etc.)

Any experiment specially designed based on the theory syllabus will be followed (Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Apply the knowledge of lex tool & yacc tool to develop a scanner & parser.
2	Design & conduct experiments for NFA and DFA from a given regular expression
3	Develop program for implementing symbol table and parser problems
4	Create program for intermediate code generation
5	Learn & use the new tools and technologies used for designing a compiler
6	Apply the knowledge of patterns, tokens & regular expressions in programming for solving a problem in the field of data mining

Distributed Systems
Code: PEC-IT601B

Contacts: 3L

Name of the Course:	**Distributed Systems**
Course Code: **PEC-IT601B**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3

Objective:

1	To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems

Pre-Requisite:

1	Database Management Systems		
Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	**INTRODUCTION** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts **DISTRIBUTED DATABASE MANAGEMENT SYSTEM** **ARCHITECTURE** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	6	
2	**DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic IntegrityControl **QUERY PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	8	
3	**DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralizedquery optimization; Ordering of fragment queries;Distributed query optimization algorithms **TRANSACTION MANAGEMENT** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models **CONCURRENCY CONTROL** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlockmanagement	8	
4	Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm	5	
5	**PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing	5	
6	**ADVANCED TOPICS** Mobile Databases, Distributed Object Management, Multi-databases	4	

Text book and Reference books:

1. Principles of Distributed Database Systems, M.T. Ozsu and PValduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Explain the distributed systems architecture.
2	Outline the inter process communication in distributed systems.
3	Explain the file accessing model and various services in distributed system.
4	Demonstrate concurrency control and properties of transaction in Distributed systems.
5	Discuss resource and process management in distributed system
6	

Distributed System Lab
Code: PEC-IT691B

Contacts: 4P

Name of the Course:	**Distributed System Lab**
Course Code: **PEC-IT691B**	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective:	
1	To experience with basic techniques in the design and development ofDistributed Systems
2	To understanding solutions of the fundamental problems in distributed systems like mutual exclusion, deadlock detection, termination detection, RPC, RMI,OPENMP, MPI and CORBA
Laboratory Experiments:	
1.	To Simulate the functioning of Lamport's Logical clock in 'c'.
2.	To Simulate the functioning of Lamport's Vector clock in 'c'.
	To Simulate the Distributed Mutual exclusion in 'c'.
	To Simulate the Non Token/ Token based algorithm in Distributed system.
	To Simulate the Distributed Deadlock Detection algorithm-Edge chasing
	To Implement 'RPC' mechanism for accessing methods of remote systems.
	To Implement 'Java RMI' mechanism for accessing methods of remote systems.
	To implement CORBA mechanism by using C++ program at one end and JavaProgram on the other
	Experiment with the application programming interface OpenMP which supports multi-platform shared-memory and multiprocessing programming in C
	Experiment with Message Passing Interface Standard (MPI).

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Apply knowledge of distributed systems techniques and methodologies.
2	Explain the design and development of distributed systems and distributed systems applications.
3	Use the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.
4	Discuss the design and testing of a large software system, and to be able to communicate that design to others.

Image Processing
Code: PEC-IT601C
Contacts: 3L

Name of the Course:	**Image Processing**
Course Code: **PEC-IT601C**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To become familiar with digital image fundamentals
2	To get exposed to simple image enhancement techniques in Spatial andFrequency domain.
3	To learn concepts of degradation function and restoration techniques.
4	To study the image segmentation and representation techniques.
5	To become familiar with image compression and recognition methods
Pre-Requisite:	
1	Basic knowledge of mathematics and programming

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction**: Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	6	
2	**Digital Image Formation**: A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling &	4	

	Quantization - Uniform & Non uniform.		
3	**Mathematical Preliminaries:** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform.	6	
4	**Image Enhancement:** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement - Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8	
5	**Image Restoration**: Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	7	
6	**Image Segmentation:** Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	7	

Text book and Reference books:

1. Gonzalez & Woods, —Digital Image Processing‖, 3rd ed., Pearson education, 2008
2. Jain Anil K., —Fundamentals Digital Image Processing‖, Prentice Hall India, 2010
3. Milan Sonka, Vaclav Hlavav, Roger Boyle, —Image Processing, Analysis and Machine Vision‖, 2nd ed., Thomson Learning, 2001
4. Rangaraj M. Rangayyan, —Biomedical Image Analysis‖, CRC Press, 2005
5. Pratt W.K, —Digital Image Processing‖, 3rd ed., John Wiley & Sons, 2007
6. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define the fundamentals of digital image processing terminologies and features of images
2	Relate the mathematical foundations with image transformation, enhancement, segmentation andanalysis.
3	Implement algorithms on enhancement and restoration on image data

4	Measure performance of image processing algorithms in providing solutions to real life problems
5	Build image processing systems to solve real world problems of image processing
6	Design solutions for various applications in different subject domains

Image Processing Lab

Code: PEC-IT691C

Contacts: 4P

Name of the Course:	**Image Processing Lab**
Course Code: **PEC-IT691C**	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective:	
1	To understand the fundamental concepts of digital signal processing and Image processing.
2	To explore DFT for 1-D and 2-D signal and FFT for 1-D signal
3	To apply processing techniques on 1-D and Image signals.
4	To apply digital image processing techniques for edge detection
Laboratory Experiments:	
1	Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2	Implementation of Relationships between Pixels
3	Implementation of Transformations of an Image
4	Contrast stretching of a low contrast image, Histogram, and HistogramEqualization
5	Display of bit planes of an Image
6	Display of FFT(1-D & 2-D) of an image
7	Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8	Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9	Implementation of image sharpening filters and Edge Detection using GradientFilters
10	Image Compression by DCT,DPCM, HUFFMAN coding
11	Implementation of image restoring techniques
12	Implementation of Image Intensity slicing technique for image enhancement
13	Canny edge detection Algorithm

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the fundamental concepts of image processing
2	Identify image transformation to transform images into different domains
3	Apply image enhancement and restoration in images of different domains
4	Implement image segmentation and classification for automated identification of objects
5	Categorize different feature extraction techniques for image analysis and recognition
6	Design image processing systems to solve real world problems of image processing

Artificial Intelligence
Code: PEC-IT602A

Contacts: 3L

Name of the Course:	**Artificial Intelligence**
Course Code: **PEC-IT602A**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To understand the definition of artificial intelligence
2	To understand the different faculties involved with intelligent behavior
3	To examine the different ways of approaching AI
4	To look at some example systems that use AI
5	To have a fair idea of the types of problems that can be currently solved by computers and those that are as yet beyond its ability.

Pre-Requisite:	
1	Basic knowledge of Probability, statistics, automata and languages, andprogramming

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction:** Overview of Artificial intelligence-Problems of AI, AI technique, Tic - Tac - Toe problem. **Intelligent Agents:** Agents & environment, nature ofenvironment, structure of agents, goal based agents,utility based agents, learning agents. **Problem Solving:** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6	
2	**Search techniques:** Solving problems by searching:	13	

	problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. **Heuristic search strategies:** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. **Adversarial search:** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.		
3	**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	3	
4	**Using predicate logic:** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. **Probabilistic reasoning:** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6	
5	**Natural Language processing:** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning:** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. **Expert Systems:** Representing and using domain knowledge, expert system shells, knowledge acquisition.	8	

Text book and Reference books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand knowledge of the building blocks of AI as presented in terms of intelligent agents.
2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3	Understand and Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
4	Understand and Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
5	Formulate and solve problems with uncertain information using Bayesian approaches.
6	Apply concept Natural Language processing to problems leading to understanding of cognitive computing.

Internet of Things
Code: PEC-IT602B
Contacts: 3L

Name of the Course:	**Internet of Things**	
Course Code: **PEC-IT602B**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	To understand the application areas of IOT
2	To realize the revolution of Internet in Mobile Devices, Cloud & SensorNetworks
3	To understand building blocks of Internet of Things and characteristics
Pre-Requisite:	
1	Basic knowledge of computer networking, data processing and electronics sensors

Unit	Content	Hrs/Unit	Marks/Unit
1	Internet: An Overview: Introduction, History of Internet, Internet Technology, Towards the IoT Universe(s), Classification of Internet, Topologies, Applications, Basics of Internet, Internet of Things Vision, The Internet of Things Today Internet of Things and Related Future Internet Technologies	6	
2	Elements of IoT: Communication, Sensing, Actuation,	6	

	I/O interfaces. Internet of Things: An overview, Introduction, Characteristics, Smart devices, IoT as a Network of Networks, IoT architecture, IoT developments, Smart Technology, Smart environment. IoT Components, Basic Principles, Embedded technology Vs IoT, Sensors, Wireless sensor networks, Aurdino, Rasberry Pi		
3	Internet Communication Technologies, Networks and Communication , Current trends in Internet: Internet of everything, Internet of everything, Internet of things, Storage, Databases Data Management , IoT Related Standardization , Protocol M2M Service Layer Standardization, OGC Sensor Web for IoT, IEEE and IETF, ITU-T, Communication protocols, Types of communication protocols, Communication Protocols-MQTT, ZigBee, Bluetooth, Communication Protocols-CoAP, UDP, TCP Addressing Schemes, M2M Service Layer Standardization	8	
4	Cloud Technology: Introduction, Overview, Why cloud ? How to implement cloud? Usage of cloud, Scalable Computing, Cloud computing, Characteristics of cloud computing, Classifications, Virtual machines,	6	
5	Virtualization technology, Models of distributed and cloud computing, Distributed computing, Clustering computing Grid computing, Service oriented Architecture. Implementations of Cloud computing.	4	
6	Protection & Security: Goals of protection and security, security attacks Device data storage- Unstructured data storage oncloud/local server, Authentication, authorization of devices	3	
7	**IoT Case Studies**: IoT case studies based on Industrial automation, Transportation **IoT Case Studies:** Agriculture, Healthcare, Home Automation	3	

Text book and Reference books:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, SpringerInternational Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define basic topology of IoT
2	Analyze the components and methods of data acquiring, organizing and analytics for IoT applications
3	Interpret models of distributed and cloud computing.
4	Compare different Application protocols for IoT.
5	Infer the role of Security in IoT.
6	Judge the applications of IoT.

Natural Language Processing
Code: PEC-IT602C
Contacts: 3L

Name of the Course:	**Natural Language Processing**
Course Code: PEC-IT602C	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	**Regular Expressions and AutomataRecap) -** Introduction to NLP, Regular Expression, Finite State Automata [2L] **Tokenization -** Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance [5L] **Morphology -** Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer [4L]	11	
2	**Language Modeling** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of	8	

	language models. [4L] **Hidden Markov Models and POS Tagging** Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation. [4L]		
3	**Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L] **Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L]	9	
4.	**Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L] **Information Retrieval** Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback [5L]	9	

Text book and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press 3.Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.

Machine Learning
Code: PEC-IT602D
Contacts: 3L

Name of the Course:	**Machine Learning**	
Course Code: **PEC-IT602C**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	To learn the concept of how to learn patterns and concepts from data without being explicitly programmed	
2	To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.	
3	To explore supervised and unsupervised learning paradigms of machinelearning.	
4	To explore Deep learning technique and various feature extraction strategies.	
Pre-Requisite:		
1	Must be comfortable with variables, linear equations, graphs of functions, histograms, and statistical means.	
2	Should have some experience programming in Python	
3	Basic knowledge of statistics and mathematics	

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	**Supervised Learning (Regression/Classification)** Basic methods: Distance-based methods, Nearest-Neighboures, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	7	
2	**Unsupervised Learning** Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)	4	
3	Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6	
4	Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	6	

5	Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	8	
6	Recent trends in various learning techniques ofmachine learning and classification methods	5	

Text book and Reference books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Develop an appreciation for what is involved in Learning models from data
2	Understand a wide variety of learning algorithms
3	Understand how to evaluate models generated from data
4	Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Big Data Analytics
Code: OEC-IT601A

Contacts: 3L

Name of the Course:	**Big Data Analytics**
Course Code: **OEC-IT601A**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To understand the big data for business intelligence.
2	To Learn business case studies for big data analytics.
3	To understand Nosql big data management.
4	To perform map-reduce analytics using Hadoop and related tools
Pre-Requisite:	
1	Should have knowledge of one Programming Language, SQL (queries and sub queries), exposure to Linux Environment.

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics	6	
2	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	6	
3	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based datastructures	7	

4	MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map- reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, outputformats	8	
5	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data	5	
	model, Cassandra examples, Cassandra clients, Hadoop integration.		
6	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	4	

Text book and Reference books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010. 10. Alan Gates, "Programming Pig", O'Reilley, 2011.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify Big Data and its Business Implications.
2	List the components of Hadoop and Hadoop Eco-System
3	Access and Process Data on Distributed File System
4	Manage Job Execution in Hadoop Environment
5	Develop Big Data Solutions using Hadoop Eco System
6	Analyze Infosphere BigInsights Big Data Recommendations.

Cyber Law & Ethics
Code: OEC-IT601B

Contacts: 3L

Name of the Course:	**Cyber Law & Ethics**
Course Code: **OEC-IT601B**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To explore the technical, legal, and social issues related to cybercrimes, Laws Cyber Ethics.
2	It is also required to have knowledge of Cyber Ethics and its role and significance
Pre-Requisite:	
1	Basic knowledge of internet, fundamentals of computer and laws

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	**Introduction of Cybercrime**: What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion. Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cyber stalking.	8	
2	**Cybercrime Mobile & Wireless devices**: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop	8	
3	**Tools and Methods used in Cyber crime**: Proxyservers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.	8	
4	**Phishing & Identity Theft**: Phising methods, ID Theft; Online identity method. Cybercrime & Cybersecurity:Legal aspects, Indian laws, IT act, Public key certificate.	8	
5	**International Laws governing Cyber Space**: Introduction to International Cyber Law, UNCITRAL, and Cyber Laws: Legal Issues and Challenges in India, Net neutrality, Role of INTERPOL.	4	
6	**Cyber Ethics:** The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.	4	

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India
2. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
3. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
4. Information Security policy & Implementation Issues, NIIT, PHI
5. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
6. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
7. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
8. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, NewYork, (2011)
9. Information Technology Act, 2000, S. R. Bhansali,, University Book House Pvt.Ltd., Jaipur (2003).
10. Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2	Locate and apply case laws and common laws to current legal dilemmas in the technology field
3	Apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4	Regulation of cyber space at national and international level.
5	Upholding ethical standards in cyber laws and intellectual property issues118

Mobile Computing
Code: OEC-IT601C

Contacts: 3L

Name of the Course:	**Mobile Computing**
Course Code: **OEC-IT601C**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	Discuss different QoS factors over wired and wireless channels in respect to the mobile Computing
2	Illustrate the basic architecture of cellular communication
3	Explain different factors to enhance the capacity of the cellular network indifferent generations.
4	Explain the issues related to Satellite systems, Virtual Networks like Bluetooth
5	Discuss the security issues and protection techniques in different MobileNetworks

Pre-Requisite:	
1	Concept of Computer Networks

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signaling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.	5	
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.	5	
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	7	
4	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G	7	

5	Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.	7	
6	Server-side programming in Java, Pervasive web application architecture, Device independent example application	5	

Text book and Reference books:

1. Pervasive Computing, Burkhardt, Pearson
2. Mobile Communication, J. Schiller, Pearson
3. Wireless and Mobile Networks Architectures, Yi-Bing Lin & Imrich Chlamtac, John Wiley& Sons, 2001
4. Mobile and Personal Communication systems and services, Raj Pandya, Prentice Hall of India, 2001.
5. Guide to Designing and Implementing wireless LANs, Mark Ciampa, Thomson learning, Vikas Publishing House, 2001
6. Wireless Web Development, Ray Rischpater, Springer Publishing,
7. The Wireless Application Protocol, Sandeep Singhal, Pearson .
8. Third Generation Mobile Telecommunication systems, by P.Stavronlakis, Springer Publishers

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Discuss different QoS factors over wired and wireless channels in respect to mobile computing
2	Illustrate the basic architecture of cellular communication
3	Demonstrate the different technologies behind mobility in Cellular Communication
4	Understand the characteristics and limitations of mobile hardware devices including their user-interface modalities
5	Analyze the security issues in different Mobile Networks

Bioinformatics
Code: OEC-IT601D

Contacts: 3L

Name of the Course:	**Bioinformatics**
Course Code: **OEC-IT601D**	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3
Objective:	

1	To provide the basic knowledge of molecular biology, interdisciplinary knowledge required in bioinformatics to the students having background incomputer science and engineering
2	To make the students familiar with the use of a wide variety of biological databases/structures and to enable them to extract relevant information using appropriate algorithms
3	To equip the students with computational intelligence techniques so that they are able to do research in computational biology and R&D in biotechnological industry and medicine.
Pre-Requisite:	
1	Design & of Analysis of Algorithms, Data Structure, Machine Learning

Unit	Content	Hrs/Unit	Marks/Unit
1	**INTRODUCTION TO MOLECULAR BIOLOGY** Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways	5	
2	**Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	2	
3	**DNA SEQUENCE ANALYSIS** DNA Mapping and Assembly: Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.	14	
4	**Introduction Probabilistic models used in Computational Biology** Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics	9	

5	**Biological Data Classification and Clustering** Assigning protein function and predicting splice sites: Decision Tree	6	

Text book and Reference books:

1. Claverie, J.M. and Notredame C. 2003 Bioinformatics for Dummies. Wiley Editor
2. Letovsky, S.I. 1999 Bioinformatics. Kluwer Academic Publishers.
3. Baldi, P. and Brunak, S. 2001 Bioinformatics: The machine learning approach,The MIT Press
4. Fogel, G.B. and Corne, D.W., 1997 Evolutionary Computation in Bioinformatics.
5. Rastogi et al 2003. Bioinformatics: Concepts, Skills and Applications. CBS
6. Rashidi and Buchler 2000. Bioinformatics Basics. CRC Press

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understanding the methodologies used for database searching, and determining the accuracies of database search.
2	Application of probabilistic model to determine important patterns.
3	Determine the protein function from sequence through analyzing data
4	Optimization of weights in a supervised and unsupervised neural network, and application of supervised learning to predict sub- cellular localization of a protein.
5	Analysis and development of models for better interpretation of biological data to extract knowledge.
6	Application of stochastic context-free grammar (SCFG) to predict RNA secondary structure.

Robotics

Code: OEC-IT601E

Contacts: 3L

Name of the Course:	**Robotics**		
Course Code: **OEC-IT601E**	Semester: VI		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	To impart knowledge about the engineering aspects of Robots and their application		
Pre-Requisite:			
1	Basic knowledge on AI, mathematics and programming		
Unit	**Content**	**Hrs/Unit**	**Marks/Unit**

1	Introduction, Brief history, types, classification and usage (basic concept), Science and Technology of robots, Interdisciplinary Areas in robotics, Applications and advantages of Robots	2	
2	Various components of Robotic System: Links and Joints, End-effecter/Gripper, Drive/Actuator, Controller, Sensor,Connectivity/degrees of freedom of a joint, Joints with one, two and three Degrees of freedom: Prismatic joint, Revolute joint, spherical Joint/Ball and Socket joint, Hooke/Universal Joint, Linear Joint and Rotary joint, Representation of joints, Degrees of freedom (DOF) of a System, Finding mobility/DOF of spatial and planar manipulators, Serial and Parallel manipulators, Grubler's criteria, numerical examples	3	
3	Classification of Robot: Point-to-point robots and Continuous Path robots, Non-servo controlled robots and servo controlled robots, Cartesian coordinate robots, cylindrical coordinate robots, polar coordinate robots and articulated coordinate robots, Robots with fixed base and mobile robots, Workspace of manipulators, Definition of Resolution, accuracy and repeatability, Types of robot end-effectors/grippers: single and	5	
	double gripper, internal and external gripper, hard and soft gripper, active and passive gripper,Robot teaching: Online and offline method, Specification of a Robot, Economic Analysis: Pay-back period, rate of return or investment, Numerical examples		
4	Representation of an object in 3d space, position, orientation, Frame Transformations: Translation and rotation of a frame, Homogeneous transformation, Roll, pitch and yaw angles, Euler angles, numerical examples, Denavit-Hartenberg Notations and rules to assign coordinate system at different joints, Link and joint parameters, Offset of link and joint angle, Rules for coordinate assignment, Forward and inverse kinematics problems, examples of Kinematics, Link representation using D-H parameters, Examples of D-H parameters and link transforms	8	
5	Trajectory Planning: cartesian scheme, Joint Space Scheme, Polynomial and Linear Trajectory functions with numerical examples, angular velocity, Singularity checking through jacobian	3	
6	Forward and Inverse Dynamics, inertia tensor, Moment of inertia,Lagrange-Euler formulation, Determination of potential and kinetic energy of the manipulator, Determination of Robotic joint torques	4	
7	Partitioned control scheme, control of motor, control architecture,Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes	4	
8	Robot vision: Steps to be followed, frame grabbing, methods of pre-processing: masking, neighborhood averaging, median filtering, edge detection, boundary descriptors, Robot motion planning: visibility graph, Voronoi Diagram, Intelligent robot	5	

Text book and Reference books:

1. King Sun Fu, Ralph Gonzalez, and CS George Lee. Robotics: Control Sensing. Vis. Tata McGraw-Hill Education, 1987.
2. Mark W.Spong, Seth Hutchinson, and MathukumalliVidyasagar. Robot modelingand control. Vol. 3. New York: Wiley, 2006.
3. H. R. Everett, Sensors for moblle robots. AK Peters/CRC Press, 1995.
4. UlrichNehmzow, Mobile robotics: a practical introduction. Springer Science & Business Media, 2012.
5. Ashitava Ghosal, Robotics: fundamental concepts and analysis. Oxford universitypress, 2006.
6. Subir KumarSaha,. Introduction to robotics. Tata McGraw-Hill Education, 2014.
7. R. K.Mittal, and I. J. Nagrath. Robotics and control. Tata McGraw-Hill, 2003.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the importance of robotics, and comprehend the basic terminologies in robotics
2	Comprehend and evaluate the forward and inverse kinematics of robots
3	Comprehend and evaluate the differential motion and velocity relationships for robots
4	Develop dynamic equations of motion and discuss methods of trajectory planning.

Project-I

Code: PROJ-IT691

Contacts: 6L

Name of the Course:	**Project-I**	
Course Code: **PROJ-IT691**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: NIL		Mid Semester exam:
Tutorial: NIL		Assignment and Quiz:
		Attendance:
Practical: 6Hrs./week		End Semester Exam:
Credit Points:		3
Objectives and detailed process:		
1	The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.	

2	The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include: 1. In depth study of the topic assigned in the light of the Report prepared underEC P1; 2. Review and finalization of the Approach to the Problem relating to theassigned topic; 3. Preparing an Action Plan for conducting the investigation, including teamwork; 4. Detailed Analysis/ Modeling/ Simulation/ Design/ Problem Solving/Experiment as needed; 5. Final development of product/process, testing, results, conclusions andfuture directions; 6. Preparing a paper for Conference presentation/Publication in Journals, if possible; 7. Preparing a Dissertation in the standard format for being evaluated by the Department. 8. Final Seminar Presentation before a Departmental Committee.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the problem
2	Compare existing literature.
3	Design experimental set-up and methodology
4	Apply modern tools
5	Analyze data
6	Develop valid conclusions & recommendations

SEMESTER-VII (Fourth Year)

Internet & Web Technology
Code: PCC-IT701

Contacts: 3L

Name of the Course:	**Internet & Web Technology**
Course Code: **PCC-IT701**	Semester: VII
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3

Objectives:

1	Describe the concepts of WWW including browser and HTTP protocol.
2	List the various HTML tags and use them to develop the user friendly webpages.
3	Define the CSS with its types and use them to provide the styles to the web pages at various levels.
4	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
5	Use the JavaScript to develop the dynamic web pages.
6	Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
7	Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

Pre-Requisites:

1	Basic knowledge of data structure, database and programming

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	**Introduction to Internet Technology:** Overview, Network of Networks, Intranet, Extranet and Internet, World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. **Review of TCP/IP**: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. **IP Subnetting and addressing**: Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables, Internet Routing Protocol .Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail POP3, SMTP.	6	

2	**HTML, Image Maps, XML, CGI Scripts:** Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value, map, area, attributes of image area. Extensible Markup Language, Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. Introduction, Environment Variable, GET and POST Methods	9	
3	**Perl, Java Script, Java applets:** Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Definition of cookies, Create and Store a cookie with example. Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.	10	
4	**Client-Server programming In Java Threats, Network Security techniques:** Java Socket, Java RMI, Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial ofservice attacks. Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH), Introduction, Packet filtering, Stateful, Application layer, Proxy	4	
5	**Internet Telephony, Multimedia Applications, Multimedia Applications:** Introduction, VoIP. Multimedia Applications **Multimedia over IP**: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	5	

Text book and Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define the principal of Internetworking, TCP/IP protocols, World Wide Web, client-serverarchitecture, IP addressing, routing etc.

2	Explain the need for secured web application development with client-side, server-side scripting languages.
3	Construct web programs using the web languages--HTML, XML, JavaScript, Applet, Perl, etc.
4	Design and Develop small interactive websites using modern tools following the professional web based engineering solutions, ethics and management techniques.
5	Explain the advanced technologies like network security, multimedia applications, search engine, web crawler, etc with the websites.

Multimedia Technology
Code: PEC-IT702A
Contacts: 3L

Name of the Course:	**Multimedia Technology**
Course Code: **PEC-IT702A**	Semester: VII
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:

1	To enable graduates to excel in multimedia technology and information technology profession by adapting to rapid advances in newer technologies.
2	To provide graduates a proper foundation in mathematical, scientific, multimediaand engineering fundamentals to solve real world problems.
3	To train graduates with good scientific, multimedia technologies and solve realtime problems.

Pre-Requisite:

1	The fundamentals of computer

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Introduction:** Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications	2	
2	**Text and Audio, Image and Video:** Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI **Image**: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.	14	

3	**Synchronization, Storage models and Access Techniques:** Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, CCD, Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	8	
4	**Image and Video Database, Document Architecture and Content Management:** Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing, Content Design and Development, General Design Principles **Hypertext**: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications of Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC **Problems**: Reader's & Writer Problem, Dinning Philosopher Problem etc.	8	
5	**Multimedia Applications:** Interactive television, Video-on- demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors	4	

Text book and Reference books:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. Nalin K. Sharda , Multimedia Information System , PHI.
3. Zred Halsall , Multimedia Communications , Pearson Ed.
4. Koegel Buford , Multimedia Systems , Pearson Ed.
5. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
6. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- MediaCoding and Content Processing , PHI.
7. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand the policy issues related to privacy, intellectual property rights, and establishing identity those are germane to electronic commerce along with the Internet and related technologies
2	Comprehend the underlying economic mechanisms and driving forces of E-Commerce
3	Analyse the impact that electronic commerce is facing and outlines the different digital transaction

	process and basic concepts of e-commerce
4	Identify the importance of digital library and specify the development of electronic commerce capabilities in a company
5	Appraise the opportunities and potential to apply and synthesize a variety of e Commerce concepts and solutions to create business value for organizations, customers, and business partners.
6	To gain knowledge of the ethical, social, and security issues of information systems

Information Theory and Coding
Code: PEC-IT702B
Contacts: 3L

Name of the Course:	**Information Theory and Coding**	
Course Code: **PEC-IT702B**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	To develop an understanding of modern network architectures from a design and performance perspective.
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3	To provide an opportunity to do network programming
4	To provide a WLAN measurement ideas.
Pre-Requisite:	
1	Basic knowledge of statistics and mathematics

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Source Coding** Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes	5	
2	**Channel Capacity And Coding** Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	5	
3	**Linear And Block Codes For Error Correction** Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4	**Cyclic Codes** Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.	5	

5	**BCH Codes** Primitive elements, minimal polynomials, generator polynomialsin terms of minimal polynomials, examples of BCH codes.	6	
6	**Convolutional Codes** Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	7	

Text book and Reference books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Design the channel performance using Information theory.
2	Comprehend various error control code properties
3	Apply linear block codes for error detection and correction
4	Apply convolution codes for performance analysis & cyclic codes for error detection and correction.
5	Design BCH & RS codes for Channel performance improvement against burst errors

Cyber Security
Code: PEC-IT702C
Contacts: 3L

Name of the Course:	**Cyber Security**	
Course Code: **PEC-IT702C**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	To introduce the fundamentals of science and engineering concepts essential for a computer engineer.
2	To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving.
3	To provide knowledge in computer systems and professional skills in prevention, investigation and alleviate the cyber-attacks.
4	To impart knowledge to analyze, design, test and implement software required for various applications.
5	To hone personality skills, trigger social commitment; inculcate societalresponsibilities and implementation of best security practices.
Pre-Requisite:	
1	Basic knowledge of computer networking and security

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Introduction**: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications.	6	
2	**Hackers and Cyber Crimes**: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7	
3	**Ethical Hacking and Social Engineering**: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modeling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defense Strategies.	8	
4	**Cyber Forensics and Auditing**: Introduction to Cyber	10	

	Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, and Collecting Network based Evidence, Writing Computer Forensics Reports, and Auditing; Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013		
5	**Cyber Ethics and Laws**: Introduction to Cyber Laws, E- Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	5	

Text book and Reference books:

1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security and Cyber Laws, Pankaj Agarwal
3. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press
4. Nina Godbole, SumitBelapure, Cyber Security, Willey
5. Hacking the Hacker, Roger Grimes, Wiley
6. Cyber Law By Bare Act, Govt Of india, It Act 2000

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify vulnerabilities critical to the information assets of an organization
2	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
3	Apply critical thinking and problem-solving skills to detect current and future attacks on an organization's computer systems and networks.
4	Develop policies and procedures to manage enterprise security risks
5	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training
6	Apply business principles to analyze and interpret data for planning, decision-making, and problem solving in an information security environment

Cloud Computing
Code: PCC-IT702D
Contacts: 3L

Name of the Course:	**Cloud Computing**
Course Code: **PCC-IT702D**	Semester: VII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks

		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	The course provides a unified and fundamental view of the broad field of computer networks.	
2	The easy to understand and extremely relevant world of Computer Net workingis introduced in a top down Approach.	
3	Introduction to intranets and intranet servers and browsers, networks andnetwork servers, LANs/WANs, internetworking technologies, the OSI reference model for networking protocols, CSMA/CD, TCP/IP implementation	
Pre-Requisite:		
1	Basic knowledge of computer networking	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Definition of Cloud Computing and its Basics:** Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)	9	
2	**Use of Platforms in Cloud Computing** Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization(access, application, CPU, storage), Mobility patterns(P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types,	12	

	VMware vSphere Machine Imaging (including mentionof Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance,Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services,		
3	**Cloud Infrastructure**: Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)	7	
4	**Concepts of Services and Applications :** Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service	8	

	Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services		

Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2	Explain the key and enabling technologies that help in the development of cloud.
3	Apply NIST cloud computing architecture to solve architecture design challenges
4	Explain the core issues of cloud computing such as resource management and security.
5	Apply current cloud technologies.
6	Illustrate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

Operations Research
Code: OEC-IT701A

Contacts: 3L

Name of the Course:	**Operation Research**
Course Code: **OEC-IT701A**	Semester: VII
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	This module aims to introduce students to use quantitative methods and techniques for effective decisions–making; model formulation and applicationsthat are used in solving business decision problems.
2	Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments.

Pre-Requisite:	
1	Basic knowledge of mathematics

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non- degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	17	
2	Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock	9	
3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5	
4	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5	

Text book and Reference books:

1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", CentralBook Agency
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Solve Linear Programming Problems
2	Identify and develop operational research models from the verbal description of the real system
3	Solve Transportation and Assignment Problems
4	Understand the usage of game theory and Simulation for Solving Business Problems
5	Develop operational research models from the verbal description of the real system.

Introduction to Philosophical Thoughts
Code: OEC-IT701B
Contacts: 3L

Name of the Course:	**Introduction to Philosophical Thoughts**	
Course Code: **OEC-IT701AB**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	After taking this class, the students should have a good preliminary understanding of the scope and method of academic analytic philosophy, and they should also have a basic understanding of what makes for a good philosophical argument.	
2	This class also fulfills a writing requirement, so the students should come out of ithaving improved their understanding of what makes for clear and convincing writing.	
3	Students in this particular course will explore fundamental philosophical conceptsand learn to deploy a variety of philosophical methods to resolve issues that arise in thinking about reality, knowledge, morality, religion, and logic.	
Pre-Requisite:		
1	Basic knowledge of human thoughts and philosophy	

Unit	Content	Hrs/ Unit	Marks/ Unit

1	**Nature of Indian Philosophy:** Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna	13	
2	**Carvaka school:** its epistemology, metaphysics and ethics.Mukti	8	
3	**Jainism:** Concepts of sat, dravya, guna, paryaya, jiva, ajiva,	5	
	anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.		
4	**Buddhism:** theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika	5	
5	**Nyaya:** theory of Pramanas; the individual self and its liberation; the idea of God and proofs for His existence.	5	

Text book and Reference books:

1. M. Hiriyanna: Outlines of Indian Philosophy.
2. C.D.Sharma: A Critical Survey of Indian Philosophy.
3. S.N.Das Gupta: A History of Indian Philosophy Vol – I to V.
4. S.Radhakrishnan: Indian Philosophy Vol – I & II.
5. T.R.V.Murti: Central Philosophy of Buddhism.
6. J.N.Mahanty: Reason and Tradition of Indian Thought.
7. R.D.Ranade: A Constructive Survey of Upanisadic Philosophy.
8. P.T.Raju: Structural Depths of Indian Thought.
9. K.C.Bhattacharya: Studies in Philosophy Vol – 1.
10. Datta and Chatterjee: Introduction of Indian Philosophy

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe and distinguish key ethical concepts.
2	Read and comprehend philosophical texts, classical or contemporary, in the area of ethics.
3	Discuss core ethical problems, such as whether religion is a source of values
4	Write clear and concise explanations and arguments about basic ethical problems.
5	Distinguish the basic ethical theories and approaches
6	Apply basic ethical concepts and approaches to solving practical problems in ethics

Soft Skill & Interpersonal Communication
Code: OEC-IT701C
Contacts: 3L

Name of the Course:	**Soft Skill & Interpersonal Communication**
Course Code: **OEC-IT701C**	Semester: VII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To acquire the knowledge of Phonetics and Phonemic sounds.
2	To learn Word stress, Accent and Intonation.
3	To study the techniques of day to day conversation and Group Discussions to strengthen the Learner's Speaking skills.
4	To enhance the confidence levels by acquiring knowledge of Role-plays, Debates and Group Discussions.
5	To present various aspects of writing by the means of Interpreting and Data Transformation.
Pre-Requisite:	
1	Basic knowledge of English language

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. 2. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. 3. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.	12	
2	1. Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. 2. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking. 3. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. 4. Non-Verbal Communication: Importance and Elements; Body Language. 5. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills	12	

3	1. Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. 2. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. 3. Etiquette and Manners – Social and Business. 4. Time Management – Concept, Essentials, Tips. 5. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.	12	

Text book and Reference books:

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Exhibit effective interpersonal communication in a different contextual environment with proper body language.
2	Effectively apply active listening skills for better perception and information
3	Exhibit de-escalatory behaviors in situations of conflict.
4	Give critical feedback effectively (non-threatening).
5	Receive, and reflect on, critical feedback from others.
6	Demonstrate acknowledgment and validation of the feelings, viewpoints, and contributions ofothers.

Numerical Methods
Code: OEC-IT701D

Contacts: 3L

Name of the Course:		**Numerical Methods**	
Course Code: **OEC-IT701D**		Semester: VII	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme			**Examination Scheme**
Theory:3 hrs./week			Mid Semester exam: 15
Tutorial: NIL			Assignment and Quiz: 10 marks
			Attendance: 5 marks
Practical: NIL			End Semester Exam:70 Marks
Credit Points:			3
Objective:			
1	To introduce the basic concepts of solving algebraic and transcendentalequations.		
2	To introduce the numerical techniques of interpolation in various intervals in real life		
3	To acquaint the student with understanding of numerical techniques ofdifferentiation and situations.		
4	To acquaint the knowledge of various techniques and methods of solving ordinary deferential integration which plays an important role in engineering and technology disciplines.		
5	To understand the knowledge of various techniques and methods of solvingvarious types of partial deferential equations.		
Pre-Requisite:			
1	Basic knowledge of mathematics		

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	4	
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	10	
3	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	5	
4	Numerical solution of a system of linear equations: Gausselimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	8	
5	Numerical solution of Algebraic equation: Bisection method,Regula-Falsi method, Newton-Raphson method.	5	
6	Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method	4	

Text book and Reference books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.

4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. Balagurusamy: Numerical Methods, Scitech.
6. Baburam: Numerical Methods, Pearson Education.
7. N. Dutta: Computer Programming & Numerical Analysis, Universities Press

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Demonstrate competence with understanding the theoretical and practical aspects of the use of numerical methods.
2	Establish the limitations, advantages, and disadvantages of different numerical methods
3	Implement numerical methods for solving various engineering problems.
4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
5	Apply numerical methods to obtain approximate solutions to mathematical problems.
6	Analyze and evaluate the accuracy of common numerical methods.

Project-II

Code: PROJ-IT791

Contacts: 12P

Name of the Course:	**Project-II**	
Course Code: **PROJ-IT791**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: NIL		Mid Semester exam:
Tutorial: NIL		Assignment and Quiz:
		Attendance:
Practical: 12Hrs./Week		End Semester Exam:
Credit Points:		6
Objectives and detailed process:		
1	The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.	
2	The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.	

3	The assignment to normally include: 1. In depth study of the topic assigned in the light of the Report prepared under ECP1; 2. Review and finalization of the Approach to the Problem relating to the assigned topic; 3. Preparing an Action Plan for conducting the investigation, including team work; 4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experimentas needed; 5. Final development of product/process, testing, results, conclusions and future directions; 6. Preparing a paper for Conference presentation/Publication in Journals, ifpossible; 7. Preparing a Dissertation in the standard format for being evaluated by the Department. 8. Final Seminar Presentation before a Departmental Committee.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the problem
2	Compare existing literature.
3	Design experimental set-up and methodology
4	Apply modern tools
5	Analyze data
6	Develop valid conclusions & recommendations

SEMESTER-VIII (Fourth Year)

Information Security
Code: PCC-IT801

Contacts: 3L

Name of the Course:	**Information Security**		
Course Code: PCC-IT801	Semester: VIII		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	Acquire background on hash functions; authentication; firewalls; intrusion		
2	Understand vulnerability analysis of network security.		
3	Understand network security threats, security services, and countermeasures.		
4	Obtain background for original research in network security, especially wireless security protocols		
5	Understand the tradeoffs and criteria/concerns for security countermeasurenetwork and MANET security.		
6	Apply methods for authentication, access control, intrusion detection anddevelopment. Indentify and mitigate software security vulnerabilities in existing systems prevention.		
Pre-Requisite:			
1	Basic knowledge on internet, cryptography and information act		
Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	**Introduction to Information Security:** Basics Principles of Confidentiality, Integrity Availability Concepts, Policies, procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology	4	
2	**Current Trends in Information Security** Current Trends in information Security, Cloud Computing: benefits and Issues related to info Sec. Standards available for Info-Sec: Cobit, Cadbury, ISO 27001, OWASP, OSSTMM, etc - An Overview, Certifiable Standards	8	
3	**Risk Assessment** Vulnerability, Threat and Risk, Risk Assessment and Mitigation + Quick fixes, Introduction to BCP / DRP / Incident management, Segregation and Separation of Duties & Roles and responsibilities, IT	8	

	ACT 2000;		
4	**Types of assessments for Information Security:** 1. VAPT of Networks 2. Web Application Audits 3. IT assessments or audits 4. Assessment of Network Equipments 5. Assessment of Security Devices (Web Filtering, Firewalls, IDS / IPS, Routers 6. Data Center Assessment 7. Security of Application Software 8. SAP Security 9. Desktop Security 10. RDBMS Security 11. BCP / DRP assessments 12. Policy reviews	6	
5	**Security Management** Windows and Linux security, Types of Audits in Windows Environment: Server Security, Active Directory (Group Policy), Anti-Virus, Mails, Malware, End point protection, Shadow Passwords, SUDO users, etc	4	
6	**Web Security** Web Application Security: OWASP, Common Issues in Web Apps, What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues, etc.	6	

Text book and Reference books:

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks-book/
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Examine and apply the fundamental techniques of computer security.
2	Identify and explain risk and potential security issues
3	Demonstrate responsible computer use as it deals with social, political, legal and ethical issues in today's electronic society
4	Demonstrate knowledge of the profession, its organizations, goals and leadership roles, Literature/publications, issues, and research foundations.
5	Demonstrate knowledge of security objectives and policy development
6	Plan for the future and design a solution based on user requirements. Explain business continuity, backup and disaster recovery. Understand troubleshooting and quality consumer support

Digital Signal Processing
Code: OEC-IT801A
Contacts: 3L

Name of the Course:	**Digital Signal Processing**	
Course Code: **OEC-IT801A**	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	To provide background and fundamental material for the analysis and processing of digital signals.
2	To familiarize the relationships between continuous-time and discrete-timesignals and systems.
3	To study fundamentals of time, frequency and z-plane analysis and to discuss the interrelationships of these analytic method.
4	To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
	To introduce a few real-world signal processing applications
Pre-Requisite:	
1	Basic knowledge of Discrete Mathematics, electronics and Matlab

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Discrete time signals & systems, linear shift invariant systems, stabilityand causality, Discrete time systems described by difference equations, Frequency domain representation of discrete timesignals and systems.	4	
2	FOURIER SERIES AND FOURIER TRANSFORMS: Discrete Fourier series representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier transforms: frequency domain sampling, , linear convolution of sequences using DFT, Computation of DFT, Relationship of DFT to other transforms, Properties of DFT, Fast Fourier transforms (FFT) - Radix-2 FFT algorithm, Radix-4 FFT algorithms, Inverse FFT.	8	
3	RANSFORMS: Review of Z-transforms, Properties of Z-transform, Rational Ztransforms, Inversion of Z- transforms, stability and causality. REALIZATION OF DIGITAL FILTERS: Structures for FIR systems: Direct form structure, Cascade form structures, Structures for IIR systems: Direct form structures, Signal flow	8	

	graphs and transposed structures, cascade form structures, Parallel form structures.		
4	DESIGN OF FIR DIGITAL FILTERS: Symmetric and antisymmeric FIR filters, Design of linear phase FIR Digital Filters using Windows, Design of linear phase FIR Digital Filters by Frequency Sampling method. DESIGN OF IIR DIGITAL FILTERS: IIR filter design by Approximation of Derivatives, IIR filter design by impulse invariance, IIR filter design by bilinear transformation, Characteristics of commonly used analog filters (Butter worth and Chebyshev), Frequency transformations, comparison of IIR & FIR filters.	8	
5	MULTIRATE DIGITAL SIGNAL PROCESSING: Decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, Filter Design & Implementation for sampling rate conversion, Multi stage Implementation of sampling rate conversion.	8	

Text book and Reference books:

1. John G. Proakis, Dimitris G. Manolakis (2007), Digital Signal Processing,Principles, Algorithms, and Applications,Pearson Education / PHI, India.
2. A.V. Oppenheim, R. W. Schaffer (2009), Discrete Time Signal Processing, PrenticeHall of India, New Delhi.
3. Andreas Antoniou (2006), Digital Signal Processing, Tata McGraw Hill, NewDelhi.
4. M. H. Hayes (2007), Schaums Outlines of Digital Signal Processing, Tata McGraw Hill, India.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Apply DFT for the analysis of digital signals & systems
2	Design FIR & IIR filters
3	Characterize finite Word length effect on filters
4	Understanding on basics of digital signal processing which can be applied to communication systems
5	Design the Multirate Filters

Natural Language Processing
Code: OEC-IT801B
Contacts: 3L

Name of the Course:	**Natural Language Processing**	
Course Code: **OEC-IT801B**	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	Understand approaches to syntax and semantics in NLP.
2	Understand approaches to discourse, generation, dialogue and summarizationwithin NLP.
3	Understand current methods for statistical approaches to machine translation.
4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.
Pre-Requisite:	
1	Data Structure, Theory of Computation, Compiler Design and Machine Learning

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Regular Expressions and Automata Recap** - Introduction toNLP, Regular Expression, Finite State Automata **Tokenization** - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance **Morphology** - Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexiconand Morphotactics, Morphological Parsing with Finite StateTransducers, Orthographic Rules and Finite State Transducers, Porter Stemmer	11	
2	**Language Modeling** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. **Hidden Markov Models and POS Tagging** Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation.	8	

3	**Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. **Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for English, Top- Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing	9	
4	**Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus –WordNet, Computational Lexical Semantics – Thesaurus based	8	
	and Distributional Word Similarity **Information Retrieval** Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback		

Text book and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze,MIT Press
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe the fundamental concepts and techniques of natural language processing.
2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each.
3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.
4	Analyze large volume text data generated from a range of real-world applications.

E-Commerce and ERP
Code: OEC-IT802A

Contacts: 3L

Name of the Course:	**E-Commerce and ERP**
Course Code: **OEC-IT802A**	Semester: VIII
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	Define E-Marketplaces and list their components.
2	Describe the types of Intermediaries in EC and their roles
3	Describe electronic Catalogs, Shopping carts, and search Engines
4	List the Major types of Electronic Markets and describe their features
5	This course provides an introduction to information systems for business and
	management.
6	It is designed to familiarize students with organizational and managerialfoundations of systems, the technical foundation for understanding information systems
Pre-Requisite:	
1	Basic knowledge of internet, marketing and software

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective,Rules & Regulations For Controlling E – Commerce, Cyber Laws.	3	
2	Technologies: Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol: Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce.	5	
3	Business Models of e – commerce: Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.	2	
4	E – Strategy: Overview, Strategic Methods for developing E – commerce.	2	

5	Four C's: (Convergence, Collaborative Computing, Content Management & Call Center). Convergence: Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing: Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management: Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management; Content Marketing. Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).	6	
6	Supply Chain Management: E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.	3	
7	E – Payment Mechanism: Payment through card system, E -Cheque, E – Cash, E – Payment Threats & Protections.	1	
8	E – Marketing:. Home –shopping, E-Marketing, Tele-marketing	1	
9	Electronic Data Interchange (EDI): Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).	2	
10	Risk of E – Commerce: Overview, Security for E – Commerce,	4	
	Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.		
11	Enterprise Resource Planning (ERP): Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse. Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales & Distribution ERP Package, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP- Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP	7	

Text book and Reference books:

1. E-Commerce,M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD 9. Krishnamurthy, E-Commerce Mgmt, Vikas

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand the basic concepts and technologies used in the field of management information systems
2	Understand the processes of developing and implementing information systems
3	Understand the role of information systems in organizations, the strategic management processes,and the implications for the management. Develop an understanding of how various information systems work together to accomplish the information objectives of an organization.
4	Know the business modules of ERP
5	Appreciate the current and future trends in ERP

Economic Policies in IndiaCode: OEC-IT802B

Contacts: 3L

Name of the Course:	**Economic Policies in India**	
Course Code: **OEC-IT802B**	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	The objective of this course is to provide students an in-depth knowledge of theoretical concepts and tools dealing with the economic behavior of individual economic agents and market structure.
2	The subject also aims to let the student know the issues that Indian economy facesduring its process of economic growth.
3	It intends to equip students with the knowledge and application of mathematical tools and techniques that are commonly used in the exposition and formulation of economic principles and theories
4	The objective of this course is to provide a detailed treatment of theoretical andpractical issues in agricultural economics.
5	The objective is to provide a thorough knowledge about the economics of industry in a clear and 24 analytical manner, particularly in the Indian context.
Pre-Requisite:	
1	Basic knowledge on statistics, sources of Indian economics and Indian culture

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	Economic Development and its Determinants Approaches to economic development and its measurement – sustainable development; Role of State, market and other institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices.	2	

2	Planning in India Objectives and strategy of planning; Failuresand achievements of Plans; Developing grass-root organizations for development – Panchayats, NGOs and pressure groups	4	
3	Demographic Features, Poverty and Inequality Broad demographic features of Indian population; rural-urban migration; Urbanization and civic amenities; Poverty andInequality	4	
4	Resource Base and Infrastructure Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing infrastructure development.	4	
5	The Agricultural Sector Institutional Structure – land reforms in India; Technological change in agriculture – pricing of agricultural inputs and output; industry; Agricultural finance policy; Agricultural Marketing and Warehousing; Issues Terms of trade between agriculture and in food security – policies for sustainable agriculture.	4	
6	Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and disinvestment debate; Growth and pattern of industrialization; Small-scale sector; Productivity in industrial sector; Exit policy – issues in labor market reforms; approaches for employment generation	4	
7	Public Finances Fiscal federalism – Centre-State financial relations; Finances of central government; Finances of state governments; Parallel economy; Problems relating to fiscal policy; Fiscal sector reforms in India.	3	
8	Money, Banking and Prices Analysis of price behavior in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money and capital markets; Working of SEBI in India.	3	
9	External Sector Structure and direction of foreign trade; Balance of payments; Issues in export-import policy and FEMA; Exchange rate policy; Foreign capital and MNCs in India; The progress of trade reforms in India	4	
10	Economic Reforms Rationale of internal and external reforms; Globalization of Indian economy; WTO and its impact on the different sectors of the economy; Need for and issues in good governance; Issues in competition and safety nets in Indian economy	4	

Text book and Reference books:

1. Ahluwalia, I. J. and I. M. D Little (Eds.) (1999), India's Economic Reforms and Development (Essays in honour of Manmohan Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
3. Bawa, R. s. and P. S. Raikhy (Ed.) (1997), Structural Changes in Indian Economy, Guru Nanak Dev University Press, Amritsar.
4. Brahmananda, P. R. and V. R. Panchmukhi (Eds.) (2001), DevelopmentExperience in the Indian Economy: Inter-State Perspectives, Book well, Delhi.

5. Chakravarty, S. (1987), Development Planning : The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996), Dilemmas of Growth : The Indian Experience, Sage Publications, New Delhi.
7. Datt, R. (Ed.) (2001), Second Generation Economic Reforms in India, Deep &Deep Publications, New Delhi.
8. Government of India, Economic Survey (Annual), Ministry of Finance, NewDelhi.
9. Jain, a. K. (1986), Economic Planning in India, Ashish Publishing House, NewDelhi.
10. Jalan, B. (1992), The Indian Economy – Problems and Prospects, Viking, NewDelhi

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Demonstrate an understanding, usage and application of basic economic principles
2	Understand the efficiency and equity implications of market interference, including government policy
3	Understand govt. policies and programs
4	Apply the comprehensive understanding of Indian Economy
5	Analyze the behavioral patterns of different economic agents

Remote Sensing and GIS
Code: OEC-IT802C
Contacts: 3L

Name of the Course:	**Remote Sensing and GIS**
Course Code:**OEC-IT802C**	Semester: VIII
Duration:6 months	Maximum Marks: 100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz : 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Objectives:	
1	In this course the students will learn about the optical, thermal and microwaves based Remote Sensing and applications for solving real life problems.
2	The students will be able to disseminate basic concepts and applications of Electromagnetic Spectrum in Remote Sensing, Energy Balance and Data acquisition platforms, sensors and their characteristics.
3	In this course the students will learn about the raster and vector data analysis and applications for solving real life problems.
4	The students will be able to disseminate basic concepts and applications ofspatial and non-spatial database in GIS, concept of co-ordinate system in Geo-tagging any data.
Pre-Requisite:	
1	Basic knowledge on digital image processing and optical physics

Unit	Content	Hrs/ Unit	Marks /Unit
1	Introduction and Overview of Geographic Information Systems Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.	3	
2	GIS and Maps, Map Projections and Coordinate Systems Mapsand their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.	4	
3	Data Sources, Data Input, Data Quality and Database Concepts Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS.	3	
4	Spatial Analysis Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.	3	
5	Making Maps Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD-ROM distribution; interactive maps and the Web.	6	
6	Implementing a GIS Planning a GIS; requirements; pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and low-cost packages.	4	
7	Technology & Instruments involved in GIS & Remote Sensing GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS career options and how to pursue them.	6	
8	Remote Sensing Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape	7	

Text book and Reference books:

1. "Principles of geographical information systems", P. A. Burrough and R. A. Mcdonnel, Oxford. 2. "Remote sensing of the environment" , J. R. Jensen, Pearson References:
2. "Exploring Geographic Information Systems", Nicholas Chrismas, John Wiley & Sons.
3. "Getting Started with Geographic Information Systems",Keith Clarke, PHI.

4. "An Introduction to Geographical Information Systems", Ian Heywood, SarahCornelius, and Steve Carver. Addison-Wesley Longman.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles
2	Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling
3	Introduce the technology and principles of Satellite Imaging
4	Theoretical explanations on Image processing and information extraction from Satellite DataProducts

Project-III

Code: PROJ-IT801

Contacts: 12P

Name of the Course:	**Project-III**	
Course Code: **PROJ-IT801**	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: NIL		Mid Semester exam:
Tutorial: NIL		Assignment and Quiz:
		Attendance:
Practical: 12Hrs./week		End Semester Exam:
Credit Points:		6

Objective:	
1	The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.
2	The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.
3	The assignment to normally include: 1. In depth study of the topic assigned in the light of the Report prepared under ECP1; 2. Review and finalization of the Approach to the Problem relating to the assigned topic; 3. Preparing an Action Plan for conducting the investigation, including team work; 4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment

as needed;
5. Final development of product/process, testing, results, conclusions and futuredirections;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the problem
2	Compare existing literature.
3	Design experimental set-up and methodology
4	Apply modern tools
5	Analyze data
6	Develop valid conclusions & recommendations