3rd SEM							
THEORY							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
01	BS(CS/IT)307	Mathematics-III	3	0	0	3	3
02	ES(CS/IT)307	Digital Electronics	3	0	0	3	3
03	PC(CS/IT)301	Computer Organization	3	1	0	4	4
04	PC(CS/IT)302	Data structure & Algorithms	3	0	0	3	3
05	HS(CS/IT)303	Economics for Engineers	3	0	0	3	3
PRACTICAL							
01	ESL(CS/IT)308	Digital Electronics Lab	0	0	3	3	1.5
02	PCL(CS/IT)303	Computer Organization Lab	0	0	3	3	1.5
03	PCL(CS/IT)304	Data structure & Algorithms Lab	0	0	3	3	1.5
04	PCL(CS/IT)305	IT Workshop (python/matlab)	0	0	3	3	1.5
		SESSIONAL					
01	CLA(IT)-3	Comprehensive Laboratory Assessment	0	0	0	0	1
		TOTAL	15	1	12	28	23

Mathematics-III
Paper Code: BS(CS/IT)307
Contacts: 40L
Credit: 3

Module 1:Sequences and series [8L]

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.

Module 2:Multivariable Calculus (Differentiation) [7L]

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.

Module 3: Multivariable Calculus (Integration) [8L]

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.

Module 4: Ordinary Differential Equation [9L]

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.

Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation.

Module 5: Graph Theory [8L]

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.

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science.
5. Derek Holton & John Clark, A First Look at Graph Theory
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.

Course Outcomes

After completing the course the student will be able to

CO 1: use the tools of power series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

CO 2: apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points in different surfaces of higher dimensions.

CO 3: evaluate multiple integrals and apply the techniques to different physical problems.

CO 4: solve first and second order ordinary differential equations by applying different techniques and also will be able to formulate differential equations for model systems and problems of engineering sciences.

CO 5: apply the basic concepts of graph theory to network analysis, data analytics and many other branches of computer science.

Digital Electronics
Code: ES(CS/IT)307
Contacts: 36L
Credit: 3

Module 1: Basic Electronic devices [8L]

PN junction diode, Application of diodes in rectification, Half wave Full wave rectifier and Factors determining rectifier performance , Transistor, Transistor characteristics for CE, CB and CC mode, current amplification factors and their relationship, Introduction to JFET, MOSFET and CMOS.

Module 2: Number system, Boolean algebra & logic gates [10L]

Binary numbers & Boolean algebra , Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, , Signed binary number representation with 1's and 2's complement methods, Maxterm, Minterm, Representation in SOP and POS forms ; Realization of Boolean functions using NAND/NOR gates

Module 3: Combinational circuits [10L]

Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer, Parity Generator and checker.

Module 4: Sequential Circuits [8L]

Flip-flops - SR, JK, Master slave JK, D and T. Register, counter

References:

1. Morries Mano, Digital Logic Design, PHI
2. Kharate, Digital Electronics, Oxford
3. Leach & Malvino, Digital Principles & Application,Mc Graw Hill
4. D chattopadhyay & P.C.Rakshit. Electronics (Fundamentals and Applications), New Age International Publishers
5. Malvino, Electronic Principle, McGraw Hill.
6. Millman & Halkias, Integrated Electronics, McGraw Hill
7. Boyelstad & Nashelsky, Electronic Devices & Circuit Theory,PHI
8. R.P.Jain, Modern Digital Electronics, McGraw Hill

Course Outcomes

After completing the course the student will be able to

CO 1: identify and understand the difference between analog and digital electronic systems.

CO 2: explain the operation of semiconductor devices from their characteristic curves.

CO 3: represent numbers in various number systems and successfully execute conversions between different representations.

CO 4: implement various logical operations using combinational logic circuits.

CO 5: design various sequential circuits.

Computer Organization
Code: PC(CS/IT)301
Contacts: 40L (3L+1T)
Credits: 4

Module 1: Introduction [3 L]

History of computing, von Neumann machine, Instruction and data, fixed-point and floating point numbers, errors, IEEE standards

Module 2: Processor design [7 L]

Instruction Set Architecture-Instruction format, opcode optimization; operand addressing; Instruction implementation-data movement, branch control, logical, Input/output and debugging instructions; arithmetic instruction implementation–addition and subtraction, multiplication-division, 2's complement multiplication; Booth's algorithm–theory and examples; bit-pair algorithm; high performance arithmetic

Module 3: Control unit design [8 L]

Hardwired control, micro-programmed control design – micro-instruction formats, control optimization;

Module 4: Memory subsystem [9 L]

Registers, Memory technology, memory interfacing, Memory hierarchy–introduction to virtual memory system; cache memory – performance, address mapping, content addressable memory (CAM)

Module 5: Peripherals [7 L]

Basic properties, bus architectures, interfacing of I/O devices, data transfer schemes –programmed I/O, DMA, mass storage, RAID

Module 6: Pipelining [6 L]

Pipelining, data path and instructions, speed up, CPI, latency; linear / non-linear pipeline–reservation table, MAL; super-pipelined and super-scalar processors.

Text Book:

1. Mano, M.M., "Computer System Architecture", PHI.
2. Behrooz Parhami" Computer Architecture", Oxford University Press

Reference Book:

1. Hayes J. P., Computer Architecture & Organisation, McGraw Hill,
2. Hamacher, Computer Organisation, McGraw Hill,
3. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, Microprocessors and Microcontrollers OUP
4. Chaudhuri P. Pal, Computer Organisation & Design, PHI,
5. P N Basu- Computer Organization & Architecture ,Vikas Pub

Course Outcomes

After completing the course the student will be able to

CO 1: represent numbers in fixed-point and floating-point systems.

CO 2: clearly visualize machine's instruction set architecture (ISA) including basic instruction fetch and execute cycles, instruction formats, control flow, and operand addressing modes.

CO 3: explain the design and functioning of a machines central processing unit (CPU), the data path components (ALU, register file) and the control unit.

CO 4: explain organization of memory hierarchies including the basics of cache design and performance of caches. Apply these ideas to solve numerical problems.

CO 5: explain basic input/output functioning including program controlled I/O and interrupt I/O.

CO 6: analyze processor performance improvement using instruction level parallelism.

Data Structure and Algorithm
Code: PC(CS/IT)302
Contacts: 38L
Credits: 3

Module 1: Introduction [10L]

Elementary Data Organizations, Data Structure Operations: insertion, deletion and traversal in arrays, asymptotic Notations, Time-Space trade off, recursion, tail recursion, Tower of Hanoi, recursion tree and master theorem method of complexity analysis, Linear Search and Binary Search Techniques and their complexity analysis, finding min max in O(3n/2) time.

Module 2: Stacks and Queues [6L]

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue and types of Queue: Simple Queue, Circular Queue, Operations on each type of Queue: Algorithms and their analysis.

Module 3: Linked List [6L]

Singly linked lists, Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list. Linked List representation of Stack and Queue. Doubly linked list: operations, space and time analysis. Circular Linked Lists: all operations and complexity analysis. Floyd-Cycle finding algorithm. [6L]

Module 4: Trees [10L]

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, binary heap, b-tree; operations on each of the trees and their algorithms with complexity analysis. Tree traversal algorithms: recursive and iterative. Catalan Number and its connection to binary trees and stack sortable permutations. Comparison of performance of Heap, array and insertion priority queues.

Module 5: Hashing [6L]

Hashing: Chaining, probing, Universal hashing function and analysis of various hashing methods.

Text Books:

1. Horowitz, Sahni, Anderson-Freed**:** Fundamentals of Data Structures in C (Second Edition), Universities Press, 2008.
2. T.H. Cormen, C.E. Leiserson, R. Rivest and C. Stein: Introduction to Algorithms,(Second/Third Edition), PHI, 2009.
3. R. Sedgewick: Algorithms in *C*, Pearson, 2004.
4. Steven S Skiena, Algorithm design manual, 2nd Edition, Springer.

Reference Book:

1. Steven S Skiena, Miguel A. Revilla, Programming Challenges: The Programming Contest Training Manual (Texts in Computer Science) Springer.

Course outcomes

After completing the course the student will be able to

CO 1: analyze the algorithm to determine the time and computation complexity.

CO 2: decide based on nature of the search problem which search technique (Linear Search, Binary Search, hashing) to use when.

CO 3: implement the Stacks, Queues and linked list data structure and apply the same to various problems

CO 4: apply non linear data structures in searching, insertion and retrieval of data. Analyze the time complexity of various balanced and unbalanced trees and to apply the data structure to relevant problems.

Economics for Engineers
Code: HS(CS/IT)303
Contacts: 30L
Credits: 3

Module 1: [6L]

Economic Decision Making – Overview, Role of Engineers in Economic Decision making, Problem in Economic Decision Making, Decision Making Process.

Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Step Cost, Product and Period Cost, Direct and Indirect Cost, , Sunk Costs, Shutdown Cost, 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, Learning Curve Model, Benefits and difficulties in estimation.

Module 2: [12L]

Cash Flow, Interest and Equivalence: Cash Flow – Diagrams and Cash Flow Statement, Time Value of Money, Real, Nominal & Effective Interest, Different Interest Formulae.

Cash Flow & Rate Of Return Analysis – Net Present Worth Analysis, Annual Worth Analysis, Internal Rate Of Return, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis.

Module 3: [6L]

Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Use of Price Indexes In Engineering Economic Analysis.

Uncertainty In Future Events - Risk, Risk vs. Return, Probability, Expected Value and Variance, Economic Decision Trees, Simulation.

Module 4: [6L]

Depreciation and Replacement Analysis - Basic Aspects, Deterioration & Obsolescence, Depreciation Calculation Fundamentals, Depreciation and Capital Allowance Methods, Replacement Analysis Decision Map, Minimum Cost Life of a New Asset.

Accounting – Function, Balance Sheet, Income Statement, Financial Ratios, Role and Functions of a Financial Manager.

Readings:

1. H.L. Bhatia & S.N. Maheswari: Economics for Engineers, Vikas Publishing House Pvt. Ltd.
2. R. Paneer Seelvan: Engineering Economics, PHI.
3. James L. Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
4. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
5. Sullivan and Wicks: Engineering Economy, Pearson.
6. Partha Chatterjee: Economics for Engineers, Vrinda Publications.

Course Outcome

After completing the course the student will be able to

CO 1: explain the role and scope of Engineering Economics and apply the process of economic decision making.

CO 2: analyze the different concepts of cost and apply different cost estimation techniques.

CO 3: explain the concepts of cash flow, time value of money and different interest formulas and create cash flow diagrams for different situations and apply different interest formulae to solve associated problems.

CO 4: apply various analytical methods like net present worth analysis, internal rate of return analysis, future worth analysis, benefit –cost ratio analysis, break-even analysis , sensitivity analysis etc. to evaluate different engineering projects.

CO 5: explain the process of inflation and apply different price indices to quantify the effects of inflation.

CO 6: state and explain the concepts of risk, return and uncertainty and incorporate the effect of uncertainty in economic analysis by using various concepts like probability, expected value, variance, decision trees and simulation.

CO 7: explain the concepts of depreciation and replacement analysis and solve associated problems of depreciation.

CO 8: interpret and apply the various concepts of Accounting like balance sheet, income statement and financial ratio analysis and understand the role and functions of a Financial Manager

Digital Electronics Lab.
Code: ES(CS/IT)308
Contacts: 3P
Credit: 1.5

Group 1: Experiments on Analog Electronics

1. I-V characteristics of semiconductor diode.
2. Input and output characteristics of BJT in CE configuration
3. Output and transfer characteristics of JFET in CS configuration.

Group 2: Experiments on Digital Electronics

1. Logic function realization using logic gates.
2. Design and implementation of half adder and full adder
3. Design and implementation of parity generator and checker
4. Construction of simple Decoder & Multiplexer circuits.
5. Realization of RS / JK / D flip flops using logic gates.

Computer Organization Lab.
Code: PCL(CS/IT)303
Contacts: 3P
Credits: 1.5

1. Familiarity with IC-chips, e.g. a) Multiplexer , b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.
2. Incremental circuit.
3. Design an Adder/ Subtractor composite unit .
4. Design a BCD adder.
5. Design of a 'Carry-Look-Ahead' Adder circuit.
6. Use a multiplexer unit to design a composite ALU .
7. Design counter circuit.
8. Implement read write operation using RAM IC.
9. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

Data Structure & Algorithm Lab
Code: PCL(CS/IT)304
Contacts: 3P
Credits: 1.5

1. Application of array insertion, deletion and traversal operations in solving problems.
2. Linear Search, Binary Search Techniques and time complexity comparison.
3. Application of binary search like divide and conquer technique in various array related O (log n) problems.
4. Implementation and applications of Stacks and queues using arrays.
5. Implementation of Singly linked lists, Linked representation of Stack and Queue.
6. Implementation of Binary Search Tree.
7. Application of binary trees in solving various problems.
8. Array implementation of binary heap.
9. Comparison of performance of binary Heap and array as priority queues.
10. Implementation of B-Tree.
11. Implementation of Chaining and probing techniques of collision resolution in hashing. Application of hashing in appropriate problems.

IT Workshop
Code: PCL(CS/IT)305
Contacts: 3P
Credits: 1.5

1. Python Introduction
2. NumPy Introduction
3. Numpy Arrays & Numerical Operations on Numpy Arrays
4. Python, Numpy and Probability
5. Weighted Choices and Weighted Samples

6. Creation of Synthetic Test Data
7. Matrix Arithmetic
8. Reading and Writing ndarrays
9. Matplotlib Introduction
10. Histograms
11. Contour Plots
12. Pandas Introduction
13. Pandas DataFrames & Data Files
14. Data Visualization with Pandas and Python
15. Python, Pandas and Timeseries

Study Material:

https://www.python-course.eu/numerical_programming_with_python.php

Course Outcome

After completing the course the student will be able to

CO 1: do numerical computations efficiently.

CO 2: exploit the parallelism in vector operations to implement mathematical calculations.

CO 3: generate synthetic test data.

CO 4: employ matrix parallelism to solve algebraic problems.

CO 5: plot graphs of functions with appropriate representation

CO 6: implement various data visualization techniques.

4th SEMESTER							
THEORY							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
01	BS(CS/IT)408	Discrete Mathematics	3	1	0	4	4
02	ES(CS/IT)409	Communication Engineering	3	0	0	3	3
03	PC(CS/IT)406	Design & Analysis of Algorithm	3	0	0	3	3
04	PC(CS/IT)407	Formal Language and Automata Theory	3	1	0	4	4
05	PC(CS/IT)408	Computer Architecture	3	1	0	4	4
06	MC(CS/IT)401	Environmental Sciences	2	0	0	2	0 (non-credit according to AICTE)
PRACTICAL							
01	ESL(CS/IT)410	Communication Engineering Lab	0	0	3	3	1.5
02	PCL(CS/IT)409	Algorithm Lab	0	0	3	3	1.5
03	PCL(CS/IT)410	Programming Lab using C++	0	0	3	3	1.5
		SESSIONAL					
01	CLA(IT)-4	Comprehensive Laboratory Assessment	0	0	0	0	1
		TOTAL	17	3	9	29	23.5

Discrete Mathematics
Code: BS(CS/IT)408
Contacts: 36L (3L+1T)
Credit: 4

Module 1: Theory of Numbers: [8L]
Principles of Mathematical Induction, Well Ordering Principle, Divisibility theory and properties of divisibility; Fundamental theorem of Arithmetic; Euclidean Algorithm for finding G.C.D and some basic properties of G.C.D with simple examples; Congruence, Residue classes of integer modulo n (Zn) and its examples, Chinese Remainder Theorem.

Module 2: Counting Techniques: [4L]
Pigeon- hole Principle, Principles of inclusion and exclusions; Recurrence relations: Formulation & Modelling of different counting problems in terms of recurrence relations, Solution of linear recurrence relations with constant coefficients (upto second order) by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.

Module 3: Propositional Logic: [6L]
Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 4: Algebraic Structures and Morphism: [10L]
Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Permutation Groups, Normal Subgroups, Quotient group, Homomorphism & Isomorphism (Elementary properties only). Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Module 5: Graphs: [8L]
Planar and Dual Graphs. Kuratowski's graphs. Homeomorphic graphs. Eulers formula (n - e + r = 2) for connected planar graph and its generalisation for disconnected graphs. Detection of planarity. Graph colouring. Chromatic numbers of simple graphs. Chromatic Numbers and its bounds, Independence and Clique Numbers, Perfect Graphs-Definition and examples, Chromatic polynomial and its determination, Applications of Graph Colouring. Simple applications of chromatic numbers. Statement of four and five colour theorems.

Text Books

1. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI.
3. J.K. Sharma, Discrete Mathematics, Macmillan.

References

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.
3. Douglas Brent West, Introduction to Graph Theory, Prentice Hall
4. Clark John, Holton Derek Allan, A First Look at Graph Theory, World Scientific

Course Outcomes

CO 1: determine multiplicative inverses, modulo n and use to solve linear congruences.
CO2: solve different engineering problems using counting techniques.
CO3: express a given logic sentence in terms of predicates, quantifiers, and logical connectives and derive the solution for a given a problem using deductive logic and prove the solution based on logical inference.
CO4: classify the algebraic structure for a given mathematical problem and evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
CO5: develop the given problem as graph networks and solve with techniques of graph theory.

Communication Engineering
Code: ES(CS/IT)409
Contacts: 36
Credit: 3

Module 1: [12L]
Introduction to Communication Engineering, need of Modulation [2L]
Amplitude Modulation(AM): Concept of AM, Calculation of Modulation Index, Total transmitted power of AM, DSB-SC modulation & SSB-SC modulation techniques, calculation of Bandwidth and Savings of power ,Demodulation of AM, Superheterodyne receiver [10L]

Module 2: [5L]
Frequency Modulation(FM): Concept of FM, Direct & Indirect Method, Bandwidth calculation of FM, Demodulation of FM. [3L]
Phase Modulation(PM) : Concept of PM , generation of PM from FM [2L]

Module 3: [12L]
Pulse & Digital Communication: Sampling Theorem, aliasing effect, natural and flat top sampling, PAM, PWM,PPM, basic concept of Pulse Code Modulation (PCM) , concept of quantization and quantization error, Companding, DPCM, Delta Modulation and Adaptive Delta Modulation, signal to quantisation noise ratio in PCM system.[9L]
ASK, FSK, PSK, QPSK [3L]

Module 4: [7L]
Data Formatting: NRZ-Unipolar, NRZ-polar, NRZ-Bipolar, RZ-Bipolar, Manchester Coding [2L]
Synchronous and Asynchronous Data Transmission [3L]
Concept of Satellite Communication [2L]

Text Books:

1. Modern Digital and Analog Communication Systems by B.P. Lathi, Published by Oxford University Press.
2. An Introduction to Analog and Digital Communications by Simon Haykin (Wiley India)
3. Principles of Communication Engineering by Taub H. & Shilling D.L.- TMH
4. Introduction to Digital and Data Communication – Michael A. Miller, Jaico Publishing House

Reference Books:

1. Communication Systems by A. B. Carlson, Published by McGraw-Hil
2. Principles and Analog and Digital Communication by Jerry D Gibson, Published by MacMillan.
3. A Text Book of Analog and Digital Communication by A Kumar, Umesh Publication
Modern Electronic Communication, Principles and Practice- Sharma & Sinha,
Dhanpat Rai Publishing Company (p) Ltd.

Course Outcomes

After completion of the course the students will be able to-
CO1: Understand the necessity of modulation and how to transfer information from one place to another place using Amplitude Modulation, Frequency modulation and phase modulation and Compare their merits & demerits.
CO2: Apply the concept of sampling for analog to digital signal conversion.
CO3: Analyze various techniques of digital communication techniques.
CO4: Understand different data formatting techniques.
CO5: Apply the concept of modulation and demodulation for understanding Satellite Communication system..

Design and Analysis of Algorithm
Code: PC(CS/IT)406
Contacts: 36L
Credits: 3

Module 1: Models of computation & Algorithm design frameworks [5L]
Models of computation [2L]: RAM model, Deterministic and Non-deterministic problems, Tractable and Intractable problems, Solvability,
Algorithm design frameworks [3L]: Divide/Decrease and Conquer, Backtracking, Greedy, Dynamic Programming, Decision and Optimization problems-; Comparison: Divide & Conquer, Greedy and Dynamic Programming.

Module 2: Sorting [8L]
Comparison based sorts: Bubble sort, insertion sort, selection sort, quick sort, merge sort, analysis and comparison. [4L]
Non-comparison based sorts: radix sort, count sort. [1L]
Median order statistics. [2L]
Lower bound of sorting. [1L]

Module 3: Illustrations of various design framework [7L]
Dynamic Programming: Optimal substructure and overlapping subproblems; Matrix-chain multiplication [4L].
Backtracking: 8-queens problem [1L].
Greedy Method: Knapsack problem, Job sequencing with deadlines [2L].

Module 4: Graph Algorithms [6L]
BFS and DFS- algorithm and comparison; Single source shortest path, All pair shortest paths; Prim's and Kruskal's algorithms for finding minimum spanning tree.

Module 5: String matching problem [3L]
Naive algorithm, Knuth-Morris-Pratt (KMP) algorithm.

Module 6: Amortized Analysis [4L]
Basic concept of amortized analysis, disjoint set data structure.

Module 7: P and NP [3L]
Notion of NP Class: P, NP, NP-hard, NP-complete; reduction (concept only); Cook’s theorem (statement only)

Text Books:

1. T.H.Cormen, C.E. Leiserson, R.L.Rivest and C. Stein ,"Introduction to Algorithms", PHI.
2. Ellis Horowitz, Sartaz R. Sahani, "Fundamentals of Computer Algorithms". Computer Science Press.
3. A. Aho, J. Hopcroft and J. Ullman, "The Design and Analysis of algorithms", Pearson Education.

Reference:

1. D.E. Knuth: The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, Addison-Wesley.
2. G.Brassard, P.Bratley, Fundamentals of Algorithmics -, PHI.
3. S.Baase, Allen Ven Gelder"Computer Algorithms-Introduction to Design & Analysis"- 3rd Edition, Pearson Education

Course Outcomes

After completing the course the student will be able to-
CO 1: classify algorithms as on the basis of various design paradigms.
CO 2: analyze a problem to determine which design paradigm to use to solve the problem.
CO 3: clearly distinguish between problems employing divide and conquer, greedy and dynamic programming.
CO 4: solve various graph problems efficiently.
CO 5: identify whether a problem is in P or NP.

Formal Language and Automata Theory
Code: PC(CS/IT)407
Contacts: 36L (3L+1T)
Credits: 4

Module 1: Introduction:[2L]
Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Module 2: Regular languages and finite automata:[10 L]
Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages (proof not required), pumping lemma for regular languages, minimization of finite automata.

Module 3: Context-free languages and pushdown automata: [9L]

Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (NPDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs(proof not required).

Module 4: Context-sensitive languages: [4L]
Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Module 5: Turing machines: [9L]
The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Module 6: Undecidability: [2L]
Universal Turing machine, the universal and diagonalization languages, Rice s theorem.

Text books:
John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

Reference books:
1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing. 4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill

Course Outcomes

After completing the course the student will be able to-
CO 1: identify the class to which a language belongs.
CO 2: design finite automaton, grammar, expressions for regular languages.
CO 3: design pushdown automaton, grammar, for context free languages.
CO 4: proof correctness of automata for various languages.
CO 5: decide whether a language is decidable or undecidable.

Computer Architecture
Code : PC(CS/IT)408
Contacts: 38 (3L+1T)
Credits : 4

Module 1
Pipelining Architecture: [10L]
Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance.
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques.

Module 2
Memory Module: [9L]
Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization.

Module 3
Instruction-level parallelism: [9L]
Basic concepts, techniques for increasing ILP, RISC Architecture, superscalar, super pipelined and VLIW processor architectures. Array and vector processors.

Module 4
Multiprocessor Architecture: [10L]
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture, Cluster computers.
Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures

TEXT BOOKS:
1. Advanced Computer Architecture-Kai Hwang & Naresh Jotwani, McGraw Hill
2. Computer Architecture and Parallel Processing -Kai Hwang and A. Briggs, McGraw Hill
3. Computer Architecture: a quantitative approach - J. L. Hennessy and D. A. Patterson,, Harcourt Asia, Singapore.
4.Computer Organization and Architecture - V. Rajaraman and T. Radhakrishnan PHI Learning Pvt. Ltd.

REFERENCE BOOKS:

1.Computer Architecture and Parallel Processing - Hwang and Briggs, TMH.
2.Computer Architecture and Organization - Hayes, McGraw-Hill.

Course Outcome

After completing the course the students will be able to-
CO 1: explain the concept of pipeline architecture, different hazards and analyze different techniques for handling pipeline hazards
CO 2: clearly visualize the hierarchical memory technology and design cache and virtual memory organization
CO 3: explain multiprocessor architecture and taxonomy of parallel architecture
CO 4: analyze the concepts of distributed shared-memory architecture, cluster computers
CO 5: explain the design of Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

ENVIRONMENTAL SCIENCES
Code: MC(CS/IT)401
Contacts: 27L
Credit: Non credit

MODULE 1: The Multidisciplinary nature of environmental studies [2 LECTURES]
Definition, scope and importance, Need for public awareness.
MODULE 2: The Natural Resources [5 LECTURES]
Renewable and non renewable resources:
a) Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.
Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity.
Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.
Land Resources: Land as a resource, land degradation, man induced landslides, soil erosion, and desertification.

b) Role of individual in conservation of natural resources.
c) Equitable use of resources for sustainable life styles.

MODULE 3: Eco Systems [5 LECTURES]
a) Concept of an eco system: Understanding ecosystems, Ecosystem degradation, Resource utilisation
b) Structure and function of an eco system.
c) Producers, consumers, decomposers.
d) Energy flow in the eco systems: Water cycle, Carbon cycle, Oxygen cycle, Nitrogen cycle, Energy cycle, Integration of cycles in nature
e) Ecological succession.
f) Food chains, food webs and ecological pyramids.
g) Introduction, types, characteristic features, structure and function of (1) Forest ecosystem (ii) Grass land ecosystem (iii) Desert ecosystem (iv) Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries)

MODULE 4: Biodiversity and its Conservation [5 LECTURES]
(a) Introduction, Definition: genetic diversity, species diversity and ecosystem diversity.
(b) Biogeographically classification of India.
(c) Value of biodiversity: consumptive, productive, social, ethical
(d) Biodiversity at global, national and local level.
(e) India as a mega diversity nation.
(f) Hot-spots of biodiversity.
(g) Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts.
(h) Endangered and endemic species of India.
(i) Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

MODULE 5: Environmental Pollution [6 LECTURES]
(a) Definition,
(b) Causes, effects and control measures of: (1) Air pollution, (2) Water pollution, (3) Soil pollution, (4) Marine pollution, (5) Noise pollution, (6) Thermal pollution, (7) Nuclear hazards
(c) Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
(d) Role of an individual in prevention of pollution.
(e) Disaster management: Floods, earth quake, cyclone and landslides, industrial safety.

MODULE 6: Social issues and the Environment [4 LECTURES]
(a) Urban problems related to energy
(b) Water conservation, rain water harvesting, water shed management

(c) Resettlement and rehabilitation of people; its problems and concerns,
(d) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust
(e) Wasteland reclamation
(f) Consumerism and waste products
(g) Environment protection Act
(h) Air (prevention and control of pollution) Act
(i) Water (prevention and control of pollution) Act
(j) Wildlife protection act
(k) Forest conservation act
(l) Issues involved in enforcement of environmental legislations
(m) Public awareness

Recommended Books:

1. Textbook of Environmental studies, Erach Bharucha, UGC
2. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd
3. Environmental chemistry, A. K. Dey
4. Environmental studies, Anil Kumar Dey & Arnab Kumar Dey, New Age International (P) Ltd.
5. Perspectives in Environmental Studies, Anubha Kaushik & C.P. Kaushik, New Age International (P) Ltd.

Course outcome

After completing the course the students will be able to-

CO 1: apply the knowledge regarding how human beings should make a sustainable living using the Earth's finite resources.
CO 2: use scientific methods judiciously in preventing causes which damage natural ecosystems.
CO 3: use the knowledge in protecting endangered and endemic species and conserving biodiversity.
CO 4: use the knowledge in preventing/minimising various types of pollution, their causes and effects.
CO 5: apply their knowledge of disaster management in case of natural and anthropogenic calamities.
CO 6: apply their knowledge of various environment protection acts, "Environment Impact Assessment" (EIA) as and when required in setting up of new industries as well as expansion of industries in which they will be employed.

Communication Engineering Lab.
Code: ESL(CS/IT)410
Contact Hrs./Week : 3P
Credit: 1.5

1. Amplitude Modulation and Demodulation
2. Frequency modulation and Demodulation.
3. Generation and Detection of PAM
4. Generation and detection of PWM & PPM
5. Generation and detection of ASK
6. Generation and detection of FSK
7. Time Division Multiplexing & Demultiplexing

Course Outcomes

After completion of the course the students will be able to-
CO1: Compare the performance of different analog communication system.
CO2: Evaluate analog modulated waveforms and measure the modulation index.
CO3: Compare the performance of different pulse modulation systems.
CO4: Evaluate the waveforms of different shift keying techniques and compare with the corresponding analog systems.
CO5: Understand the concept of multiplexing and demultiplexing of different signals.

Algorithm Lab
Code: PCL(CS/IT)409
Contact Hrs./Week : 3P
Credit: 1.5

1. Comparison of performance of various sorting algorithms.
2. Implementation of median order statistics in O(n) time
3. Performance comparison of problem solving using dynamic programming and recursion
4. Solving 8 queens problem using backtracking and brute force method with comparison of performance
5. Solving of Knapsack and job sequencing using greedy approach
6. Implementation of BFS and DFS both recursive and non-recursive version and their performance comparison

7. Implementation of Prim's algorithm and performance comparison based on different data structures used
8. Implementation of Dijsktra's algorithm and performance comparison based on different data structures used
9. Implementation of Bellman Ford algorithm and all pair shortest path algorithm.
10. Implementation of KMP algorithm

Course Outcomes

After completion of the course the students will be able to-
CO1: Compare performance of various sorting algorithm.
CO2: Decide which design paradigm to use for a particular problem
CO3: Implement various graph algorithms
CO4: Apply graph algorithms to real life problems
CO5: Implement string matching algorithms.

Programming Lab Using C++
Code: PCL(CS/IT)410
Contact Hrs./Week : 3P
Credit: 1.5

1. Introduction to the source code writing, compilation and execution process of C++ programme. Writing C++ Programme using I/O stream, command line arguments. basic loop control, functions with CBV and CBR, identification of variables with scope resolution operator. [3P]
2. Programme writing on classes, creation of objects, constructors and destructors, accessing members, array of objects, accessing of static members [3P]
3. Programme writing on function overloading, constructor overloading and default constructor, Object passing as function arguments and returning of objects from functions. [3P]
4. Programme writing on friend functions, local classes., dynamic initialization of objects [3P]
5. Programme writing on copy constructor, operator overloading – binary and unary operators. operator overloading using friend functions [3P]
6. Programme writing on derived classes, implementation of single inheritance, multilevel inheritance, hierarchical inheritance with constructor calling sequence. [3P]
7. Programme writing on multiple inheritances, constructor calling in derived classes, virtual base classes. [3P]
8. Programme writing on abstract classes, pointer to objects, this pointer, pointers to derived class. [3P]

9. Programme writing on virtual functions and run time polymorphism [3P]
10. Programme writing on basic Class and Function templates [3P]

Course Outcomes

After completion of the course the students will be able to-
CO1: Implementing ADT in the form of classes incorporating their data protection along with ways of accessing the different class members and distinguishing between function call by value and call by reference.
CO2: Recognizing the usage of same function declaration under different implementation scenarios and also sharing of private data between different classes including nested classes.
CO3: Utilizing indirect accessing of class members through pointers and also exploring the data abstraction concept through operator overloading.
CO4: Applying code reusability through generalization/specialization concept and utilizing same functions for different types of specialized entities with their different implementation scenarios.
CO5: Implementation of generalized structure patterns with class and function templates.

THEORY							
5th SEM							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
01	PC(CS/IT)511	Operating Systems	3	1	0	4	4
02	PC(CS/IT)512	DBMS	3	1	0	4	4
03	PC(CS/IT)513	Object Oriented Programming	3	1	0	4	4
04	PEC(IT)501	Elective-I A: Information Theory and Coding B: Computer Graphics C: Advanced Computer Architecture D: Computational Geometry	3	0	0	3	3
05	MC(CS/IT)502	Constitution of India/ Essence of Indian Traditional Knowledge	2	0	0	2	0 (non-credit according to AICTE)
PRACTICAL							
01	PCL(CS/IT)514	Operating System Lab	0	0	3	3	1.5
02	PCL(CS/IT)515	DBMS Lab	0	0	3	3	1.5
03	PCL(CS/IT)516	Programming Lab using Java	0	0	3	3	1.5
		SESSIONAL					
01	CLA(IT)-5	Comprehensive Laboratory Assessment	0	0	0	0	1
		TOTAL	14	3	9	26	20.5

Operating System
Code: PC(CS/IT)511
Contact: 3L + 1T
Credit: 4
Allotted Hrs: 36L

Module I:
Introduction of O.S [2L]: Concept of OS. Operating system services, dual-mode operation, Evaluation of O.S, Different types of O.S: batch, multi-programmed, timesharing, real-time, distributed, network.
Introduction of Process [2L]: Concept of process, Process life cycle, Operations on processes, IPC.

Module II:
System Structure [2L]: Computer system operation, Operating system structure, kernel: microkernel, monolithic kernel, system calls.
Threads [2L]: Overview, Benefits of threads, User and kernel threads.

Module III:
CPU Scheduling [4L]: Scheduling criteria, Preemptive & non-preemptive scheduling, Scheduling algorithms(FCFS,SJF/SRTF,RR,Priority), MLQ scheduling, Multi-processor scheduling.
Process Synchronization [3L]: Race condition, Critical Section problem, Semaphore, Mutex, Monitor.
Deadlocks [3L]: Deadlock criteria, Methods for handling deadlocks, Resource allocation graph, Banker's algorithm, Recovery from deadlock.

Module IV:
Memory Management [3L]: Background, Logical vs. physical address, Address binding, Swapping, Contiguous memory allocation, Fragmentation, Segmentation, Paging.
Virtual Memory [3L]: Concept**,** Demand paging, Page replacement, Page replacement algorithms (FCFS, LRU, Optimal).
File Systems [2L]: File attributes, File system structure, File access methods, File allocation methods (contiguous, linked, indexed).

Module V:
Disk Management [3L]: Disk structure, Disk formatting, Boot block, Bad blocks, Disk scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK,C-LOOK).

Module VI:
I/O Management [3L]: I/O hardware, Polling, Interrupts, DMA, Application I/O interface, Kernel I/O subsystem, Spooling and device reservation.
Protection & Security [2L]: Goals of protection, Security problem, Authentication, Program threats, System threats
Case Study [2L]: Windows family, Linux family, Mac and iOS, VMWare, XEN family, Android.

Text Books / References :

1. Silbersehatz A.,Galvin P. And Gagne G."Operating System Concepts", Willey.
2. Tanenbaum A.S. and Woodhull "Operating System Design & Implementation", Pearson Education US.
3. Milenkovie M, "Operating System : Concept & Design", McGraw Hill.
4. Dhamdhere: Operating System. TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions.
6. Dietel H. N, "An Introduction to Operating Systems", Addison Wesley.

Course Outcomes:

After successful completion of this course students can able to
CO1: Understand the concept of operating system with different types of operating system and concept of process.
CO2: Understand the structures of operating system and mechanism to handle resources and concept of kernel and thread.
CO3: Analyze different mechanism to handle CPU scheduling of processes, process synchronization, deadlock.
CO4: Analyze different memory management mechanism to provide better performance to users, file management mechanism
CO5: Implement different disk management policies.
CO6: Implement input/output devices management technique, evaluate protection and security aspects related to operating system and some case studies related to modern day operating systems.

Database Management System
Code: PEC(CS/IT)512
Contacts: 3L + 1T
Credits: 4
Allotted Hrs: 36L

Module 1: Introduction [2L]:
Concept of File system & Database system & their differences, Data abstraction & Data independence in DBMS, Instances & Schemas, Data models, Database languages (Data definition & Data manipulation languages).

Module 2: Entity Relationship Model [3L]:
Basic concepts, Types of attributes, Relationship sets, Mapping cardinalities & Participation constraints, Types of Keys., Entity – Relationship diagram(E-R diagram)., Strong & Weak entity sets, Specialization & Generalization & Aggregation in ER model.

Module 3: Relational Model [4L]:
Fundamental operations in Relational Algebra, Extended Relational Algebra operations, Concept of View, Relational Calculus.

Module 4: Relational Databases [11L]:

Introduction to SQL [4L]:
Characteristic of SQL, Types of SQL commands(DDL, DML, DCL, TCL), SQL operators & their procedures, Queries, Sub-queries & nested queries., Aggregate Functions, Operations on Modification of databases (Insertion, Updation, Deletion).

Integrity Constraints [2L]:
Concept of Foreign Key, Definition of integrity constraints, Types of integrity constraints(Domain Constraints, Entity Integrity Constraint, Referential Integrity Constraints, Key Constraints).

Functional Dependencies & Normalization [5L]:
Functional Dependency, Closure of functional dependency, Armstrong's Axioms, Canonical Cover., Lossless join decomposition & Dependency preservation, Full & Partial & Transitive dependency, Prime & Non-prime attribute, Need of Normalization, 1NF, 2NF, 3NF, BCNF.

Module 5: Transaction Management [13L]:

Transaction [6L]:
Overview of Database transaction concepts, ACID properties, Transaction state, Concurrent executions, Conflicts in Transaction, Serializability, Conflict & View Serializability, Test for serializability (Precedence Graph), Recoverability, Recoverable& Cascadeless & Strict schedules.

Concurrency Control [4L]:
Shared lock & Exclusive lock, Two phase locking protocol, Deadlock handling, Deadlock prevention, Deadlock detection, Deadlock Recovery

Recovery System [3L]:
Causes of transaction failure, Storage structure, Log-based recovery, Write Ahead Logging (WAL) protocol, Checkpoints, Shadow paging

Module 6: Storage [3L]:
Single level & Multi level indexing, Structure of B & B^+ tree, File organization in B^+ tree, Hashing techniques.

Text Books
1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Ramakrishnan Gehrke: Database Management System , McGraw-Hill

Reference
1.SQL, PL/SQL the Programming Language of Oracle,4th edition, Ivan Bayross
2.An Introduction to Database Systems, 8th edition, C.J. Date,

Course Outcomes:

After completing the course the student will be able to-

CO 1: Design ER-models to represent simple database application scenarios.
CO 2: Implement SQL queries on data.
CO 3: Apply normalization to Improve database design.
CO 4: Solve concurrency problems in database transactions.
CO 5: Explain basic database storage structures and access techniques.

Object Oriented Programming
Code: PC(CS/IT)513
Contact: 3L + 1T
Credit: 4
Allotted Hrs: 36L

Module I [2L]
Introduction to Object Oriented Programming Concepts
Object Oriented Programming language concepts & features, Comparison between Object Oriented Programming language and conventional programming languages, Object Oriented Modelling concepts.

Module II [10L]
Introductory Concept of Java Programming
Advantages of Java, Data types & variables, Loops, Arrays, Operators, Control statements, constants, methods, Compile time Polymorphism: Method Overloading, Keyboard input operations.

Classes & Objects
Defining Classes and Creation of objects, Access specifiers, Instance variables and Static variables, Constructors, Constructor overloading, Static blocks, Array of objects, Use of **this** keyword, Passing objects as parameter to a method & returning objects from a method, Nested classes & Inner classes concept of string object with length(), equals() and charAt() method of string object, Command Line Arguments, garbage collection.

Module III [10L]
Inheritance and Polymorphism in Java
Concept of Inheritance, Super classes & Subclasses, Object Modelling in Java: Generalization and Specialization, Constructor calling mechanism in inheritance, Use of **super** keyword, Runtime Polymorphism: Method Overriding. Use of **static** keyword in java.

Abstract classes & Interfaces
Concept of Abstract classes & Interfaces and their properties, use of **final** keyword, Dynamic binding in abstract classes and interfaces, Inheritance of interfaces, Nested Abstract classes & Nested Interfaces.

Packages in Java
Creation of packages, Importing packages, Member access rules in the aspect of packages.

Module IV [5L]
Exception handling in Java
Basic concept of exception handling in Java, Different types of exception classes, Concept of **try** and **catch** block, Concept of nested try block and multiple catch blocks, **throw** and **throws** clause, Concept of **finally** block, Creation of user defined exception classes.

Module V [6L]
Multithreading in Java
Basic concept of multithreading, Concept of main thread and child thread, Thread life cycle, Creation of multiple threads, Thread priorities, Thread synchronization, Inter thread communication, Deadlocks, Suspending & Resuming threads.

Module VI [3L]
Applet Programming in Java
Basics of applet programming, Applet life cycle, Differences between application & applet programming, Parameter passing through applets, I/O operations in applets.

Text books:
1. **Core Java Volume I — Fundamentals (9th Edition)** by **Cay S Horstmann and Gary Cornell**
2. Object Oriented Modelling and Design by Rambaugh, James Michael, Blaha; Prentice Hall, India
3. **Java: A Beginner's Guide** by Herbert Schildt, Oracle Press.

References:
1. Head First Java by Kathy Sierra and Bert Bates
2. Deitel and Deitel- "Java How to Program", Pearson Education.

Course Outcomes:

After completion of this course the students will be able to -
CO1: Recognize some of the enhanced features of Object Oriented Programming (OOP) and also be able to design an entity structure in the perspective of object oriented modelling.
CO2: Implement ADT with data protection, method overloading, string operations and object independent access features of the java programming.
CO3: Inherit selective members of the parent class, implement run time polymorphism for abstractions, and build modular programming scenarios with packages.
CO4: Effectively handle java run time exceptions, recognize the control flow of exception paths and also design user defined exception classes.
CO5: Implement parallel processing scenarios with multithreading concepts and their synchronizations.
CO6: Design window based I/O operations for web applications through applet programming.

Information Theory and Coding
Code: PEC(IT)501 A
Contact Hrs./Week: 3L
Credit: 3
Allocated Hrs: 36L

ModueI
Information Theory [4L]
Review of probability theory, Uncertainty and Information, Self and Mutual Information, Entropy, Mathematical Properties of the Entropy Function.

ModueII
Source Coding Theorem [5L]
Entropy and Coding, Shannon-Fano Coding, Variable-Length Codes: Unique Decoding, Instantaneous Codes, Construction of Instantaneous Codes, Prefix tree for prefix code, The Kraft Inequality, Huffman codes.

ModueIII
Channel Capacity and Coding [5L]
Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

ModueIV
Error Control Coding [6L]
Introduction, Matrix description of linear block codes, parity check matrix, Encoding and decoding of Linear Block-codes, Syndrome Decoding, Hamming Codes.

Cyclic Codes [4L]
Polynomials, Method for generating Cyclic Codes, Matrix description of Cyclic codes, Golay codes.

ModueV
BCH Codes [6L]
Properties of BCH codes, minimal polynomials, generator polynomials, check polynomials, examples of BCH codes, Reed Solomon Code.

ModueVI
Convolutional Codes [6L]
Introduction, Polynomial description of Convolutional Codes, Generating function, Matrix description of Convolutional Codes, Viterbi Decoding of Convolutional codes, Trellis codes.

Text Books:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Error Control Codes – S Gravano; Oxford.

References :
3. Coding and Information Theory – R. W. Hamming; Prentice Hall.
4. Information and Coding Theory - G. A. Jones and J. M. Jones ; Springer – Verlag.
5. Essentials of Error-Control Coding – Jorge C. Moreira and Patrick G Farrell; Wiley.
6. Error Control Coding - Shu Lin and D J Costello Jr.; Prentice Hall.

Course Outcomes:

After completion of the course, the students will be able to
CO1: Learn the basic notions of information and channel capacity.
CO2: Design the channel performance using Information theory.
CO3: Comprehend various error control code properties.
CO4: Implement linear block codes and cyclic codes for error detection and correction
CO5: Design BCH & RS codes for Channel performance improvement against burst errors.
CO6: Apply convolution codes for performance analysis.

Computer Graphics
Code: PEC(IT)501 B
Contact Hrs./Week: 3L
Credit: 3
Allotted Hrs: 36L

Module I [4L]
Introduction to Computer Graphics & Graphics Systems
Overview of CG, definitions of CG, types of CG, storage tubes displays, CRT technologies– Raster Scan Display, Computer graphics software.

Module II [4L]
Scan Conversion
Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generating algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module III [6L]
2D Transformation
Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.

Module IV [4L]
Viewing
Viewing pipeline, Window to Viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

Module V [6L]
3D Transformation & Viewing
3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, Viewport clipping, 3D viewing, perspectives & Depth Cueing.

Module VI [4L]
Curves and Fractals
Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Module VII [4L]
Hidden Surfaces
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Module VIII [4L]
Color & Shading Models
Introduction, Modeling Light Intensities and Sources, Diffuse Reflection, Lambert's Cosine Law, Specular Reflection, Halftoning, Color Models - RGB Color, CMY Color.

Text books:
1. Computer Graphics (C version) – Hearn D, Baker M P, Pearson.

2. Computer Graphics –A programming Approach– Harrington, Steven; McGraw Hill

References:

1. Computer Graphics – principles and practice - Foley, Van Dam, Feiner and Huges; Pearson.
2. Computer Graphics, Multimedia and Animation – Pakhira Malay K ; PHI Learning Pvt. Ltd.

Course Outcomes:

After completion of this course the students will be able to -
CO1: Understand basic working principle of graphics systems and hardware.
CO2: Design and implement algorithm to display basic geometric 2D graphic on graphic systems they have learned.
CO3: Implement 2D transformation to animate their graphic on graphic systems they have learned.
CO4: Perform clipping operations according to the user viewing system.
CO5: Understand and perform operations on 3D graphics system.
CO6: Understand the curves and fractal geometry.
CO7: Understand and implement algorithm for hidden surface removal on 3D graphic systems.
CO8: Understand and control the colour, light, material, and shadow in a graphics environment.

Advanced Computer Architecture
Code: PEC(IT)501C
Contact Hrs./Week: 3L
Credit: 3
Allocated Hrs: 36L

Module 1 [12L] :
Introduction to High Performance Computing
Pipeline Processing : Pipeline Performance, design of arithmetic pipelines Pipeline hazards – structural hazards, data hazards, control hazards & their solutions Pipeline scheduling Theory: Greedy pipeline scheduling algorithm – Static and Dynamic Pipelining.
Parallel Processing, Taxonomy of Parallel Architectures : 1) SISD, 2) SIMD, 3) MIMD, 4) MISD, Concurrent and Exclusive Read-Write PRAM variants Parallel Algorithms, Matrix Multiplication ,Selection Problem. Amdahl's Law and parallel speed up.

Module 2 [7L] :
RISC architecture, RISC VS CISC, VLIW architecture Vector and Array Processors, Super-scalar machines,Distributed computing architectures, Data flow architectures.

Module 3 [5L] :
Interfacing : Peripheral interfacing, Interfacing a microprocessor with memory and various I/O controllers.

Module 4 [8L] :
Advanced Memory Technology : SRAM, SDRAM, Flash memory, Dual port memory, Cache memory. Memory interleaving, virtual memory.

Module 5 [4L] :
Introduction to FPGA and Reconfigurable architecture.

Text Books :
[1] M. R. Bhujade, "Parallel Computing", Newage International Pvt. Ltd., 1995.
[2] Stallings William, "Computer organization and architecture, designing for performance", Prentice Hall of India, 1997
[3] J. L. Hennessy and D. A. Patterson, "Computer architecture: a quantitative approach", Harcourt Asia, Singapore 1996
[4] Hwang and Briggs, —Computer Architecture and Parallel Processing‖, TMH.
[5] Hayes, —Computer Architecture and Organization‖, McGraw-Hill.

References :
[1] Hwang, —Advanced Computer Architecture‖, McGraw-Hill.
[2] Kain, —Advanced Computer Architecture: a system Design approach‖, PHI.
[3] Flynn, —Computer Architecture‖, New Age Computer Network
[4] Parhami – Computer Architecture, Oxford University Press
[5]Quinn,M.J, -Parallel Computing 'Theory and Practice McGraw Hill
[6]Akl,Selim G. The Design and Analysis of Parallel Algorithms ,Prentice-Hall

Computational Geometry
Code: PEC(IT)501 D
Contact Hrs./Week: 3L
Credit: 3
Allotted Hrs: 36L

Module 1 [10]
Introduction: Geometric preliminaries. Convex Hulls: Convex Hull Algorithms in the Plane -Graham's Scan Algorithm, Jarvi's March, Divide and Conquer Algorithm.
Line Segment Intersection (using plane sweep), Doubly linked edge list
Overlay subdivisions. Triangulations: Polygon Triangulation (Triangulating monotone polygons, Partitioning monotone polygons). Convex Partitioning.

Module 2 [7]
Voronoi diagrams: algorithms, closest pair problems.
Delaunay triangulations: algorithms (divide-and-conquer, flip, incremental), duality of Voronoi diagrams, properties (min-max angle).

Module 3 [9]
Orthogonal Search: Geometric data structures; Range search (Quad-tree, kd-tree), Improvements on range searching (Range tree, fractional cascading), Inverse Range Search (Segment tree, interval tree, priority search tree)
Geometric searching: point-location, 2d linear programming with prune and search.

Module 4 [6]
Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems.
Arrangements: Zones (Duality, line arrangements; many-faces complexity, incremental algorithm, zone theorem), algorithms.

Module 5 [4]
Geometric Applications: Robot Motion Planning (Trapezoidal Maps, point robots, Translational Motion Planning), Computing the Visibility Graph.

Text Book:
1. M. de Berg, M. van Kreveld, M. Overmars, and O. Schwarzkopf. Computational Geometry: Algorithms and Applications. Springer-Verlag, 2nd edition, 2000.

Reference Book:
1. Franco P. Preparata and Michael Ian Shamos, Computational geometry: An Introduction, 1 st edition, Springer-Verlag New York.

Constitution of India
Code: MC(CS/IT)502
Contact: 2L
Credit: 0
Allotted Hrs: 35L

Indian Constitution: [5]
Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Union government and its administration: [10]
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. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

Supreme court: [10]
Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL.

Local Administration: [10]
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 Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Text books:
1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

Reference books:

1. D D Basu, " Introduction to the constitution of India", 21st Edition, Lexis Nexis Books Publication ltd, India.

Course Outcomes:

After completion of this course, the learners will be able to
1. describe
   - different features of Indian constitution.
   - power and functioning of Union, state and local self-government.
   - structure, jurisdiction and function of Indian Judiciary.
   - basics of PIL and guideline for admission of PIL.
   - Functioning of local administration starting from block to Municipal Corporation.

2. identify authority to redress a problem in the profession and in the society.

OPERATING SYSTEM LAB
Code: PCL(CS/IT)514
Contact:3P
Credits: 1.5
Allotted Hrs: 33P

1. Managing Unix/Linux Operating System [9P]:
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 [3P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. Signal [3P]: 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).

Database Management System Lab
Code: PCL(CS/IT) 515
Contacts: 3P
Credits: 1.5
Allotted Hrs: 33P

1. Structured Query Language [6P]
   Creating a Database, Creating a Table, Specifying Relational Data Types, Specifying Constraints, Creating Indexes

2. Table and Record Handling[6P]
   INSERT statement, Using SELECT and INSERT together, DELETE, UPDATE, TRUNCATE statements, DROP, ALTER statements.

3. Retrieving Data from a Database[9P]
   The SELECT statement, Using the WHERE clause, Using Logical Operators in the WHERE clause, Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause, Using Aggregate Functions, Combining Tables Using JOINS, Sub queries.

4. Database Management[6P]
   Creating Views, Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE

5. PL/SQL Concepts and Constructs[6P]
   Introduction of PL/SQL , Structure of basic PL/SQL Structure, Conditional statements, Basic loops, Cursors in Oracle PL / SQL

Programming Lab Using Java
Code: PCL(CS/IT)516
Contact: 3P
Credit: 1.5
Alloted Hours:

1. Programming with java classes involving data members having various access protection, class methods, constructors, overloading features, this and final keyword, static block, static variables and methods.

2. Use of array of objects, passing of object in method and returning of object form method, use of string handling functions– length (), equals (), charAt(), keyboard input operations, command line arguments.

3. Program implementation for nested/inner classes, name conflict resolving for inner and outer classes.

4. Programme implementation for abstract class, interface, inheriting multiple interfaces in a single class, extending multiple interfaces within a single interface, combined inheritance of both abstract class and interface. Use of dynamic method dispatch for abstract class and interface implementation.

5. Implementation of nested abstract class and interface combinations. Resolving name conflict scenarios for the combined inheritance of abstract class and interface.

6. Designing programme modules with creation and accessing of packages.

7. Handling exception with try, catch and finally. Adoption of throw, throws and user defined exception.

8. Programme writing for creation of multiple threads, thread synchronization, inter thread communication.

9. Applet programme execution with I/O operation, use of repaint () method.

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Course Outcome:

After completion of this course the students will be able to -

CO1: Implement java classes with incorporation of data protection, method overloading, string operations, call by reference aspects and object independent access of the class members.

CO2: Design nested structuring of classes and resolve name conflict issues for the nested classes.

CO3: Implement abstract class, interface and their nested structuring along with dynamic method dispatch.

CO4: Tackle java run time exceptions, and also design user defied exception classes.

CO5: Perform parallel processing with multithreading concept and implement their synchronization.

CO6: Execute applet programming for web applications with window based I/O operations.

Syllabus for B. Tech. (IT), 6th Semester , GCECT

THEORY							
6th SEM							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
01	PC(CS/IT)617	Computer Network	3	1	0	4	4
02	PC(CS/IT)618	Compiler Design	3	0	0	3	3
03	PEC(IT)602	Elective-II	3	0	0	3	3
04	OEC(IT/CS)601	Open Elective-I	3	0	0	3	3
05	HS(CS/IT)604	Industrial Management	3	0	0	3	3
PRACTICAL							
01	PCL(CS/IT)619	Computer Network lab	0	0	3	3	1.5
02	PROJ(IT)601	Project 1	0	0	6	6	3
		SESSIONAL					
01	CLA(IT)-6	Comprehensive Laboratory Assessment	0	0	0	0	1
		TOTAL	15	1	9	25	21.5

PEC(IT)602
A: Software Engineering
B: Cryptography and Network Security
C: Multimedia
D: Wireless Communication

OEC(IT/CS)601
A: Optimization Techniques
B: Digital Communication
C: Cyber Law and Security
D: Control System

Computer Network
PC(CS/IT) 617
3L+1T
Credit: 4
Total Lecture: 44L

Module I: Introduction[4L]: Overview of Data Communication and Networking; Layered Network Architecture; Mode of communication, topology, Data and Signal; Transmission Media: Guided, Unguided, categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Module II: Physical Layer[4L]: Transmission Media: Guided, Unguided; switching: time division & space division switch, TDM bus, Banyan switch; MODEM, Repeater and hub, Multiplexing: TDM, FDM, SDM, WDM.

Data link Layer[8L]: Medium Access sub layer: MAC address and LLC; Error Control: Types of errors, framing (character and bit stuffing), error detection & correction; Flow control: Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Point to Point Protocol, LCP, NCP, Token Ring; Access mechanism: Reservation, Polling, Random access: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, TDMA, FDMA, CDMA, Traditional Ethernet, fast Ethernet.

Module III: Network layer[10L]: Internetworking & devices: Bridges, Switches, Router, Gateway; Addressing: IP addressing (IPV4, IPv6), masking, Classful and Classless Addressing, Subnetting, NAT; Routing : Intra and Inter Domain Routing, Unicast, Multicast Broadcast routing. static vs. dynamic routing, Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP and RARP, IP, ICMP, IPV6; Mapping between IP and MAC address: ARP & RARP Switching Communication Networks: Circuit switching; Packet switching; Routing in packet switched networks; X.25; Frame Relay; ATM, SONET.

Module IV: Transport layer [8L]: Process to Process delivery; UDP; TCP, Features, Segment, Three-Way Handshaking, socket and port addressing, Flow Control, Error Control, Congestion Control: Open Loop, Closed Loop, choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.

Module V: Application Layer [5L]: Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW;
Security [3L]: Attacks, Cryptography, Firewalls, IDS & IPS, Malware, IP and transport layer security, DMZ.
Modern topics [2L]: ISDN services & ATM, DSL technology, Wireless LAN, Bluetooth, VPN.

Text Books:
1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education

Reference Books:

4. Black, Data & Computer Communication, PHI

5. Kurose and Rose – "Computer Networking -A top down approach featuring the internet" – Pearson Education

COMPILER DESIGN

PC(CS/IT)618

Contracts: 3L

Credits: 3

Total Lecture: 36L

Module I [6L]

Introduction to Compiling [2L]

Compilers, Analysis-synthesis model, phases of the compiler, Cousins of the compiler, Basic concepts of NFA, DFA.

Lexical Analysis [4L]

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Specifications of a token, Recognition of tokens, lexical analyzer generator (Lex).

Module II [11L]

Syntax Analysis [7L]

The role of a parser, Top down Parsing, Predictive parsing (LL), Bottom up parsing, Operator precedence parsing, LR parsers (SLR, LALR,CLR), Parser generators (YACC).

Syntax directed translation [4L]

Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions.

Module III [9L]

Type checking [3L]

Type systems, Specification of a simple type checker.

Run time environments [6L]

Activation trees, Control stack, scope of declaration, Binding of names, Activation records, Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables.

Module IV [10L]

Intermediate code generation [4L]

Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization [4L]

Basic blocks & flow graphs, Transformation of basic blocks, DAG representation of basic blocks, the principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations [2L]

Issues in the design of code generator, Register allocation & assignment.

Text Book:

1.Alfred Aho, Ravi Sethi, Jeffrey D Ullman.- Compilers Principles, Techniques, and Tools, 2nd Edition, Pearson Education, New Delhi, 2006

Reference Books:

1. A.I.Holub -Compiler Design in C, Prentice Hall of India, New Delhi, 1995
2. J.P. Tremblay - The Theory and Practical of Compiler Writing, McGraw Hill, Singapore, 1993.
3. K.C. Louden- Compiler Construction: Principles and Practice, Thomson Learning, New Delhi, 2005.
4. Chattopadhyay, S- Compiler Design (PHI)

Software Engineering

Code: PEC(IT) 602A
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module I

Information System-Systems development life cycle, Software Engineering –Objectives, Definitions Software Process models – Waterfall Model , Spiral model. Software Requirements (SRS), Feasibility Analysis **[6L]**

Module II

Software Design : Context diagram and DFD, Physical and Logical DFDs , Data Dictionary, ER diagrams, Decision tree, decision table and Structure chart, Structured English. **[6L]**

Module III

Software Testing – Levels of Testing, White-box and Black-box Testing, Test Case Generation, Acceptance Testing, Software Validation, Mutation Analysis, Cyclomatic complexity. **[10L]**

Module IV

Software Reliability, Hazard, MTTF, MTBF, Repair and Availability, Reliability Model. **[4L]**

Module V

Software Quality- Quality attributes, Risk Management, Software Quality Assurance, Total Quality Management. **[4L]**

Module VI

Software Project Management – Software Project Planning, Project Scheduling, Software Configuration Management, Cost estimation-COCOMO. **[6L]**

Suggested Books:

1. Software Engineering : A practitioner's approach– R.G. Pressman (TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)
5. Software Engineering- I. SomerVille(Pearson Education)
6. Fundamentals of Software Engineering- C. Ghezzi, M. Jazayeri and D. Mandrioli(PHI)
7. Software Engineering Fundamentals- Behforooz(OUP)

Cryptography and Network Security
Code: PEC(IT) 602B
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module 1 [4L]
Introduction, Need for Security, attacks, services and mechanism, introduction to cryptography. Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, stream and block ciphers, Cryptanalysis, Steganography.

Module 2 [8L]
Symmetric key Cryptography: Block Cipher principle, Feistel structure, The Data Encryption Standard, Strength of DES, Triple DES, Block Cipher modes of operations, IDEA encryption and decryption, RC5 algorithm, Overview of AES.

Module 3 [8L]
Asymmetric key Cryptography: Principles of Public key Cryptography Systems, Knapsack Cryptosystem. Euler's Totient Function, Fermat's Little Theorem, Euler's Theorem, Extended Euclidean Algorithm. RSA Cryptosystem. Elliptic curve cryptography.

Module 4 [5L]
Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, Hash functions- MD5 & SHA 1(algorithm), birthday attacks. Digital Signatures and digital signature standards (DSS).

Module 5 [5L]
Key Management: Key Distribution Centre, Diffie-Hellman Key Agreement, Man in the middle attack.
Network Authentication Protocol: Kerberos. Certificate based Authentication- X.509.
Electronic mail security: Pretty Good Privacy, S/MIME.

Module 6 [6L]
IP Security: Framework, AH, ESP. Web Security: SSL and TLS, Secure Electronic Transaction.
Firewalls-Packet filters, Application-Level Gateway, Encrypted tunnels.

Text Books:
1. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill. 2010

2. William Stallings, Cryptography and Network Security, Pearson Education, 2014

Reference Books:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, PHI, 2002
2. Johannes A. Buchmann, Introduction to Cryptography, Springer-Verlag.
3. Atul Kahate, Cryptography & Network Security, TMH.
4. B. Schneier, Applied Cryptography, Protocols, Algorithms, and Source Code in C, 2nd Edn, Wiley, 1995.

Multimedia Systems

Code: PEC(IT) 602C
Contacts: 3L
Credits: 3
Total Lecture: 38L

Module1: Introduction to Multimedia System[3L]

Multimedia Components and Structure, Hardware and Software Specifications, Application Domains, uses of multimedia, Analog and digital media, digitization, Visual Display Systems: Cathode Ray Tube, Liquid Crystal Display, Plasma Display

Module 2: Text[3L]

Types of Text, Font, ASCII Character Set, Unicode, File Formats, Text compression, Text file format

Module 3: Audio [3L]

Concept of Sound, Components of audio systems, Data acquisition, Sampling and Quantization, Audio file formats, Audio tools, Audio processing software, MIDI

Module 4: Image [5L]

Image acquisition and representation, Image pre-processing, Colour models (Device Dependent and Device Independent), File Formats

Module 5: Computer Graphics [3L]

Components of graphics system, 2D and 3D modelling, Graphics file formats.

Module 6: Animation[4L]

Principles of animation, Computer based animation, 3D animation, Rendering Algorithms, File format, Animation software

Module 7: Video [4L]

Video Frame, Frame Rate, Composite video signal NTSC, PAL and SECAM Video Standards, Formats, Digital Video, Steps of Video Processing and Software

Module 8: Compression [4L]

Lossy and Lossless Compression, Run Length encoding, Huffman Encoding, Arithmetic Encoding, Differential Pulse Code Modulation, JPEG image compression standard, MPEG video compression, H.261

Module 9: Synchronization [4L]
Intramedia and Intermedia Synchronization, Jitter, Skew, Delay, Error rate, Quality of Service

Module 10: Image and Video Database [5L]
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

Suggested Books:
1. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications & Applications, Pearson Ed.
2. Parekh Ranjan, Principles of Multimedia, Mc Graw Hill. 3. Koegel Buford, Multimedia Systems, Pearson Ed.
4. Ralf Steinmetz and Klara Nahrstedt, Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing, PHI.
5. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.
6. Nalin K. Sharda, Multimedia Information System, PHI.

Wireless Communication
Code: PEC(IT) 602D
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module I: [8L]
Introduction to wireless communication and wireless network, Examples & comparison of different wireless communication systems, Evolution of Mobile radio communication, Multiplexing, Modulation Techniques, Spread Spectrum modulation (FHSS, DSSS), Multiple access techniques (FDMA, TDMA, CDMA).

Module II: **[10L]**
Cellular concept and architecture: GSM Network Architecture, GSM call set up procedure, Authentication and security, Routing of a call to a mobile subscriber. CDMA based cellular network.

Module III : [8]
Fundamentals of Wireless Networks (WLAN): WLAN transmission Technology**,** WLAN system architecture, IEEE 802.11standard. Wireless Media Access Control: Wireless Issues, ALOHA, Carrier Sense Multiple Accesses with Collision Avoidance, Mobile IP and Wireless Access Protocol.

Module IV:[4]
Introduction to satellite communication, Satellite communication subsystems, transponder, satellite link (uplink & downlink)

Module V: [6]
Recent advances in wireless communication: Wide Band (UWB) communication, Wireless Fidelity (Wi-Fi) systems; Wireless Sensor networks, Bluetooth technology, Cognitive Radio Network

Suggested Books:
1. T. S. Rappaport, "Wireless Communications: Principles & Practice," Prentice-Hall.
2. I.Saha Misra, "Wireless Communications and Networks, 3G and beyond" TMH.
3. W.Stallings, "Wireless Communications and Networks" PHI.
4. Satellite Communication – D.C Agarwal, Khanna Publications, 5th Ed

OPTIMIZATION TECHNIQUES
Code: OEC(IT/CS)601A
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module I
Introduction: Historical Development, Engineering application of Optimization, Classification of optimization problems. **(2L)**

Module II
Linear Programming: Introduction to linear programming, formulation of linear programming model, Graphical method for solving LPPs with 2 variables; Simplex method; Duality in Linear Programming; Transportation problem; Assignment problems. **(12L)**

Module III
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. **(4L)**

Module IV
Sequencing Models: Johnson's Rule and its logic, method of solution; Two machines and n jobs (no passing), Three machines and n jobs (no passing), Two jobs and m machines, n jobs and m machines. **(5L)**

Module V

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. **(4L)**

Module VI

PERT/CPM: Introduction to Network analysis, definition of a project, job and events, drawing of arrow diagrams, Project management origin and use of PERT, origin and use of CPM, Application of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labelling. **(4L)**

Module VII

Dynamic Programming: Basic Concepts, Bellman's optimality principles, Dynamic programming approach in decision making problems. **(3L)**

Module VIII

Non-Linear Programming: Unconstrained optimization techniques, Direct search methods – Fibonacci Search Method, Golden section Search Method. **(2L)**

Text Books:

1. H. A. Taha, "Operations Research", Pearson
2. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
3. J. K. Sharma - "Operations Research", Macmillan Publishing Company

Reference Books:

1. Kanti Swaroop — "Operations Research", Sultan Chand & Sons
2. Rathindra P. Sen—"Operations Research: Algorithms and Applications", PHI
3. R. Panneerselvam - "Operations Research", PHI
4. A.M. Natarajan, P. Balasubramani and A. Tamilarasi - "Operations Research", Pearson
5. M. V. Durga Prasad – "Operations Research", CENGAGE Learning
6. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House

DIGITAL COMMUNICATION

Code: OEC(IT/CS)602B
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module I: Sampling and Pulse Modulation techniques: [8L]

Sampling theorem, sampling rate, impulse sampling, natural & flat topped sampling, reconstruction of signal from samples, Concept of Aliasing and anti-aliasing filter.

Quantization noise, Uniform quantization, Non-uniform quantization, A-law and μ-law. A/D and D/A conversion techniques, Concept of Bit rate, Baud rate, M-ary encoding. Analog pulse modulation-PAM, PWM, PPM. Fundamentals of PCM, Block diagram of PCM, basic concept of Delta modulation, Adaptive delta modulation. Introduction to DPCM. Different types of multiplexing: TDM, FDM.

Module II: Digital Transmission: [8L]

Basic concept of Digital communication, comparative study of digital communication and analog communication.

Encoding, coding efficiency. Line coding & its desirable properties, Different types of line coding: NRZ & RZ, AMI, Manchester coding and their spectra.

Base band pulse transmission, optimum filter, Matched filter and correlation filter, Inter Symbol Interference (ISI), Eye pattern, Signal power in binary digital signal.

Module III: Digital carrier modulation & demodulation technique: [8L]

Introduction to the digital modulation techniques- ASK. FSK, PSK, BPSK, QPSK, M-ary PSK, **MSK** and their comparisons. Basic concept of spread spectrum modulation and CDMA.

Module IV: Introduction to information theory: [6L]

Introduction, Measurement of Information and its unit, Entropy, Mutual information, Information rate, Types of channels, the channel Capacity, the source coding & entropy coding .

Module V: Error control coding theory: [6L]

Basic principle of error control & error correction coding, Parity coding, Vertical Redundancy Check (VRC), Linear Block Codes and Hamming Codes, Cyclic Code.

Text Books:

1. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford University press
2. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
3. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
4. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson, Education Asia.
2. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, S. K. Kataria & Sons
3. Principles of Communication Systems, Taub and Schilling, Tata McGraw-Hill Education

Cyber Law and Security

Code: OEC(IT/CS)601C

Contacts: 3L

Credits: 3
Total Lecture: 36L

Module1[2L]
Introduction: Cybercrime, Category of Cybercrime, Forgery, Hacking, Software Piracy, Network intrusion.

Module2[6L]
Attacks and malicious software: passive attacks, Active attacks, cyberstalking, Man in the middle attack, Malicious software: virus, worm, Trojan horse and backdoor, key logger and keystroke dynamics, spam.

Module 3[6L]
Security policy: Intrusion detection system (IDS), password protection through IDS, Intrusion protection system, Firewall.

Module3[6L]
Cybercrime on Mobile & Wireless devices: Security challenges in mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking, Ethical and patriot hacking, Bluetooth hacking, Different viruses on laptop.

Module4[4L]
Database attack: DOS & DDOS attacks; SQL injection: buffer overflow. Prevention on database attack.

Module5[6L]
Online attack: Phishing methods, Identity theft, Online identity method, social engineering, ransomware, spam and hoax mail, prevention.

Module6[6L]
Cyber law: Legal aspects, Indian laws, IT act 2000, Amendments of IT act, Digital certificate, Aadhar(UID).

Text Book:
Cyber security , Nina Gobole & Sunit Belapune; Wiley India Publication

Reference Book:
Cyber Security and Cyber Laws, Nilakshi Jain & Ramesh Menon, Wiley Publication

Control System
Code: OEC(IT/CS)601D
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module 1: Introduction to Control System (3 L)

Introduction to control system, objectives and areas of applications
Open loop system and closed loop system
Feedback control and Automatic control: concepts and examples
Concept and examples of linear and nonlinear systems, sensitivity, robustness, accuracy

Module 2: Concept of transfer function: mathematical modeling of physical systems (7 L)

Transfer function of real life systems, properties and applications
Basic concepts of poles and zeroes of a transfer function
Mathematical modeling: electrical analogy of spring–mass-dashpot system
Block diagram representation of physical systems and analysis of block diagram
Different techniques for block diagram reduction
Development of signal flow graph, Mason's gain formula

Module 3: Control system components (3 L)

Potentiometer, Synchros, Resolvers, Position encoders, Tacho-generators, Actuators
Basic concept of position control, speed control, temperature control, liquid level control, pressure control

Module 4: Time domain analysis (7 L)

Impulse, step and ramp function
Step response of first and second order system
Time domain analysis of a standard second order closed loop system
Understanding of Steady state error, undamped natural frequency, damping, overshoot, rise time and settling time and their applications
Effect and stability assessment using locations of poles and zeroes
Stability analysis using Routh-Hurwitz criteria

Module 5: Stability Analysis and control (11 L)

Stability analysis using Root locus techniques from transfer function,
Idea of semi-log graph, Bode plots and stability analysis using Bode plots from transfer function
Measurement of phase margin and gain margin
Development of polar plots from transfer function
Measure of relative stability using Nyquist criteria
PI, PD and PID control

Module 6: Introduction to State variable Analysis (5 L)

State variables and state space model, Diagonalization
Solution of state equations
Computation of stability, controllability and observability from state model

Suggested Books:

1. **Modern Control Engineering, K. Ogata,** 5th Edition, Pearson Education India
2. **Control System Engineering, I. J. Nagrath & M. Gopal.** 6th Edition, New Age International Publication.
3. **Automatic Control Systems, B.C. Kuo & F. Golnaraghi,** 10th Edition, McGraw Hill India
4. **Automatic Control Systems (with Matlab Programs), S. Hasan Saeed**, Kataria, S. K., & Sons

5. **Modern Control Engineering, D. Roy Choudhury**, PHI Learning
6. **Control Systems, A. Anand Kumar**, 2nd Edition, PHI Learning
7. **Linear Control Systems with MATLAB Applications, B. S. Manke**, Khanna Publishers

Industrial Management

Code: HS (CS/IT)604
Contacts: 3L
Credits: 3
Total Lecture: 36L

Module-1: Human Resource Management: [2L]

Introduction of Human Resource Management, Recruitment and selection, Performance appraisal, Industrial Relations, Trade Union, Collective Bargaining

Module-2: Organizational Behaviour: [8L]

Different Schools of Management Thought: Scientific Management, Administrative Theory, Theory of Bureaucracy, Human Relations Theory(Elton Mayo).
Motivation: Concept, Different Theories (Maslow, ERG, Herzberg,) Communication: Purpose, process, Barriers to effective communication, Guidelines to make communication effective. Perception: Process, Importance, Factors influencing perception, Shortcuts for judging people- Halo effect, Stereotyping, Projection.

Module-3: Quality Management: [6L]

Concept, Dimensions for goods and services, Cost of Quality, Statistical Quality Control, Control Charts, Acceptance Sampling (single). Total Quality Management: Concept, benefits, Criticism. New Quality Tools: Kaizen, Six Sigma, Quality Circles.

Module-4: Productions Management: [2L]

Concept. Difference from Operations Management, Types of Production (Mass, Batch, Project), Functions of Production Management. Productivity: Concept, Different Inputs and Productivity Measures, Efficiency and Effectiveness, Measures to increase Productivity.

Module-5: Marketing Management: [2L]

Basic Concepts of Marketing, Difference between Selling and Marketing, Elements of Marketing Mix- the 4 P's. Brief idea about Marketing Environment, Simple Marketing Strategies: SWOT Analysis.

Module-6: Introduction to Accounting [7L]

Basic accounting concepts, important definitions, uses, limitations, advantages; types of Accounting, Financial statements, introduction to Journal Accounting; different types of Vouchers, double entry bookkeeping, different types of transactions related to Financial Accounting.

Module-7: Financial Control [5L] Posting of Ledgers and preparation of Trial Balance; preparation of Balance Sheet and Profit and Loss Accounts; Controlling other departments by Financial Accounting (A practical Approach).

Module-8: Budget Analysis: [4L]
Union and State Budget Analysis of concerned year: Budget at a Glance, Annual financial Statement, Economic Survey of Concerned year

Suggested Books:
1. Industrial Management, Vol.1 L.C. Jhamb, EPH
2. Industrial Relations, Trade Unions & Labour Legislation - Sinha, Pearson Education Asia
3. Organizational Behaviour, S.P. Robbins, Prentice Hall
5. Marketing Management, Phillip Kotler, Prentice Hall/Pearson Education.
6. Productions and Operations Management, Joseph Monks,TMH
7. Financial Management and Accounting - P. K. Jain, S. Chand & Co.
8. For Union Budget: indiabudget.gov.in

Computer Network Lab
PCL(CS/IT) 619
Contacts: 3P
Credit: 1.5
Total Lecture: 36P

1.NIC Installation & Configuration (Windows/Linux)
2. Understanding IP address, subnet, MAC address, IP configuration
3. Networking cables (CAT5, UTP), Connectors (RJ45, T-connector)
4. Physical verification of existing LAN
5.TCP/UDP Socket Programming
   i) UDP time client server program
   ii) UDP echo client server program
   iii) TCP time client server program
   iv) TCP echo client server program
   v) TCP chat client server program
   vi) Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
6. Server Setup/Configuration FTP, TelNet, DNS.
7. Firewall configuration in client level
8. Mini project: Multiple user chat server implementation

Syllabus for B. Tech. (IT), 7th Semester , GCECT

7th SEMESTER							
THEORY							
SL. NO.	PAPER CODE	PAPER NAME	L	T	P	CONTACT HRS./WEEK	CREDIT
01	PEC(IT)703	Elective-III	3	0	0	3	3
02	PEC(IT)704	Elective-IV	3	0	0	3	3
03	OEC(IT/CS)702	Open Elective II	3	0	0	3	3
PRACTICAL							
01	PROJ(IT)702	Project 2	0	0	12	12	6
02	PEC(IT)704(A/B/C/D)-L	Elective-IV Lab.	0	0	3	3	1.5
SESSIONAL							
01	INDTR(IT)701	Industrial Training	0	0	0	0	1
02	CLA(IT)-7 Comprehensive Laboratory Assessment		0	0	0	0	1
TOTAL			11	0	15	24	18.5

PEC(IT)703 A: Machine Learning
B: Distributed Systems
C: Cloud Computing
D: Real Time Operating System

PEC(IT)704 A: Web Technology
B: Internetworking
C: Pattern Recognition
D: Natural Language Processing

OEC(IT/CS)702 A: VLSI Design and Algorithms
B: Digital Signal Processing
C: Management Information System
D: Big Data Analytics

Name of the course	**MACHINE LEARNING**
Course Code: PEC(IT)703A	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term I: 15 Marks
Credit Points: 3	Mid Term II: 15 Marks
	Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks
	End Semester Exam: 50 Marks

Objective:

1.	To understand and implement existing learning algorithms.
2.	To employ probability, statistics, calculus and linear algebra in order to develop new predictive models for learning methods.
3.	To select and apply an appropriate learning algorithm for problems of different kinds, including classification, regression, structure prediction and clustering.
4.	To Formulate real-world problems involving data, such that they can be solved by machine learning.

Pre-Requisite:

1.	Mathematics I [BS(CS/IT)101], Mathematics II [BS(CS/IT)205], Mathematics III [BS(CS/IT)307].
2.	Programming knowledge in Python [PCL(CS/IT)305]

Unit	Content	Hrs	Marks
1	**Introduction:** Basic definitions, types of learning. Probability and Bayes learning, Framework for Developing Machine Learning Models, Prepare the Data for Machine Learning Algorithms, Data Cleaning, Handling Text and Categorical Attributes, Handling Missing Values, Exploration of Data using Visualization, Types of Machine Learning Systems.	4	
2	**Linear Regression:** Linear regression, Multivariate regression, Decision trees, Gradient Descent Algorithm for Linear Regression Model, Multi-collinearity, Logistic Regression.	4	
3	**Classification:** Training a Binary Classifier, Measuring Performance, Classification using Linear Regression and Logistic Regression, Multiclass Classifier, Multi-label Classification, Multi-output Classification.	4	
4	**Supervised Learning** : Different types of classifiers, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees: Random Forests, Support Vector Machines, Model Evaluation and Improvement.	5	

5	**Dimensionality Reduction :** Dimensionality Reduction, Feature Extraction, and Manifold Learning, Principal Component Analysis (PCA), Randomized PCA, Incremental PCA, Kernel PCA, Selecting a Kernel and Tuning Hyper-parameters.	5	
6	**Unsupervised Learning:** Different clustering algorithms - Partitive, hierarchical and density based, Clustering for big data, Anomaly Detection using Gaussian Mixtures, Assessment Metrics for Clustering Algorithms.	5	
7	**Reinforcement Learning :** Introduction, model free and model based RL, RL algorithms – Q learning, Stae-Action-Reward-State-Action (SARSA) etc.	4	
8	**Neural Network :** Introduction, Multilayer network, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation, Introduction to Deep Neural Network, Convolution Neural Network and Recurrent Neural Network.	7	

Text books:

1. Tom Mitchell, Machine Learning , McGraw Hill Education.
2. M. Mohri, A. Rostamizadeh, A. Talwalkar, Foundation of Machine Learning, MIT Press.
3. Christopher Bishop. Pattern Recognition and Machine Learning. 2e, Springer.

Reference books:

1. S. S. Shwartz and S. B. David, Understanding Machine Learning : From Theory to Algorithms, Cambridge University Press, 2014.
2. I. Goodfellow, Y. Bengio and A. Courville, Deep Learning, MIT Press.
3. V.S. Devi; M.N. Murty, Pattern Recognition: An Introduction, Universities Press, Hyderabad, 2011.
4. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000

Course Outcome: After successful completion of this course, the learners will be able to -

CO1: Analyze the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CO2: Employ a wide variety of learning algorithms.

CO3: Apply principles and algorithms to evaluate models generated from data.

CO4: Compare the Machine Learning algorithms in the paradigms of supervised, un-supervised and reinforcement learning.

CO5: Design and implement various machine learning algorithms in a range of real world applications.

Name of the course	**DISTRIBUTED SYSTEMS**
Course Code: PEC(IT)703B	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term I: 15 Marks
Credit Points: 3	Mid Term II: 15 Marks
	Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks
	End Semester Exam: 50 Marks

Objective:

1.	To learn the principles, architectures, algorithms and models used in distributed systems.
2.	To give an understanding of the principles and techniques behind the design of distributed systems, such as message passing, coordination, synchronization and fault tolerance.
3.	To understand the issues involved in a virtual uniprocessor system of multiple computers along with a distributed shared memory.
4.	To provide an exposure conceptually into the design and functioning of existing distributed systems

Pre-Requisite:

1.	Operating Systems [PC(CS/IT)511]
2.	Computer Networks [PC(CS/IT)617]

Unit	Content	Hrs	Marks
1	**Introduction:** Introduction to DCS, DCS design goals, Design issues, Transparencies, Examples and trends in distributed system, Challenges, Architectural models.	4	
2	**Inter-process communication:** Basic Message Passing Model, Issues in IPC by message, RPC basics, The RPC Model, RPC implementation, RPC communication protocols, Lightweight RPC.	6	
3	**Distributed Coordination:** Temporal ordering of events, Lamport's logical clocks, Vector clocks, Ordering of messages, Physical clocks, Global state detection.	5	
4	**Distributed System Synchronization:** Distributed Mutual Exclusion, Election Algorithms, Deadlocks in Distributed Systems, Termination detection.	7	
5	**Distributed Shared Memory:** DSM Concepts, Architecture, Design and Implementation Issues, Algorithms for implementing DSM. Memory Coherence, Heterogeneous and other DSM systems.	4	
6	**Fault Tolerance:** Failure Models, Process Resilience, Reliable	5	

	Client Server and Group Communications, Distributed Commit Protocols, Check-pointing and Recovery		
7	**Distributed File System:** DFS definition, Characteristics, Goals, DFS Design, DFS Implementation, File Caching and Replication in DFS.	5	

Text books:

1 Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems Principles and Paradigms, PHI.

2. Coulouris, G. et al, Distributed Systems: Concepts and Design, 3rd Edition, Addison Wesley.

3. P. K. Sinha, Distributed Operating Systems: Concepts and Design, IEEE press.

Reference books:

1. Singhal Mukesh & Shivaratri N. G., Advanced Concepts in Operating Systems, TMH

2. Tanenbaum, A. S. Distributed Operating Systems, Prentice Hall.

3. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press.

Course Outcome: After successful completion of this course, the learners will be able to -

CO1: Enumerate the design goals, issues and challenges associated with the design of a distributed system.

CO2: Demonstrate and handle the knowledge of details of message passing system and RPCs of distributed environment.

CO3: Apply important methods in distributed systems to support coordination and synchronization of the system.

CO4: Use and articulate Distributed Shared Memory, Distributed File Systems and recovery techniques.

CO5: Discern the issues related with faults in a distributed system and suggest basic measures.

Name of the course		**CLOUD COMPUTING**	
Course Code: PEC(IT)703C		**Semester: 7th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Term I: 15 Marks	
Credit Points: 3		Mid Term II: 15 Marks	
		Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks	
		End Semester Exam: 50 Marks	
Objective:			
1.	To understand the concept of cloud computing.		
2.	To introduce the various levels of services that can be achieved by cloud.		
3.	To describe the security aspects in cloud.		
4.	To solve a real-world problem using cloud computing.		
5.	To appreciate the emergence of cloud as the next generation computing paradigm.		
Pre-Requisite:			
1.	Operating System [PC(CS/IT)511]		
2.	Computer Networks [PC(CS/IT)617]		
Unit	Content	Hrs	Marks
1	**Introduction to Cloud Computing:** Cloud Computing (NIST Model), Properties, Characteristics & Disadvantages	3	
2	**Cloud Computing Architecture:** Cloud computing stack, Service Models, Deployment Models	5	
3	**Infrastructure as a Service (IaaS):** Introduction to IaaS, Resource Virtualization, Case study on IaaS	6	
4	**Platform as a Service (PaaS):** Introduction to PaaS, Cloud Platform and Management, Case study on PaaS.	5	
5	**Software as a Service (SaaS):** Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS	5	
6.	**Service Management in Cloud Computing:** Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data	6	
7	**Cloud Security:** Infrastructure Security, Data security and Storage, Identity & Access Management, Access Control, Trust, Reputation,	6	

	Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations		

Text books:

1.Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

2.Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

Reference books :

1. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

2. Rittinghouse, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

4. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.

Course Outcome: After completion of this course, the learners will be able to –

CO1: Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.

CO2: Compare the advantages and disadvantages of various cloud computing platforms.

CO3: Deploy applications over commercial cloud computing infrastructures.

CO4: Select the appropriate technologies and approaches for implementation and use of cloud.

CO5: Analyze the performance, scalability, and availability of the underlying cloud technologies and software.

CO6: Identify security and privacy issues in cloud computing.

Name of the course	**REAL TIME OPERATING SYSTEM**
Course Code: PEC(IT)703D	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term I: 15 Marks
Credit Points: 3	Mid Term II: 15 Marks
	Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks
	End Semester Exam: 50 Marks

Objective:			
1.	To understand the structure and properties of real time operating system.		
2.	To understand resource management activities in Real time operating system.		
3.	To apply different techniques for process management and memory management in RTOS.		
4.	To implement RTOS models.		
Pre-Requisite:			
1.	Operating Systems [PC(CS/IT)511]		
Unit	Content	Hrs	Marks
1	**Introduction to RTOS** Overview of Architecture of OS, Virtual Computers, Interaction of O.S. & hardware architecture, Distributed real-time systems, multiprocessor real-time systems.	6	
2	**Architecture of RTOS** Defining Real time systems, designing and Developing Real-time Systems, Special Characteristics of real time systems, Hard Real Time System and Soft Real Time System, Interrupts and Exceptions, Concepts of interrupt driven activation, need for real time monitor, pseudo parallelism, meeting of deadlines & real time constraints, Real-Time Devices, Event driven activities, Timers and Real-time Facilities.	8	
3	**Resource management** Resource management in real-time systems, potential problems and their resolution, issues in building real-time systems. Resource sharing in real-time systems.	6	
4	**Process Management** Multitasking in Real-Time Systems, Real Time Scheduling concepts. Uniprocessor scheduling, Multiprocessor Scheduling, schedulable analysis, clock-driven and priority-driven scheduling Process Synchronization, Inter-task communication Networking,	6	
5	**Memory management** Memory space protection, Memory allocation schemes, deallocation, large virtual address space, memory protection.	4	
6	**Implementation model** Overview of WARD & MELLOR Methodology: Ward & Mellor Life Cycle, the essential model step, the real time extensions of DFD Real time languages: overview of ADA/Java Extension	6	

Text books:

1. "Real Time Systems,"- C.M. Krishna and G. Shin, -McGraw-Hill International Edition
2. "Real Time Systems and software" -Alan C. Shaw; John Wiley & Sons Inc

3. "Real time Systems", J. W. S. Liu, Pearson

Reference books:

1. "Embedded and real time operating systems" ---K.C. Wang- Springer
2. "Building a real time operating system" ---Colin Walls. - Newnes publication
3. "Real time operating system books" –Jim Cooling

Course Outcome: After completion of the course students will able to -

CO1: Review and analyze different types of Operating systems, their basic structure and features.
CO2: Select the architecture of real time operating system.
CO3: Analyze the resource management in real time operating system.
CO4: Determine the process management in real time operating system.
CO5: Evaluate the memory management in real time operating system.
CO6: Develop different real time implementation models.

Name of the course	**WEB TECHNOLOGY**
Course Code: PEC(IT)704A	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term I: 15 Marks
Credit Points: 3	Mid Term II: 15 Marks
	Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks
	End Semester Exam: 50 Marks

Objective:	
1.	To understand the web-based technologies and able to apply the appropriate one to design web-based applications.
2.	To apply different web design tools & techniques for developing web application.
3.	To understand the underlying architecture of web-based applications.
4.	To solve the common ecommerce site design and maintenance problems.

Pre-Requisite:			
1.	Object Oriented Programming [PC(CS/IT)513]		
2.	Database Management System [PC(CS/IT)512]		
Unit	Content	Hrs	Marks
1	**Module1: Introduction to Web Application** Web Client, Web server, Web Application Architecture, Web Client-Server Request-Response Paradigm, Server-side Technologies: Common Gateway Interface, JEE Overview,	3	

	JEE Architecture.		
2	**Module2: Web Pages** Static, Dynamic and Active Web Pages, Overview of HTML, CSS and Bootstrap, Java Applets: Applet Life Cycle, Applet API, Graphics and Event Handling in Applet.	5	
3	**Module3: JavaScript** Variables, Expressions, Control Statements, Arrays, Objects, Functions, Events and Validations, Regular Expressions.	4	
4	**Module4: XML** Introduction to XML, Document Type Definition and its attributes and entities, Namespaces and Schema, XSLT.	3	
5	**Module5: JDBC** Introduction to Java database connectivity, JDBC Drivers, Establishing connection, Executing query, Result processing, Database Metadata, Working with PreparedStatemnt, Callable Statement.	3	
6	**Module6: Java Servlet** Server-side programming, Servlet API, The Servlet Architecture, The Servlet Life Cycle, GET and POST, Servlet Life Cycle methods, Processing form data, Database connectivity through servlet, ServletConfig and ServletConext, Servlet chaining.	6	
7	**Module7: Java Server Pages** Introduction to JSP, Life Cycle of a JSP Page, JSP Elements: Directives, Scripting Elements, JavaBeans, Implicit Objects and Scope.	6	
8	**Module8: Cookies and Session Management** The Contents of a Cookie, Types of Cookies, Creating Cookies using Servlet, Lifecycle of HTTP Session, Session Tracking with Servlet API, Working with a Session.	4	
9	**Module9: Enterprise Java Beans** Introduction to EJB, Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Writing Enterprise Beans.	4	

Text books:

1. Java EE for Beginners, Sharanam Shah, SPD Publications
2. Beginning Java EE 5: From Novice to Professional, Mukhar and Zelenak, Apress

Reference Books:

1. Professional Java Server Programming, Allamaraju, WROX Publishers
2. Java Server Programming Java EE 7 (J2EE 1.7), Kogent Learning Solutions Inc.

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

CO1: Differentiate among various types of web application development technologies related to web applications.

CO2: Design the front-end of any web application with the help of associated technologies.

CO3: Apply the skills related to client-side validation technique and able to recognize different aspects of document type definition in web design.

CO4: Work with different database management system and also able to perform different database CRUD operations.

CO5: Create dynamic web pages and also be able to develop server-side scripting for server-side processing.

CO6: Apply user sessions in dynamic web project and also be able to design business logic.

Name of the course		**INTERNETWORKING**	
Course Code: PEC(IT)704B		**Semester: 7th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Term I: 15 Marks	
Credit Points: 3		Mid Term II: 15 Marks	
		Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks	
		End Semester Exam: 50 Marks	
Objective:			
1.	To build an understanding of the fundamental concepts of layered protocol stack, Internet administration, architecture and interconnection..		
2.	To give an understanding of the general principles behind different addressing schemes, routing, network diagnostics, address translation.		
3.	To cover the issues involved in different Internet related protocols and connection oriented services to support network applications and QoS.		
4.	To provide an exposure on the issues of different applications, network-management and network-security.		
Pre-Requisite:			
1.	Computer Networks [PC(CS/IT)617]		
Unit	Content	Hrs	Marks
1	**An Overview of the Internet:** Introduction, The need and scope, Accessing the Internet, Protocol Layering, OSI-ISO, The TCP/IP Internet, Internet services, Internet standards and administration.	4	

2	**Internetworking Concepts:** Review of Network technologies: LAN, WAN, Switching Network; ISDN and ATM services, Internet and Intranet, Introduction to Internet Architectural model, Application level and Network level interconnection, Interconnection through IP Gateways or routers.	5	
3	**Internet Addressing:** Introduction, Universal identifiers, Classful and classless IP addresses, CIDR, Broadcast addresses, Multicast addressing, Special addresses, subnet and supernet addressing, Mapping internet addresses to physical addresses (ARP), IPv6.	5	
4	**Routing:** Routing direct and indirect delivery, Table driven IP routing, Default Routes, The origin of Gateway routing tables, Original Internet Architecture and Cores, Core Routers, Distance Vector (Bellman-Ford) routing, Link State Routing, Autonomous system concept, An Exterior Gateway Protocol: BGP, Interior Gateway Protocol (RIP, OSPF) Routing with partial information, MPLS.	8	
5	**Internet Protocols:** The concept of Connectionless delivery system, The Internet Datagram, Error and control messages: ICMP; Natting. The concept of connectionless and connection oriented transport layer services: UDP datagram, TCP services, TCP segments, TCP performance, SCTP.	7	
6	**Internet Servers and Applications:** DNS, DHCP, FTP Servers, www, E-Mail and SNMP.	4	
7	**Internet Security and Firewall:** Introduction, IP Security: IPSec, Authentication Header, ESP; SSL: Architecture, implementation (four protocols), Use of SSL; Introduction to Firewall, Types and configuration of firewall, SSH, VPN, DMZ.	5	

Text books:

1. Internetworking with TCP / IP - Douglas E .Comer; PE.
2. Computer Networks and Internets - Douglas E. Comer; PE.
3. TCP/IP protocol suite - Forouzan Behrouz A; TMH.

Reference books:

1. Communication Networks - Leon-Garcia-Widjaja; TMH.
2. Computer Networks – Andrew S. Tanenbaum; PHI.
3. Data and Computer Communication - William Stallings; PHI.

Course Outcome: After successful completion of this course, the learners will be able to -

CO1: Analyze the fundamental issues and challenges in Internetworking and distinguish both the workings of intranet and the Internet.

CO2: Apply the fundamental concepts of different addressing schemes and their translation.
CO3: Compare Routing scenarios and implement the required algorithms for routing.
CO4: Apply key networking protocols and handle their hierarchical relationship in the context of TCP/IP framework.
CO5: Analyze a given architecture to discern vulnerabilities and recommend security measures to mitigate the threat.

Name of the course		**VLSI DESIGN AND ALGORITHMS**	
Course Code: OEC(IT/CS)702A		**Semester: 7th**	
Duration: 6 months		**Maximum Marks: 100**	
		Examination Scheme	
Theory: 3 hrs./week		Mid Term I: 15 Marks	
Credit Points: 3		Mid Term II: 15 Marks	
		Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks	
		End Semester Exam: 50 Marks	
Objective:			
1.	To understand the basic idea about MOS transistor models and fundamental idea about CMOS inverter.		
2.	To realize the dynamic and static power dissipation of CMOS.		
3.	To understand the Placement & Routing mechanism of CMOS VLSI circuit.		
4.	To understand the Verification and Testing of CMOS circuit and different types of testing.		
5.	To apply the Computer aided design tools for digital systems.		
6.	To apply the Hardware Description Language for Combinational and Sequential Circuit design.		
Pre-Requisite:			
1.	Digital Electronics [ES(CS/IT)307]		
2.	Computer Organization [PC(CS/IT)301]		
3.	Computer Architecture [PC(CS/IT)408]		
Unit	Content	Hrs	Marks
1	**Introduction to CMOS:** MOS Structure, MOS Transistor models: NMOS, PMOS and CMOS Logic, Enhancement & Depletion Transistor, Threshold Voltage, MOS device design equations, the inverter, MOS transistor switches. NMOS Inverter and Transfer Characteristics. pull up and pull down ratios of NMOS, Alternative forms of pull up the CMOS Inverter and transfer characteristics. CMOS Inverter Delays. Combinational Logic, NAND gate, NOT Gate, Compound	8	

	Gates, Multiplexers, Memory-Latches and Registers.		
2	**Power Dissipation:** Static dissipation, Dynamic dissipation, Short-circuit dissipation, Total power dissipation.	2	
3	**Placement & Routing:** Mincut based placement – Iterative improvement, placement, simulated annealing. Segmented channel routing – maze routing – routability and routing resources.	4	
4	**Verification and Testing:** Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability.	5	
5	**Introduction to Computer aided design tools for digital systems:** Hardware description languages, Introduction to VHDL. Design Methods: Behavioural Synthesis, RTL synthesis. Introduction to behavioral, dataflow and structural models.	15	
6	**Applications of VHDL**: Combinational Circuit Design such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters etc.	4	

Text books:

1. CMOS Digital Integrated Circuit, S.M.Kang & Y .Leblebici ; TMH.
2. Algorithm for VLSI Design & Automation ; N.Sherwani, Kluwer .
3. Principle of CMOS VLSI Design, Weste and Eshrighian ; Pearson Education.
4. Modern VLSI Design: system on silicon, Wayne Wolf, Addison; Wesley Longman Publisher.

Reference books:

1. "Digital Integrated Circuits" Demassa & Ciccone, Willey Pub.
2. "Modern VLSI Design: system on silicon" Wayne Wolf; Addison Wesley Longman Publisher
3. "Basic VLSI Design" Douglas A. Pucknell & Kamran Eshranghian; PHI
4. "CMOS Circuit Design, Layout & Simulation", R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Course Outcome: After completion of this course, the learners will be able to -

CO1: Analyze the MOS transistor models and fundamental idea about CMOS inverter.
CO2: Compare the dynamic and static power dissipation of CMOS circuit.
CO3: Evaluate the Placement & Routing mechanism of CMOS VLSI circuit.
CO4: Classify the basic idea about Verification and Testing of CMOS circuit
CO5: Design Combinational and Sequential Circuit using VHDL.

Name of the course	**DIGITAL SIGNAL PROCESSING**
Course Code: OEC(IT/CS)702B	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term I: 15 Marks
Credit Points: 3	Mid Term II: 15 Marks
	Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks
	End Semester Exam: 50 Marks

Objective:	
1.	To understand the properties of different type of discrete time signals and systems
2.	To apply different mathematical tools for frequency domain analysis of discrete time signals.
3.	To design different types of digital filters and compare their performances
Pre-Requisite:	

Unit	Content	Hrs	Marks
1	**Discrete-time signals** Concept of discrete-time signal, basic idea of sampling, sampling theorem, sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences.	4	
2	**LTI Systems** Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical and analytical methods to compute convolution supported with examples and exercises, properties of convolution, stability and causality conditions	6	
3	**Z-Transform** Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, inverse Z-transform	6	
4	**Discrete Fourier Transform** Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises.	9	

5	**Fast Fourier Transform** Radix-2 algorithm, decimation-in-time, decimation-in-frequency FFT algorithms.	5	
6	**Digital Filter** Basic concepts of IIR and FIR digital filters. design of Butterworth IIR filter using impulse invariant and bilinear transformation method, design of FIR filter using window method.	6	

Text books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India)

Reference books:

1. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.

Course Outcome: After completion of this course, the learners will be able to -

CO 1: compare the characteristics of different discrete time signals and systems.
CO 2: describe Z transform of discrete time sequences and its properties.
CO 3: apply the concepts of sampling in frequency domain for computing DFT and IDFT of discrete time sequences.
CO 4: compare the performance of different Fast Fourier Transform(FFT) techniques.
CO 5: design different types of Digital Filters.

Name of the course	**MANAGEMENT INFORMATION SYSTEM**
Course Code: OEC(IT/CS)702C	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Term I: 15 Marks
Credit Points: 3	Mid Term II: 15 Marks
	Assignment, Test based on assignments, Surprise tests, Quizzes, Presentations, Attendance etc. : 20 Marks
	End Semester Exam: 50 Marks
Objective:	

1.	To understand the structure of Management Information Systems (MIS) and different types of Information Systems.		
2.	To learn about MIS Planning and Development and analyzing of Economic Behavior.		
3.	To understand the relationship between MIS and BPR and also have knowledge about ERP and E-enterprise System.		
4.	To learn about MIS support models and current trends in MIS along with security issues.		
Pre-Requisite:			
1.	Economics for Engineers [HS(CS/IT)303]		
2.	Industrial Management [HS (CS/IT)604]		
Unit	Content	Hrs	Marks
1	**Understanding MIS and Conceptual Foundations:** Introduction to Management Information Systems, MIS Categories, Managers and Activities in IS, The Decision Making Process, System Approach to Problem Solving, The Structure of Management Information System, Kinds of Information Systems, Governance Modes in the use of IT	5	
2	**Planning, Development and MIS Organization Structure:** MIS Planning, MIS development, MIS at Management levels, Strategic Level Planning, Operational Level Planning, Economic and Behavior Theories	5	
3	**MIS and BPR:** Business Process Re – Engineering, Improving a process in BPR, Object Oriented methodology, BPR – Current Focus	4	
4	**Enterprise Resource Planning and E-Enterprise System:** Basics of ERP, Enterprise Systems in Large Organizations, Organization of Business in an E-enterprise, E-business, E-commerce, E-communication, E-collaboration	6	
5	**MIS – Support Models and Knowledge Management:** Market Research Methods, Ratio Analysis for Financial Assessment, Procedural Models, Project Planning and Control Models, Operations Research Models: Mathematical Programming Techniques, Knowledge Management	8	
6	**Ethical Issues and Trends in MIS:** Control Issues in Management Information Systems, Security Hazards, Ethical Issues, Technical solutions for Privacy Protection, Decision Support Systems (DSS), Types of Database Users, Designing of DBMS, Artificial Intelligence (AI), Basic Network Terminologies, The Intranet and the Extranet	8	

Text books:

1. Kenneth C. Laudon, Jane P. Laudon, Management Information System, Pearson Education India
2. Ramesh Behl, James A. O'Brien, George M. Marakas, Management Information Systems, McGraw Hill Education India
3. S. Sadagopan, Management Information Systems, PHI Learning
4. Indrajit Chatterjee, Management Information Systems, PHI Learning

Reference books:

1. Girdhar Joshi, Management Information Systems, Oxford University Press India
2. Oz Effy, Management Information Systems, Cengage Learning Inc

Course Outcome: After completion of this course, the learners will be able to

CO1: Describe MIS, Structure of MIS as well as different kinds of Information Systems.
CO2: Use the concept of MIS Planning, Development and Economic and Behavior Theories.
CO3: Implement the relation between MIS and BPR.
CO4: Apply ERP, E-business, E-commerce, E-communication and E-collaboration.
CO5: Design MIS- Support Models and use the concept of Knowledge Management.
CO6: Identify the Security Hazards in MIS and implement the applications currently trending in MIS.

*Special Remarks (if any)
The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course	**Web Technology Lab.**
Course Code: PEC(IT)704A-L	**Semester: 7th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 3 hrs./week	Laboratory journal book and Results: 40 marks
Credit Points: 1.5	Viva Voce conducted during semester: 40 marks
	Attendance, Overall conduct, Skills etc.: 20 marks

Objective:	
1.	To design and deploy web enabled services with the help of appropriate technologies.
2.	To maintain the modules associated with web-based applications.
3.	To solve the common ecommerce site design and maintenance problems.
Pre-Requisite:	
1.	Object Oriented Methodology [PC(CS/IT)513]
Laboratory Experiments:	
1.	Designing of web pages using HTML, CSS.
2.	Client-side scripting using java script.
3.	XML.
4.	CRUD operations using JDBC.
5.	Servlets.
6.	JSP.
7.	Session Management.
8.	Case study on designing web-application module.
9.	Demonstration on AJAX.

Course Outcome: After completion of the course the students will be able to-

CO1: Design front end of the web pages with the help of web page development skills and apply the skills to validate web pages using client-side scripting technologies.
CO2: Apply the knowledge of XML in web development skills.
CO3: Create database CRUD operations performed in web technology.
CO4: Design web pages using server-side scripting technologies and also able to apply server-side validation techniques.
CO5: Learn to work with user specific data to manage user sessions and also be able to learn session management techniques in server-side scripting.
CO6: Analyze the tier of dynamic web project and also be able to create web application.

Name of the course	**Internetworking Lab.**
Course Code: PEC(IT)704B-L	**Semester: 7th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 3 hrs./week	Laboratory journal book and Results: 40 marks
Credit Points: 1.5	Viva Voce conducted during semester: 40 marks
	Attendance, Overall conduct, Skills etc.: 20 marks

Objective:	
1.	To learn coding and implementation of different types client server socket programing.
2.	To design IP address allocation scheme and handle basic router configuration.
3.	To have exposure on some common server configuration.
Pre-Requisite:	
1.	Computer Network lab [PCL(CS/IT)619]
Laboratory Experiments:	
1.	Using TCP/IP sockets, client – server programming.
2.	Programming for error detection using CRC.
3.	Implementation of data link protocols - Stop and Wait protocol
4.	Designing a scheme for IP address allocation
5.	Router Configuration Using Packet Tracer (free simulator)
6.	NS2/ NS3 based simulations.
7.	Configuration of DNS server
8.	Configuration of firewall.

Course Outcome: After completion of the course the students will be able to-

CO1: Determine the structure and organization of computer networks, IP addressing schemes.

CO2: Implement basic concepts of client/server models and communicate using socket programming.

CO3: Handle transport layer concepts and protocols; including connection oriented and connection-less models, techniques to provide reliable data delivery.

CO4: Simulate basic networking environments and routing.

CO5: Configure some application servers.