SEMESTER - I

15XD11 CALCULUS AND ITS APPLICATIONS 3 2 0 4

LIMITS AND CONTINUITY: Function of single variable – Definition, limit, continuity, piecewise continuity, periodic, differentiable, absolutely integrable, fundamental theorem of Calculus. (9+6)


MULTIPLE INTEGRALS: Double integrals in Cartesian form - Change of order of integration – double integrals in polar form, triple integrals in rectangular, cylindrical and spherical coordinates. Applications of multiple integrals to find areas, volume, moments, masses. (9)

ORDINARY DIFFERENTIAL EQUATIONS: Linear Differential Equations of first order - Exact differential equations, Integrating factors, Bernoulli equations - Linear Differential Equations of higher order with constant coefficients - Euler’s equation with variable coefficients - Simultaneous equations - Method of variation of parameters. Modeling simple systems. (12+8)

TEXT BOOK:

REFERENCES:

15XD12 ENGLISH FOR PROFESSIONAL SKILLS 3 0 0 3

READING COMPREHENSION: Developing Reading Skills like Skimming and Scanning for information, Critical Reading, Inferential, Cognition, and analytical Skills- appropriate reading texts to be used from general, scientific, and literary genres. (10)

PRINCIPLES OF CLEAR WRITING: The fundamental aspects of formal writing like objectivity, conciseness, clarity, simplicity, coherence, parallelism, unity, cohesion and accuracy to be focused Writing in different ways to create an emphasis – samples from news items, creative articles and reports to be used. (4)

TECHNICAL WRITING: Technical Style, Mechanics, Critical Evaluation of different types of technical texts and different genres of technical writing. – Format and different types of formal reports – Technical Papers. (4)

CORRESPONDENCE: Memos, Principles of Official, Social, and E-mail Correspondence to be focused. (4)

FOCUS ON SOFT SKILLS: Intra and Interpersonal Communication, Telephone Etiquette, Body language and Interview Techniques. (5)

PRACTICALS: Listening exercises using Language Laboratory, Making short speeches, Group Discussions and Role-Plays. (18)

Total L : 45

TEXT BOOK:
1. Teaching Material prepared by the Faculty, Department of English.
REFERENCES:

15XD13 APPLIED PHYSICS


SEMI CONDUCTORS AND DEVICES: Elemental and compound semiconductors. Intrinsic and extrinsic semiconductors - Properties. Hall effect - Hall coefficient in extrinsic semiconductors, experimental determination of Hall coefficient. Application of Semiconductors –Solar Cells, LED and LCD. Introduction to semiconductor memory devices: Random Access Memory (RAM), Read only Memory (ROM), DRAM CCD. (12)


ADVANCED MATERIALS AND APPLICATIONS: NANO MATERIALS - Synthesis - PVD and ball milling techniques, properties, applications. Shape Memory alloys (SMA) – Characteristics, properties of NiTi alloy, application in MEMS. Superconductivity- types of superconductors - High Tc superconductors, Application of superconductors - SQUID, Levitation and cryotron. (12)

Total L: 60

TEXT BOOKS:

REFERENCES:

15XD14 DIGITAL ELECTRONICS

SEMI CONDUCTOR DEVICES AND CIRCUITS: (Qualitative treatment only) Fundamental aspects of semiconductors - PN junction diode - Zener diode - Rectifiers - Zener voltage regulators - Filters - Bipolar Junction Transistors - Transistor Amplifiers - Field Effect Transistor. (5)

NUMBER SYSTEM AND CODES: Binary - Octal - Hexadecimal - BCD - Excess three - Gray codes - Error correcting and detecting codes. (8)

DIGITAL CIRCUITS AND GATES: AND, OR, NOT, NAND and NOR gates - exclusive OR gates. Positive and negative logic systems - Digital integrated circuits-Characteristics - TTL and MOS logic circuits - Comparison. (8)

BOOLEAN ALGEBRA AND KARNAUGH MAPS: Boolean relations - Laws and theorems - Simplifications - Karnaugh maps and simplifications - Don’t care conditions - NAND-NAND realizations. (8)

COMBINATIONAL LOGIC: Design and Implementation of Half and Full adders - Subtractors – Parallel adders - Carry look ahead addition - Encoders and decoders - Multiplexers and De-multiplexers. (8)

OPERATIONAL AMPLIFIERS: Definition of terms - Inverting and non-inverting amplifiers, inverting summing amplifier, integrators and differentiators.

A/D AND D/A CONVERTORS: DACs: weighted and binary ladder types - ADCs: counter, dual slope, successive approximation types.

REFERENCES:

REFERENCES:

15XD15 PROBLEM SOLVING & C PROGRAMMING

PROBLEM SOLVING: Introduction to Problem Solving- Program development- Analyzing and Defining the Problem- Modular Design – Algorithm - Flow Chart - What is a programming language-Types of programming language- Program Development Environment.

C LANGUAGE: Introduction to C Language - C character set - Identifiers and Keywords - Data Types - Constants - Variables - Arrays - Declarations - Expressions - Statements - Symbolic constants - Operators and Expressions - Library Functions - Data Input and Output Functions.


FUNCTIONS: Defining Function - Accessing a Function - Passing Arguments to Functions - Specifying Arguments Data Types - Function Prototypes - Storage Classes - Auto - Static - Extern and Register Variables.

ARRAYS: Defining Array – Processing array - Passing array to a function - Multi dimensional array - Array and strings.

POINTERS: Declarations - Pointers to a function - Pointers and one dimensional arrays - Operating a pointer - Pointer and multi dimensional arrays - arrays of pointers - passing functions to other functions.

STRUCTURES AND UNIONS: Definition of Structure and Union - Processing a structure – Bit field representations - Structures and pointers - Passing structure to functions - Self referential structures – Nested structure.

FILES: File Structure concepts introduction - Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files – Operations on Files – Types of Files, Various input and output functions on Files.

Enumerated Data Type – Typedef - Preprocessor Directives - Command Line Arguments.

TEXT BOOKS:

REFERENCES:

15XD16 ENGINEERING GRAPHICS AND GEOMETRIC MODELLING
INTRODUCTION: BIS specifications - lines, lettering, and dimensioning. Projection – types. (4)

FIRST ANGLE PROJECTION: Introduction- Projection of points, lines, planes, and solids – parallel, perpendicular and inclined to planes. (8)

ISOMETRIC PROJECTION: Introduction- prismatic and cylindrical components. (2)

INTERACTIVE GRAPHICS: Parametric modeling – 1D, 2D and 3D geometry – transformations - display – points, lines using software. (4)

CURVES: Types- parametric curves generation-displaying - evaluating points on curves. (4)

SURFACES: Types- parametric surface generation-displaying - evaluating points on surfaces. (5)

SOLIDS: Generation of part models using Computer Aided Geometric Modeling software. (3)

LABORATORY COMPONENT:
Engineering Graphics using CAD
1. Introduction to CAD Software.
2. First angle projection of a. Points b. Lines
4. Conversion of isometric to orthographic projection.
5. Orthographic to isometric projection.
7. Perspective projection of simple solids.

Geometric Modeling using a graphical programming language
8. Modeling and displaying a point and line using orthographic projection and performing simple geometric transformation.
11. Modeling and displaying of parametrically represented NURBS curve.

Total: P: 60

TEXT BOOKS:

REFERENCES:

15XD17 C PROGRAMMING LAB

1. Simple programs to understand the concepts of data types.
2. Familiarizing conditional, control and repetition statements.
3. Usage of single and double dimensional arrays including storage operations.
4. Implementation of functions, recursive functions.
5. Defining and handling structures, array of structures and union.
6. Implementation of pointers, operation on pointers and dynamic storage allocation.
7. Creating and processing data files.

Total P: 60

15XD18 APPLIED PHYSICS AND DIGITAL ELECTRONICS LAB

0 0 4 2

APPLIED PHYSICS LABORATORY
1. Resistivity of an Alloy – Carey Foster’s Bridge.
2. Band Gap of Thermistor – Post Office Box.
4. Temperature co-efficient of Resistance – Post Office Box.
5. Efficiency of Solar Cell.

DIGITAL ELECTRONICS LABORATORY
1. Study of basic logic gates and realization of logic gates using universal gates.
2. Multiplexer and demultiplexer.
3. Half and full adder / subtractor.
4. Encoder and decoder.
5. Binary decade counter.
6. BCD to seven segment decoder.
7. Study of D/A converter.
8. Crystal Oscillator using logic gates

Total P: 60

SEMESTER - 2
15XD21 DISCRETE STRUCTURES
3 2 0 4


RELATIONS AND FUNCTIONS: Definition and properties of binary relations – Representing Relations – Closures of Relations – Composition of Relations – Equivalence Relations – Partitions and Covering of Sets – Partial Orderings – n-ary Relations and their Applications. Functions - Injective, Surjective, Bijective functions, Composition, Identity and Inverse. (8+4)

COMBINATORICS: Basics of counting – The Pigeonhole principle - Permutations and Combinations with and without repetition, Permutations with indistinguishable elements, distribution of objects - Generating permutations and combinations in lexicographic order. (8+6)

RECURRENCE RELATIONS: Some Recurrence Relation Models- Solutions of linear homogeneous recurrence relations with constant coefficients- solution of linear non-homogeneous recurrence relations by the method of characteristic roots - Divide and conquer recurrence relations. (7+5)

LATTICES: Lattices as partially ordered set – Properties of Lattices– Lattices as algebraic system – Sublattices – Direct product and Homomorphism – Some special lattices. (5+5)

Total
L:45+T:30=75

TEXT BOOKS:

REFERENCES:

15XD22 TRANSFORMS AND ITS APPLICATIONS

TRANSFORM METHODS: Concept of Transformation - Examples for Transformations. (2+2)

LAPLACE TRANSFORM: Definition - Transforms of Standard Functions - Transform of unit step function - Dirac delta function. – Transforms of derivatives and integrals -Transforms of Periodic functions - Inverse Laplace transform- Convolution Theorem. Method of solving ordinary linear differential equations with constant coefficient and solving integral equations by Laplace transform technique. (12+8)

FOURIER SERIES: Even and odd functions, Dirichlet’s conditions, statement of Fourier theorem, Fourier coefficients, change of scale, Half-range sine and cosine series, RMS value, Parseval’s theorem. (10+8)


Total: L:45 + T:30 = 75

TEXT BOOKS:

REFERENCES:

15XT23 DATA STRUCTURES

INTRODUCTION: Software Development process – Abstraction - Data structures - Abstract Data Types - Primitive data structures - Analysis of algorithms - Best, worst and average case time complexities - notations. (4)

ARRAYS: Operations - Implementation of one, two, three and multi dimensioned arrays – Sparse and dense matrices - Applications. (4)

STRINGS: Implementation - operations - String applications. SETS: Operations on sets - implementation of sets. (3)

STRUCTURES AND UNIONS: Implementation – operations – Applications. (3)

STACKS: Primitive operations - Sequential implementation - Applications: Subroutine handling - Recursion – Expression Processing. (3)

QUEUES: Primitive operations - sequential implementation - Priority Queues - Dequeues - Applications: Image component labeling; Machine shop simulation. (5)


REFERENCES:

TEXT BOOKS:

REFERENCES:

15XD24 OBJECT ORIENTED PROGRAMMING


FUNCTIONS IN C++: Function Prototyping - Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function - Overloading - Friend and Virtual Functions - Classes and Objects - Member functions - Nesting of Member functions - Private member functions - Memory allocation for Objects - Static data members - Static Member Functions - Arrays of Objects - Objects as Function Arguments - Friend Functions - Returning Objects - Const Member functions - Pointers to Members.

CONSTRUCTORS: Parameterized Constructors - Multiple Constructors in a Class - Constructors with Default Arguments - Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors overloading.

OPERATOR OVERLOADING: Overloading Unary and Binary Operators - Overloading Binary Operators using Friend functions – Operator Type conversion.


TEMPLATES & EXCEPTION HANDLING: Introduction to Templates, Generic Functions and Generic Classes – Exception Handling – Examples.

STREAMS: String I/O - Character I/O - Object I/O - I/O with multiple Objects - File pointers - Disk I/O with member functions.

REFERENCES:

TEXT BOOKS:

Total L: 45

15
15XD25 THEORY OF PROBABILITY


RANDOM VARIABLES: Discrete and continuous random variables - probability mass function and density function - distribution function - Expectation and variance. (4+2)

THEORETICAL DISTRIBUTIONS: Discrete: Binomial, Poisson and Geometric - Continuous: Uniform, Normal, Exponential, Weibull, Erlang and Gamma. (8+8)

BIVARIATE DISTRIBUTIONS Joint probability distributions - Marginal and conditional distributions - Statistical independence - Conditional expectation – Transformation of two random variables. (8+2)

LIMIT THEOREMS: Moments and moment generating functions- Sums of independent random variables - Limit theorems: Markov and Chebyshev inequalities, Law of Large numbers, Central Limit Theorem. (8+2)


Total: L:45 + T:30 = 75

TEXT BOOKS:

REFERENCES:

15XD26 OBJECT COMPUTING LAB

Exercises pertaining to the following outlines are to be experimented using C++:

1. Arithmetic operations using array of objects and dynamic data members.
2. Creation of a class having read-only member function and processing the objects of that class.
3. Creation of a class which keeps track of the member of its instances. Usage of static data member, constructor and destructor to maintain updated information about active objects.
4. Illustration of a data structure using dynamic objects.
5. Usage of static member to count the number of instances of a class.
6. Illustration for the need of default arguments.
7. Usage of a function to perform the same operation on more than one data type.
8. Creation of a class with generic data member.
9. Overloading the operators to do arithmetic operations on objects.
10. Acquisition of the features of an existing class and creation of a new class with added features in it.
11. Implementation of run time polymorphism.
12. Overloading stream operators and creation of user manipulators.
13. Implementation of derived class which has direct access to both its own and public members of the base class.
14. Implementation of Streams to store and maintain Library system, with the features of Book Issue and Book Return.

Total P: 60

15XD27 DATA STRUCTURES LAB

Implementation of the following problems:
1. Sparse and dense Matrix operations using arrays.
2. Library of string operations - representing strings using arrays.
3. Set operations.
4. Stack and Queue using array.
5. Linked Lists: Singly linked, Doubly linked and Circular lists.
6. Linked Stacks and Queues.
7. Conversion and Manipulation of Expressions.
8. Binary trees and Threaded trees (with graphical representation).
9. Hash trees and Threaded trees (with graphical representation).

**15XD28 MATHEMATICAL COMPUTING LAB**

Implementation of the following problems using Matlab / R programming:

1. Differentiation and integration.
2. Finding Fourier series.
5. Solving difference equations using Z transform.
6. Plotting Probability distributions using R Programming
7. Analyzing probability distributions to verify the limit theorems

Total P: 60

**SEMESTER - 3**

**15XD31 APPLIED STATISTICS**


**STATISTICAL INFERENCE:** Sampling distribution - Estimation: Point estimation, interval estimation - Criteria of a good estimator – Interval estimation of mean, proportion, and variance (single sample and two samples) - Maximum likelihood estimator, Hypothesis Testing: General concepts - Errors in Hypothesis testing - One-and two-tailed tests - Tests concerning mean, proportion, and variance - Tests for Goodness of fit and independence of attributes.

**CORRELATION AND REGRESSION:** introduction - Estimation using the regression line - Correlation analysis -Limitations, errors, and caveats of using regression and correlation analyses - Multiple regression and correlation analysis - Inferences about population parameters – Modeling techniques.

**ANALYSIS OF VARIANCE:** Introduction to design of experiments, Analysis of variance - Completely Randomized Design and Randomized Block Design.

Total P: 30

**TEXT BOOKS:**


**REFERENCES:**


**15XD32 ABSTRACT ALGEBRA**

Total L: 45
ALGEBRAIC STRUCTURES: Groups - Definition and Example, Properties of Groups, Permutation Groups, Symmetric Groups, Cyclic Groups.

SUBGROUPS AND NORMAL SUBGROUPS: Subgroups – Definition, Cosets and Lagrange’s theorem, Homomorphism, Isomorphism, Automorphism – Cayley’s theorem – Normal subgroups – Factor group – Fundamental theorem of group homomorphism

GROUPS AND CODING: Coding of Binary information and Error detection – Group codes – Decoding and Error correction.


FIELDS: Definition – subfields - Finite fields – structure of Finite field, GF ($2^n$).

TEXT BOOKS:

REFERENCES:
**15XD34 ADVANCED DATA STRUCTURES**


MULTIDIMENSIONALSEARCH TREES: Range search–k-d trees- Quad trees

PRIORITY QUEUES (HEAPS): d-Heaps- Leftist Heaps - Property and operations- Binomial heap- Fibonacci heaps.

DATA STRUCTURES FOR DISJOINT SETS: Disjoint set operations-linked list representation of disjoint sets, disjoint set forests, tree representation, union by rank, find by path compression - analysis.

GRAPHS: Definition – Representations (Adjacency matrix, packed adjacency list and linked adjacency list) – Network representation, shortest path- Dijkstra’s algorithm, Graph search methods (Breadth first and depth first traversals)- Applications of depth first search-biconnectivity- finding strong components.

REFERENCES:

**TEXT BOOKS:**

**REFERENCES:**

**15XD35 COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE PROGRAMMING**

DATA REPRESENTATION: Data types - Fixed point and floating point number representation (IEEE format) - Representation of signed numbers – arithmetic operation on signed numbers - Alphanumeric data representation.

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes- Computer registers - Register transfer language - micro operations -Computer Instructions - Instruction Cycle - Memory Reference Instructions - Input - Output and Interrupts – Design of Basic Computer.

CENTRAL PROCESSING UNIT: Processor Bus organization - Stack organization - Instruction formats - Data transfer and manipulation — Multiprocessor Organization - RISC and CISC machine characteristics – Control Unit Design - Hardwired and micro programmed control.

MEMORY INTERFACING: Memory hierarchy - Main memory: RAM and ROM - address spaces - Cache memory – Associative memory - Virtual memory, TLBs - Memory Interleaving.


ASSEMBLY LANGUAGE PROGRAMMING: Programs for multi precision addition, subtraction - Block moves - Array processing - String processing - Procedures and Interrupts - Interrupt Service Routines. 

REFERENCES:

TEXT BOOKS:

15XD36 APPLIED STATISTICS AND PYTHON PROGRAMMING LAB

Implementation of the following problems using Statistical Packages:
1. Classification and tabulation of data and Graphical and diagrammatic presentation of data. 
2. Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skewness, moments and kurtosis. 
3. Determination of point and interval estimates. 
4. Solving linear regression, polynomial regression and non-linear regression based problems and solving multiple regression and correlation analysis based problems. 
5. Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts.

Exercises pertaining to the following outlines are to be experimented using Python:
6. Write a program that asks the user about textbook prices and reports how overpriced the textbooks are. 
7. Create a new function called clubhouseAnimate( objlist ) that loops through the window objects in the list and randomly switches them to either yellow (200, 190, 100) or dark (40, 50, 60). You can use a slice like mylist[1:] to loop over all the elements in a list except the first one.
8. Create a main function that creates a GraphWin, calls clubhouseInit and assigns its return value to a variable like cbhouse. Then call the getMouse and close methods of your GraphWin object. Test your clubhouse.
9. Problems to practice various image drawing functions to visualize data
10. Problems to practice lists and objects collections to analyse data
11. Problems to practice python function and parameters to code the calculations of measures of dispersion
12. Problems to practice classes, dictionaries and inheritance
13. Problems to practice command line arguments to find linear regression
14. Problems to Create your own Python module packages containing functions and data to visualize non-linear models
15. Problems to Import your own and other Python modules and use contained objects
16. Problems to understand the use local, global and built-in names within functions to package on applied statistical problems

Total P: 60

15XD37 ADVANCED DATA STRUCTURES LAB

Implementation of the following problems:
1. Problems related to sorting algorithms.
2. Problems using linear search and binary search.
3. Applications of binary search tree and its operations.
4. AVL tree including all rotations.
5. B-tree and its operations.
6. Disjoint set operations and some applications.
7. Problem using heap data structure.
8. Implementation of binomial heap and one application.
9. Problems related to graphs and graph traversals.
10. Implementation of shortest path algorithm.

Total P: 60
15XD38 ASSEMBLY LANGUAGE PROGRAMMING LAB

Prerequisite:

- 15XD17: Problem Solving Lab

Lab objectives

- To understand the arithmetic operation in various number representation.
- To practice on the DEBUGGER and 8086 Emulator tool.
- To enable the students to use the tools for checking the memory and internal register contents and debugging.
- To use arithmetic and logical instruction and control structures.
- To perform string operations and interrupt functions.
- To design a microprocessor based input/output system using interrupts.

LABORATORY COMPONENT:

1. Implementing the functionality of AND, OR and NOT gates.
2. Conversion of data between different number systems.
3. Arithmetic operations of binary numbers using both one’s complement and two’s complement arithmetic.
4. Implement parity bit generation for a n-bit binary data.
5. Practice on the DEBUGGER and 8086 Emulator Tool.
6. Conversion of BCD numbers into ASCII characters and vice versa.
7. Multiprecision addition and subtraction.
8. Packing and unpacking of BCD digits.
9. Programs on Logical and Arithmetic Instructions.
10. Implementation of Control Structures (FOR, LOOP, IF.. THEN, DO.. WHILE etc..)
11. Programs using Arrays and Strings.
12. Programs using Special Instructions DAA, XCHG, CMPSW etc…
13. Programs using interrupt functions for input and output.

Total P: 60

SEMESTER - 4

15XD41 LINEAR ALGEBRA

SYSTEM OF LINEAR EQUATIONS AND MATRICES: System of linear equations, Gaussian elimination, Elementary matrices and a method for finding inverse of a matrix. (7+8)

VECTOR SPACES: Vector spaces and subspaces – Linear combination, Span, Linear independence and dependence - Null space, Column space, and Row space – Basis and dimension of a vector space – Rank and nullity-Applications to Electrical network. (10+2)

LINEAR TRANSFORMATION: Introduction to linear transformations – General Linear Transformations – Kernel and range – Matrices of general linear transformation- Geometry linear operators-Change of basis. (8+2)

EIGEN VALUES AND EIGEN VECTORS: Introduction to Eigen values- Diagonalizing a matrix- Orthogonal diagonalization- Applications to differential equations- Positive definite matrices- Similar matrices – Quadratic forms- Quadratic surfaces Singular value decomposition. (10+10)

TOTAL: L:45+T:30 = 75

TEXT BOOKS:

REFERENCES:

15XD42 DATABASE DESIGN 3 0 0 3


DATA MODELS: Introduction – Conceptual data modeling – Motivation - Entities, entity types, various types of attributes, relationships, relationship types - E/R Diagram(ERD) notation - Generalization – Aggregation – Conversion of ERD into relational schema – Introduction to Network data model and Hierarchical data model. (8)

RELATIONAL DATA MODEL: Introduction – Keys, relational algebra operators: selection, projection, cross product, various types of joins, division, examples, tuple relation calculus, domain relational calculus . (8)

RELATIONAL DATABASE MANIPULATION: Structured Query Language (SQL) - Basic data retrieval – nested queries- correlated and uncorrelated - SQL Join – Views. (4)

DATABASE DESIGN THEORY: Functional dependencies – Normal forms - Dependency theory - Functional Dependencies(FD) – Armstrong’s axioms for FDs - Closure of a set of FDs, Minimal covers – 1NF, 2NF, 3NF and BCNF - Join dependencies and definition of 5NF – Examples. (9)


TOTAL L: 45

TEXT BOOKS:

REFERENCES:

15XD43 DESIGN AND ANALYSIS OF ALGORITHMS 3 0 0 3

DIVIDE AND CONQUER: Integer multiplication, Strassen’s matrix multiplication, closest pair.

GREEDY METHOD: Minimum cost spanning tree (Kruskal and Prim’s algorithms) , topological sorting, Huffman codes and data compression.

DYNAMIC PROGRAMMING: Principles of dynamic programming – 0/1 knapsack problem, all pairs shortest problem, travelling salesman problem.

STRING MATCHING: The naïve string-matching algorithm, Rabin-karp algorithm and analysis.

NP AND COMPUTATIONAL INTRACTABILITY: Basic concepts – Polynomial time reductions, efficient certification and NP, NP hard and NP complete problems.


REFERENCES:

REFERENCES:

15XD44 OPERATING SYSTEMS


PROCESS AND THREADS: Relationship between process and threads – Thread State – Thread Synchronization – Types of Thread – Multithreading model.

PROCESS SCHEDULING: Scheduling basics - CPU-I/O interleaving- (non-)preemption - context switching- Types of Scheduling – Scheduling Criteria – Scheduling Algorithms.


Total: L:45

23
TEXT BOOKS:

REFERENCES:

15XD45 PREDICTIVE ANALYTICS

LINEAR REGRESSION: Coefficient of determination, Significance test, Residual analysis, Confidence and Prediction intervals. (10)

MULTIPLE LINEAR REGRESSION: Coefficient of determination, Interpretation of regression coefficients, Categorical variables, heteroscedasticity, Multi-co linearity outliers, Auto regression and Transformation of variables, Regression, Model Building. (15)

LOGISTIC AND MULTINOMIAL REGRESSION: Logistic function, Estimation of probability using Logistic regression, Variance, Wald Test, HosmerLemshow Test, Classification Table, Gini Co-efficient. (10)

FORECASTING: Moving average, Exponential Smoothing, Casual Models. (10)

TIME SERIES ANALYSIS: Moving Average Models, ARIMA models , Multivariate Models (10)

CASE STUDIES (5)

TEXT BOOKS:

REFERENCES:

15XD46 UNIX SYSTEMS LAB


1. Overview of an Operating System, Boots and Shutdown.
2. UNIX File System Commands.
3. UNIX Commands.
4. SHELL Programming.
5. Writing programs using UNIX System Calls.
7. Thread Creation and Execution.
9. Developing Application using Inter Process communication (using sharedmemory, pipes or message queues).
10. Implementation of Memory Management Schemes.
11. Creating Linux Modules.

TEXT BOOKS:

REFERENCES:

15XD47 RDBMS LAB

0 0 4 2
1. Working with DDL and DML commands of SQL for creation and manipulation of single, multiple tables, Report Generation.
2. Working with PL/SQL- Triggers and stored procedures.
3. Developing Packages using a database.

Total P: 60

15XD48 DESIGN AND ANALYSIS OF ALGORITHMS LAB

0 0 4 2

Implement the following:
1. Problem using closest pair algorithm.
2. Prim’s minimum cost spanning tree.
3. Kruskal’s minimum cost spanning tree using min heap data structure, union and find operation.
4. Problem related to topological sorting.
5. Application of all pairs shortest path problem.
6. Optimal binary search tree.
7. Optimal caching.
9. TSP using branch and bound.

Total P: 60

SEMICER - 5

15XD51 APPLIED NUMERICAL ANALYSIS

4 0 0 4

TYPES OF ERRORS: Different types of error.

SOLUTION OF ALGEBRAIC EQUATIONS: Newton Raphson method, Modified Newton Raphson method, Method of false position, Graffe’s root squaring method, Bairstow’s method.


INTERPOLATION AND CURVE FITTING: Finite difference operators-Interpolating Polynomials, Divided Difference, Spline Curves, Bezier Curves and B-Spline Curves. Solution of linear second order difference equations with constant coefficients.

NUMERICAL DIFFERENTIATION AND INTEGRATION: Numerical Differentiation using Newton forward and backward formulas. Numerical Integration: Newton –Cotes formula, Trapezoidal rule, Simpson’s $\frac{1}{3}$rd and $\frac{3}{8}$ th rule, Gaussian Quadrature Applications of Cubic Splines.


Total: L:60
15XD52 STOCHASTIC MODELS


GENERAL QUEUEING MODELS: Single and Multi server Poisson Queues - Single Server Queue with Poisson input and general service M / G/1 – General input and exponential service – G/M/1 Queueing model. (10)

BROWNIAN MOTION: First Passage time distribution – The maximum of a Brownian Motion – The Zeros of Brownian Motion – Brownian Motion with Drift - Geometric Brownian Motion. (11)

Total L:60

REFERENCES:

15XD53 COMPUTER NETWORKS

INTRODUCTION: Network goals - Applications of Networks - Design issues for the layers - OSI Reference Model - Types of Network - Network Topologies- Analog and Digital data transmission- Data encoding- Bandwidth and data rate- Bit Rate, Baud Rate.- Sampling Rate. (6)


DATA COMMUNICATION: Multiplexing - Synchronous and Asynchronous TDM – FDM –CDM - Switching, Circuit Switching, Packet Switching. (3)


ROUTING AND CONGESTION CONTROL: Distance vector routing _ Link state Routing – RIP – OSPF- BGP. Congestion control- TCP congestion control- Rate limiting and traffic shaping.  

APPLICATIONS: FTP, SMTP - MIME Format, DNS, HTTP- Content distribution networks.


EXCEPTION HANDLING: Fundamentals - Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses - Nested Try statements - Throw - Throws - Java Built-in Exception - Creating your own subclasses.

MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Main thread - Creating the Thread - Synchronization - Interthread Communication - Deadlock.


TUTORIAL PRACTICE:
1. To create runtime polymorphism using abstract class, interface.
2. To create callback feature using interface.
3. To create a program for interface inheritance.
4. To implement a user defined package.
5. To implement a user defined checked exception and unchecked exception.
6. To create threads, thread groups.
7. To create inter-thread communication using shared memory, piper stream.

Total P: 60

REFERENCES:

15XD57 COMPUTER NETWORKS LAB

1. Familiarize with GNS3 simulator.
2. Implement Hamming code and CRC.
3. Implement a primitive email server.
4. Familiarize with packet capturing tools in Java and Wireshark.
5. Implement a simple firewall system.
6. Analyse the existing routing protocols and implement any one of them.
7. Write a program where a single entity can communicate with other entities by using IP-multicasting.
8. Assignments using the network simulator.

Total P: 60

15XD58 SUPERVISED AND UNSUPERVISED LEARNING LAB

Implement the following algorithms using R Package
2. Naïve Bayes Classifier for discrete and continuous data.
3. Naïve Bayes Classifier using Smoothing.
4. Bayesian Decision making with loss function.
5. Entropy and information gain calculation.
6. Decision tree construction.
7. Clustering algorithms K-means, K-medoids, Agnes, DIANA.

Total P: 60
**SEMESTER – 6**

**15XD61 PARALLEL AND DISTRIBUTED COMPUTING**


PARALLEL COMPUTER MEMORY ARCHITECTURES: Shared Memory - Distributed Memory - Hybrid Distributed-Shared Memory Multiprocessors: Communication and Memory issues - Message Passing Architectures - Vector Processing and SIMD Architectures. (5)

PARALLEL PROGRAMMING MODELS: Overview - Shared Memory Model - Threads Model - Message Passing Model - Data Parallel Model - Other Models. (5)


PRAM ALGORITHMS & BSP: PRAM model of computation- Work-Time formalism and Brent's Theorem; algorithm design techniques-parallel prefix, pointer jumping, Euler tours, divide and conquer, symmetry breaking; survey of data-parallel algorithms; relative power of PRAM models - Bulk synchronous parallel model. (6)

HIGH PERFORMANCE COMPUTING ARCHITECTURES: Latency Hiding Architectures - Multithreading Architectures - Dataflow Architectures - GPGPU Architecture- Overview of basic Accelerators /GPU / GPGPU and its programming model – CUDA - OpenCL. (6)


DENSE LINEAR ALGEBRA: Matrix transposition - Matrix product - Gaussian elimination - Data distribution - Parallel linear algebra libraries. (5)

Total L: 45

**TEXT BOOKS**


**REFERENCES**


**15XD62 DATA MINING**

INTRODUCTION: Motivation for Data Mining - Data Mining Issues - Importance - Data Mining from a Database Perspective - Statistical Perspective on Data Mining, Similarity Measures, Classification of Data Mining Systems – Major issues in Data Mining. (4)

DATA PREPROCESSING: Types of data - Data cleaning – Aggregation - Sampling – Feature subset selection – wrapper and filter methods. (6)
MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic concepts – Efficient and Scalable Frequent Itemset Mining methods – Apriori, FP-Tree - Handling large larger data sets in main memory. (5)

ENSEMBLE OF CLASSIFIERS: Classification – Prediction – Voting, Bagging, Boosting, Stacking, Cascading, Random forest, Semi supervised Learning. (6)

CLUSTERING: Similarity and Distance Measures, Hierarchical Algorithms, Clustering Large Data sets, Clustering with Categorical Attributes-Outlier analysis. (5)

MINING DATA STREAMS: Challenges–Stream data model – Sampling data in a stream, Frequency moments of data stream- Counting frequency items in a stream- Mining time- Series databases. (8)

MINING MASSIVE DATA SETS: Challenges- Mining high dimensional association rules – CARPENTER- classifying high-dimensional data- PLANET- clustering high-dimensional Data – BIRCH Distributed Data Mining. (8)

CASE STUDIES: Web Mining, Spatial Mining, Graph Mining, Temporal Mining. (3)

LABORATORY COMPONENT:
1. Study of Data mining tool WEKA and Statistical package R
2. Association rule mining using Apriori algorithms.
3. Classification rules using Decision Tree classifier, Ensemble of Classifiers.
4. Implementation of Clustering Algorithms
5. Analyzing data with log liner models and graphical models using R
6. Handling massive data using map reduce

Total L: 45

TEXT BOOKS:
1. Jiawei Han and Micheline Kamber , "Data Mining – Concepts and Techniques", Morgan Kaufmann, 2012.

REFERENCES:

15XD63 MODERN DATABASE SYSTEMS

PARALLEL AND DISTRIBUTED DATABASES: Architecture of parallel databases – Parallel query evaluation, Parallel query optimization – Introduction to parallel and distributed databases, DDBMS Architecture, Distributed Database Design, Distributed Query Processing and Optimization. (6)

DATA MODELING FOR BIG DATA: Big Data and Challenges, Big Data models, NoSQL data models, Basic principles of NoSQL models, SQL databases VsNoSQL databases. (9)

NOSQL DATABASES (PART 1): Key - Value Stores: Oracle Coherence – FoundationDB – Amazon’s DynamoDB, Key -Value Stores (in-memory) : Redis, Key-value Stores (B-tree): Berkeley DB, Column Oriented Store: Google BigTable - Apache Cassandra – Hbase. (10)

NOSQL DATABASES (PART 2): Document Oriented Stores – Amazon's SimpleDB for cloud – MongoDB - Apache CouchDB - XML databases - ClusterPoint, Graph databases: Neo4J- OrientDB, Object Database: Db4o - Perst. (10)

MAP-REDUCE: Apache Hadoop and HDFS, Pig, Hive, Microsoft Azure –Big data Applications. (5)


Total L: 45

TEXT BOOKS:
REFERENCES:

15XD64 OPTIMIZATION TECHNIQUES

LINEAR PROGRAMMING: Graphical method for two dimensional problems – Central problems of Linear Programming - Definitions – Simplex method – Two-phase Simplex Method. (8)


INTEGER PROGRAMMING: Gomory cutting plane methods for integer and mixed integer programming problems - Branch and Bound method (Land – Dolg and Dakin algorithms) – Zero-One Implicit enumeration Algorithm. (8)


PERT: Arrow networks - Time estimates - Earliest expected time, latest allowable occurrence time and slack of events - Critical path - Probability of meeting scheduled date of completion of project. (4)

CPM: Calculations on CPM networks - Various floats for activities - Critical path - Updating a project - Operation time cost trade off curve - Project time cost off curve - Selection of schedule based on cost analysis. (4)


TUTORIALS PRACTICE:
1. Solving inequalities using Simplex, Two-Phase, Dual Simplex, Revised Simplex method.
2. Finding initial basic feasible solution using North-West corner rule, Matrix minimum and Vogel's approximation method and optimal test using MODI method.
4. Gomory's cutting plane methods for all IPP and mixed IPP
5. Solving Dynamic programming problems.
6. To find the critical path for the given PERT and CPM networks
7. Gradient Method for non-linear programming problems

TEXT BOOKS:

REFERENCES:

15XD66 PARALLEL AND DISTRIBUTED COMPUTING LAB

1. Basic Master – Worker program and send messages.
2. Write a program to find the summation of largest number in a very larger array of integers. (The contents of the array should be equally distributed to all processes).
3. Write a parallel program in SPMD to calculate the PI value using integral approximation method.
5. Select your own choice of very dense computational problem having divide and conquer method and implement it in parallel algorithm. And produce the performance chart with 2, 4, 6 and 8 nodes.

Total P: 60
15XD67 MODERN DATABASE SYSTEMS LAB

2. Implementation of No-SQL databases: DynamoDB, MongoDB, Google’s BigTable, DBo4, Neo4J.
3. Implementation of Map-Reduce on Big Data (Hadoop).

Total P: 60

15XD68 SCRIPTING LANGUAGES LAB

INTRODUCTION: What is a scripting language? Motivation and applications of scripting - How scripting languages differ from non-scripting languages - Biased, naive and thoughtful position papers and debates on the merits of scripting languages - Types of scripting languages.

OVERVIEW OF POPULAR SCRIPTING LANGUAGES: Important features of and sample code in bash, Ruby, JavaScript, Perl, Python, Tcl - A list of other scripting languages with uninformative but possibly interesting synopses.

COMMON SCRIPTING LANGUAGE CONSTRUCTS: List comprehensions, iterators, complex datatype literals, higher-order functions, closures, unlimited extent, regular expressions, threads, and others - Implementation strategies.


TYPING: Static vs. dynamic typing; Manifest vs. inferential typing; Duck typing; Tradeoffs; Debates; Object orientation in dynamic typing. A detailed look at the typing systems of Ruby and Python; Classical (e.g. Ruby) vs. Prototype-based (e.g. JavaScript) inheritance.

INTERPRETATION AND COMPILATION: Interpretation vs. Compilation; Virtual machines; interpretations at compile-time (e.g. Perl's BEGIN and END blocks) and compilation at run-time.

PERFORMANCE OF SCRIPTING ENGINES: The real or imagined tradeoff between expressiveness, flexibility, extensibility, and rapid development, and high performance - compile-time type safety - scripts optimization - Modern garbage collection algorithms - A look at some runtime engines.

SHELL SCRIPTS: Responsibilities of a shell; A tour of the most popular Unix shells. CLIENT-SIDE WEB SCRIPTING: The DOM; JavaScript; DHTML; Ajax; XSLT scripting. SERVER-SIDE WEB SCRIPTING: Rails, PHP, Zope, the JSP expression language; The evils of scriptlets; Scripting and the SemanticWeb. EXTENSION LANGUAGES: The concept of command hooks; Classic applications (Emacs); Other applications; Interoperability, e.g. Groovy and Java.

LABORATORY COMPONENT:
1. Input validation using PHP
2. Implementing a linked list RUBY / Python
3. Basic programs in RUBY / PHP / Python
4. Server Side Scripting using RUBY
5. Server Side Scripting using PHP
6. Server Side Scripting using Python

Total P: 60

REFERENCES:

SEMESTER 7
15XDP1 PROJECT WORK I
SEMESTER – 8

15XD81 REINFORCEMENT LEARNING

REINFORCEMENT PROBLEM: Introduction - Elements of RL, History of RL- Evaluative feedback -Goals and rewards – Returns – Markovian Decision Problem (MDP) – Value functions-Optimality Criterion in MDPs. (10)

DYNAMIC PROGRAMMING(DP): Policy Evaluation- Policy Improvement- Value Iteration, asynchronous DP- Efficiency of DP. (6)

MONTE CARLO METHODS: Policy Evaluation- Policy Improvement- On-policy and off- policy Monte Carlo controls-Incremental implementation. (6)

TEMPORAL DIFFERENCE LEARNING(TD): TD-prediction- Optimality of TD - Sarsa- Q-Learning – R- Learning-Actor-Critic Model- Unifying Monte Carlo and TD-Traces- Games. (9)

FUNCTION APPROXIMATION- Value prediction and control – Gradient Descent methods-Linear methods – Artificial Neural Network based approximation. (6)

PLANNING AND LEARNING: Model based learning and planning- prioritized sweeping-Heuristic search. (6)

CASE STUDIES (2)

Total L: 45

TEXT BOOKS:

REFERENCES:

15XD82 DATA PRIVACY AND SECURITY

INTRODUCTION: Security Problems in computing – security goals –threats and attacks. – Services and mechanisms. (4)


33
Differentially private social network analysis – Web privacy: online tracking and advertisement – Privacy and machine learning –
case study: HIPAA privacy rule .

**TEXT BOOKS:**

**REFERENCES:**

**15XD83 ADVANCED ANALYTICS**

**COMPONENT AND FACTOR ANALYSIS:** Principal Component analysis, Factor analysis, Conjoint analysis, Discriminant analysis,
ARCH (autoregressive conditional heteroscedasticity) and GARCH(general autoregressive conditional heteroscedasticity), Monte Carlo Simulation.

**SURVIVAL ANALYSIS AND ITS APPLICATIONS:** Life tables, KapMeier estimates, Proportional hazards, Predictive hazard
modeling using Customer history data.

**SIX SIGMA :**Six sigma as a problem solving methodology, Six Sigma Tool Box; Seven quality tools, Quality function deployment (QFD), Statistical Process Control, Value Stream mapping.

**CLASSIFICATION:** Classification and regression trees (CART), Chi-Squared automatic interaction detector (CHAID).

**CASE STUDIES**

**TEXT BOOKS:**

**REFERENCES:**

**15XD86 REINFORCEMENT LEARNING LAB**

1. Ranking of nodes of a graph using Q-Learning (PageRank, TrustRank, DistanceRank).
2. Implementing n-armed Bandit problem.
3. Finding shortest paths in graphs using RL.
5. RL for Stochastic grid word.
6. Automated Chess player.
7. Multi-agent system.
8. Distributed RL.
10. Feed forward neural network.
15XD87 DATA PRIVACY AND SECURITY LAB

1. Design of a Client server application for a basic cryptosystem.
2. Performing a frequency analysis attack on a cipher text enciphered with Affine cipher.
3. Detection of a Buffer overflow attack.
4. Packet Sniffing using Wireshark Tool to perform the traffic analysis attack.
5. Implementation of RSA cryptosystem.
6. Key distribution using RSA (KDC) – Key hacking.
8. Authentication of File transfer using Hashing / Message digest.
11. Securing transaction by defending SQL Injection attacks.
12. Cross- Site scripting.
13. Implementation of security techniques to safeguard the database against accidental or deliberate breaches.
15. Analysis and removal of vulnerabilities from a web application.

Total P: 60

15XD88 ADVANCED ANALYTICS LAB

Implement the following problems using R/Perl Programming
1. Classification Algorithms.
2. SIX sigma implementation.
3. Extract information from customer support data.
4. Predictive analytics to find the trend of stock market level.
5. To implement Survival analysis tools.
6. Different outlier analysis techniques.
7. Dimensionality reduction using PCA.

Total P: 60

SEMESTER – 9

15XD91 WEB ANALYTICS


GOOGLE ANALYTICS: Key features and capabilities – Quantitative and qualitative data - Working of Google analytics – Privacy - Tracking visitor clicks, Outbound links and Non HTML files.

Total L: 45

TEXT BOOKS:

REFERENCES:
15XD92 NETWORK SCIENCE

INTRODUCTION: Basics of networks and graphs, random network model - degree distribution, evolution, small world property, six degrees of separation, Watts-Strogatz model, local clustering coefficient, random networks and network science. (5)

BARABÁSI-ALBERT MODEL: Growth and preferential attachment, Barabási-Albert model, degree dynamics, degree distribution, diameter and the clustering coefficient, preferential attachment - absence of growth, measure, non-linearity, the origins. (8)

SCALE-FREE PROPERTY: Power laws and scale-free networks, Hubs, Universality, Ultra-small property, role of the degree exponent, Generating networks with a pre-defined degree distribution. (8)

EVOLVING NETWORKS: Bianconi-Barabási model, measuring fitness, Bose-Einstein condensation, evolving networks. (8)

DEGREE CORRELATIONS: Assortativity and disassortativity, Measuring degree correlations, Structural cutoffs, Degree correlations in real networks, Generating correlated networks, impact of degree correlations. (8)

NETWORK ROBUSTNESS: Percolation theory, robustness of scale-free networks, attack tolerance, cascading failures, modeling cascading failures, building robustness. (8)

TEXT BOOK:

REFERENCES:

15XD93 INFORMATION RETRIEVAL

INTRODUCTION: Overview of IR Systems - Historical Perspectives - Goals of IR - The impact of the web on IR - The role of artificial intelligence (AI) in IR. (3)

TEXT REPRESENTATION: Statistical Characteristics of Text: Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Basic Tokenizing, Indexing: Simple tokenizing, stop-word removal, and stemming; inverted indices; Data Structure and File Organization for IR - efficient processing with sparse vectors. (8)


QUERY PROCESSING: Query Operations and Languages- Query expansion; Experimental Evaluation of IR: Performance metrics: recall, precision, and F-measure. (5)

TEXT CATEGORIZATION AND CLUSTERING: Categorization : Rocchio; Naive Bayes, kNN; Clustering: Agglomerative clustering; k-means; Expectation Maximization (EM); Dimension Reduction: LSI, PCA. (6)

INFORMATION FILTERING TECHNIQUES: Introduction to Information Filtering, Relevance Feedback - Applications of Information Filtering: RECOMMENDER SYSTEMS: Collaborative filtering and Content-Based recommendation of documents and products. (4)

WEB SEARCH: IR Systems and the WWW - Search Engines: Spidering, Meta Crawlers; Link analysis : Hubs and Authorities, Google PageRank, Duplicate Detection. (4)
INFORMATION EXTRACTION AND INTEGRATION: Extracting data from text; Basic Techniques: NE Recognition, Co-reference Resolution, Relation Extraction, Event Extraction; Extracting and Integrating specialized information on the web, Web Mining and Its Applications.

TEXT BOOKS:

REFERENCES:

15XD96 INFORMATION RETRIEVAL LAB
1. Building a web crawler.
2. HITS/PageRank for ranking of Web Pages.
3. Spam detection personal mails in R.
4. Build a simple recommender system.
5. Designing a personalized Search Engine.
7. Extracting information from web pages.
8. Designing a Desktop search engine.

Total P: 60

15XD97 - WEB ANALYTICS LAB
1. Data collection using different analytics tools.
2. Web log analysis.
3. Identifying reach.
5. Calculating the conversion from search to purchase.
6. Retain ratio computation.
8. Implementing the working of Google analytics.
9. Implementing the working of Yahoo! Analytics.
10. Implementing the working of Omniture.

Total P: 60

15XD98 NETWORK SCIENCE LAB
1. Implementation of Barabási-Albert model.
2. Implementation of Watts-Strogatz model.
3. Implementation of Bianconi-Barabási model.
4. Obtaining Degree correlations in real networks.
5. Case studies of the theory concepts on real networks.

Total P: 60

SEMESTER 10
15XDP2 PROJECT WORK II
ELECTIVES
15XDA1 DATA COMPRESSION

DATA COMPRESSION LEXICON: Introduction to Data Compression - Dawn Age - Coding - Lossy Compression. (4)

MINIMUM REDUNDANCY CODING (THE DAWN AGE): The Shannon - Fano Algorithm, The Huffman Algorithm - Into the Huffman Code : Counting the Symbols, Building the tree . (5)

ADAPTIVE HUFFMAN CODING: Adaptive Coding - Updating the Huffman Tree - Escape code. (5)

ARITHMETIC HUFFMAN CODING: Arithmetic Coding with floating point data type – Arithmetic coding with integral data type. (6)


DICTIONARY-BASED COMPRESSION: LZ77 Compression and Decompression - LZSS Compression and Decompression - LZ78 Compression and Decompression - LZW Compression and Decompression – LZMW Compression and Decompression – LZAP Compression and Decompression. (10)

SPEECH COMPRESSION: Digital Audio Concepts - Lossless Compression of Sound. (5)

VIDEO COMPRESSION: JPEG Compression - Implementing DCT - Complete Code Listing. (5)

TUTORIAL PRACTICE:
1. Implement Shannon Fano algorithm and Huffman algorithm.
2. Design compression and decompression program using adaptive Huffman coding.
3. Implement arithmetic coding algorithm.
4. Design compression program using statistical modeling upto 3 order.
5. Design compression and decompression program using L277 algorithm.

TEXT BOOK:

REFERENCES:

Total: L: 45+T: 30 = 75

15XDA2 MOBILE COMPUTING


GSM: Mobile services - System architecture -- Handover – GPRS – Mobile services – System Architecture. (6)


Building smart client applications – Mobile Operating systems – Client development process – Design, Development, implementation, testing and deployment phase. Thin client development process – design, development, implementation, testing and deployment phase.


TUTORIAL PRACTICE: Developing Mobile based applications using J2ME, Windows CE , Symbian OS , Android OS. Suggested Applications:
1. Online Shopping Cart.
2. Airline Reservation System.
3. WAP Portal Site.
4. M-Commerce applications.
5. Location based Services.

TEXT BOOKS:

REFERENCES:

15XDA3 DIGITAL IMAGE PROCESSING

DIGITAL IMAGE PROCESSING: Elements of a Digital image processing system – Structure of the Human eye – Image formation and contrast sensitivity – Sampling and Quantization – Neighbours of a pixel – Distance measures – Photographic firm structure and exposure – Film characteristics – Linear scanner – Video camera – Image processing applications.


IMAGE ANALYSIS AND COMPUTER VISION: Typical computer vision system – Image analysis techniques – Spatial feature extraction – Amplitude and Histogram features. Transform features – Edge detection – Gradient operators – Boundary extraction – Edge linking – Boundary representation – Boundary matching – Shape representation.
TUTORIAL PRACTICE:
1. Implementation of viewing digital images, bits and bytes, sampling and quantization.
2. Apply scaling, translation and rotation, sums and differences with the grayscale and color images.
3. Implementation of histograms and stretches, convolutional filters.
5. Implement Fourier transforms and the frequency domain, non-linear filters.
6. Implement the image restoration techniques.
7. Apply various image encoding methods with grayscale images.
8. Implement the conversion between color spaces.
9. Extract the Spatial, Histogram, and Transform features.
10. Implement the boundary and shape representation of digital images.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDA4 MULTIMEDIA ANALYTICS


DESIGNING A CONTENT-BASED IMAGE RETRIEVAL SYSTEM: Feature Extraction and Representation, Similarity Measurements, Dimension Reduction and High-dimensional Indexing, Clustering, The Semantic Gap, Learning, Relevance Feedback, Benchmarking Solutions. (7)

DESIGNING A CONTENT-BASED VIDEO RETRIEVAL SYSTEM: Video Parsing, Video Abstraction and Summarization, Video Content Representation, Indexing and Retrieval, Video Browsing Schemes, Samples of Video Retrieval Systems. (6)

AUDIO MINING: Overview, Audio Retrieval, Audio Mining, Taxonomy for Audio Mining. (2)

TUTORIAL PRACTICE:
1. Construct the following multimedia databases and manipulate them.
   a. Text Databases
   b. Image Databases
   c. Audio Databases
   d. Video Databases
2. Implement the various phases of text mining algorithm.
3. Construct a document classification system and analyze its performance.
4. Develop a CBIR system for a benchmark database with semantic and relevance feedback.
5. Construct an index based video retrieval system.
6. Develop an audio retrieval system.

Total: L: 45+T: 30 = 75
15XDA5 COMPUTATIONAL NEUROSCIENCE


MATHEMATICAL BACKGROUND: Linear systems - eigenvalues, eigenvectors for symmetric matrices – quadratic forms, solving a system of linear equations - Dynamic systems, bifurcation map in terms of trace and determinant - Phase plane analysis: null clines - Hopf bifurcation and limit cycles. (9)


INTRODUCTION TO INFORMATION THEORY: Communication channel and information gain – Information measure and Entropy – Properties of Joint and Conditional Information Measures and A Markov Source – Non-linear correlation measures. (5)

CASE STUDIES: Complex network analysis- Structural and functional brain networks. (6)

TUTORIAL PRACTICE:
1. Familiarity with tools such as EEGLab, MATLAB, UCINET.
2. Implementation of signal processing concepts – Frequency Component Analysis of signals etc.
3. Implementation of various Artificial Neural Network algorithms using real time neuroscience datasets.
4. Implementation of complex network metrics using UCI Net / PAJEK.
5. Statistical Analysis on Neuroscience data.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

WEB LINKS:
3. http://home.earthlink.net/~perlewitz/
15XDA6 PERVASIVE COMPUTING


APPROACHES FOR DEVELOPING PERVERSIVE APPLICATIONS: Categorization - smart services for pervasive application development - developing mobile applications – presentation transcoding – device independent view component – heterogeneity of device platforms - Context Awareness and Mobility to building pervasive applications.


CONTEXT AWARE SYSTEMS: Modeling - mobility awareness - spatial awareness - temporal awareness - ICT system awareness - Intelligent Systems - basic concepts- autonomous systems - reflective and self aware systems - self management and autonomic computing - complex systems.


TUTORIAL PRACTICE:
1. Create Application with onClick, onKeydown, onFocusChanged Event Handlers.
2. Create Application with Toast Notifications.
3. Create Application with Android’s Advanced User Interface Functions.
5. Create Application to Create, Modify and Query an SQLite Database.
6. Create Application that Works with an Android Content Provider.
7. Create application that performs Data Storage and Retrieval from Android External Storage.
8. Create Location-Aware application that uses Proximity Alerts and Google Maps API.
9. Implementation of small packages to demonstrate all apis.
10. Design and Implement the query classification and query transition in LDQ processing.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDA7 MARKETING ANALYTICS

INTRODUCTION: Marketing Analytics, Models and metrics- Market Insight – Market data sources, sizing, PESTLE trend analysis, and porter five forces analysis – Market segment identification and positioning.
COMPETITIVE ANALYSIS AND BUSINESS STRATEGY: Competitor identification, Intelligence gathering, analysis and strategy- Analytics based strategy selection, with strategic models and metrics , Forecasting, balanced scorecard, and critical success factors. (8)

PRODUCT, SERVICE AND PRICE ANALYTICS: Conjoint analysis model, decision tree model, portfolio resource allocation, Pricing techniques, pricing assessment, pricing for business markets, price discrimination. (12)

DISTRIBUTION AND PROMOTION ANALYTICS: Retail location selection, distribution channel evaluation, and multi-channel distribution, Promotion budget estimation and allocation, promotion metrics for traditional media and social media. (8)

SALES ANALYTICS: E Commerce sales mode, sales metrics, profitability metrics and support metrics. (9)

TUTORIAL PRACTICE:
1. Implementation of different metrics in marketing analytics.
2. Implementation of forecasting techniques for sales data.
3. Implementation of portfolio analysis.

Total: L: 45+T: 30 = 75

TEXT BOOK:

REFERENCES:

15XDA8  NATURAL LANGUAGE PROCESSING 3 2 0 4

INTRODUCTION: Applications of NLP techniques and key issues - MT - grammar checkers – dictation - document generation - NL interfaces - Natural Language Processing key issues - The different analysis levels used for NLP: morpho-lexical - syntactic – semantic - pragmatic - markup (TEI, UNICODE) - finite state automata - Recursive and augmented transition networks – open problems. (8)

LEXICAL LEVEL: Error-tolerant lexical processing (spelling error correction) - Transducers for the design of morphologic analyzers – Features - Towards syntax: Part-of-speech tagging (Brill, HMM) - Efficient representations for linguistic resources (lexica, grammars,...) tries and finite-state automata. (8)

SYNTACTIC LEVEL: Grammars (e.g. Formal/Chomsky hierarchy, DCGs, systemic, case, unification, stochastic) - Parsing (top-down, bottom-up, chart (Earley algorithm), CYK algorithm) - Automated estimation of probabilistic model parameters (inside-outside algorithm) - Data Oriented Parsing - Grammar formalisms and treebanks - Efficient parsing for context-free grammars (CFGs) - Statistical parsing and probabilistic CFGs (PCFGs) - Lexicalized PCFGs. (8)


NATURAL LANGUAGE GENERATION: content determination - sentence planning - surface realization. (3)


TUTORIAL PRACTICE:
1. Implementing word similarity.
2. Implementing simple problems related to word disambiguation.
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic analyzer.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDA9 SOFT COMPUTING

ARTIFICIAL INTELLIGENCE AND SOFT COMPUTING: Subject of AI – Problem solving by intelligent search – Breadth First Search, Depth First Search, Iterative Deepening, Hill Climbing, Iterative Deepening, A*, Best First Search. (7)


TUTORIAL PRACTICE:
1. Genetic algorithm for Travelling Salesman Problem.
2. Genetic algorithm for Feature Selection.
3. Fuzzy set for Classification and Feature Selection.
4. Perceptron for XOR Problem.
5. Backpropagation for fine-tuning the parameters of any algorithm.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDA2 COMPUTER GRAPHICS

GRAPHICS INPUT - OUTPUT DEVICES: Raster scan Displays - Random scan displays - Direct view storage tubes - Flat panel displays - Joy Stick - Digitizers - Touch panels - LCD. GRAPHICAL USER INTERFACE AND INTERACTIVE INPUT METHODS: The user dialog - Input of graphical data - Input function - Interactive picture construction techniques - Virtual reality environments. (3)

RASTER GRAPHICS: Fundamentals: generating a raster image, representing a raster image, scan converting a line drawing, displaying characters, speed of scan conversion, natural images - Solid area scan conversion: Scan conversion of polygons, Y-X algorithm, properties of scan conversion algorithms - Interactive raster graphics: painting model, moving parts of an image, feedback images. (8)


IMAGE PROCESSING FUNDAMENTALS: Sampling and Quantization, Image Enhancement - Histogram Processing, Filtering, Edge Detection, Image Transforms. (7)

THREE DIMENSIONAL GRAPHICS: 3D transformations - Viewing 3D graphical data - Orthographic, oblique, perspective projections - Hidden lines and hidden surface removal. (5)

FRACTAL-GEOMETRY METHODS: Tiling the plane - Recursively defined curves - Koch curves - C curves - Dragons - Space filling curves - Fractals - Grammar based models - Graftals - Turtle graphics - Ray tracing. (5)

OPENGL: Architecture, The OpenGL API, Primitives and Attributes, Color, Viewing, Control Functions, Programming Event-Driven Input, Transformations, OpenGL Extensions. (4)

TUTORIAL PRACTICE:
1. Drawing a line, circle using algorithms.
2. Implementation of 2D Transformations (translation, scaling, rotation).
3. Window – viewport simulation with various aspect ratios.
4. Polygon clipping and line clipping using algorithms.
5. Drawing a 2D curve using Bezier generation.
6. Drawing a 2D curve using B-Spline generation.
7. Model a primitive (car / Aircraft) with OpenGL API.
8. Simulate the primitive.
9. Animate the primitive.

Note: Algorithms in the Computer Graphics have to be implemented by the student using C++/OpenGL. (Wherever applicable).

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDAB ALGORITHMIC BIOINFORMATICS

INTRODUCTION: Biological data, DNA, RNA, Amino acids, Protein, Structural databases, genomes, Central dogma – Molecular Biology, Prediction of molecular function and structure. (7)

SEQUENCE COMPARISON ALGORITHMS: Dynamic Programming Algorithms, Edit Distance and Alignments, Alignment with Gap Penalties, Spliced Alignment, Similarity-Based Approaches to Gene Prediction, Multiple Alignment, HMM, Profile HMM Alignment, Viterbi Algorithm, Randomized Algorithms-Gibbs sampling, Genetic, Expectation Maximization Algorithm. (10)


CLUSTERING ALGORITHMS: Support Vector Machine, Ant Colony Algorithm, Clustering and Trees, Hierarchical Clustering, k-Means Clustering, Evolutionary Trees, Distance-Based, Additive Matrices, parsimony Tree Reconstruction.

TUTORIAL PRACTICE:
1. Motif Finding.
2. Sequence Comparison.
3. Searching biological databases.
4. Applications of HMM.
5. Finding SBH using Hamilton cycle / Eulerian Path.
6. Implementation of some clustering algorithms.

Total: L: 45+ T: 30 = 75

TEXT BOOKS:

REFERENCE:

15XDAC MATHEMATICAL MODELLING

INTRODUCTION TO MODELING: Modeling process, Overview of different kinds of model.

EMPIRICAL MODELING WITH DATA FITTING: Error function, least squares method; fitting data with polynomials and splines.


PORTFOLIO MODELING AND ANALYSIS: Portfolios, returns and risk, risk-reward analysis, asset pricing models, mean variance portfolio optimization, Markowitz model and efficient frontier calculation algorithm, Capital Asset Pricing Models (CAPM).

DISCRETE-TIME FINANCE: Pricing by arbitrage, risk-neutral probability measures, valuation of contingent claims, and fundamental theorem of asset pricing, Cox-Ross-Rubinstein (CRR) model, pricing and hedging of European and American derivatives as well as fixed-income derivatives in CRR model, general results related to prices of derivatives.

STOCHASTIC CALCULUS: Brownian motion, martingales, Itô's formula, Itô integral, risk-neutral measure, SDE; Risk-neutral measure, Girsanov’s theorem for change of measure, martingale representation theorems, representation of Brownian martingales, Feynman-Kac formula.


TUTORIAL PRACTICE:
Softwares : MATLAB programming, Mathlab, Mathematica, Maple.
Topics : Some of the major topics to be covered include (not necessarily in the order given):
1. Algebraic Models: Linear, Quadratic, and Exponential.
2. Polynomial curve fitting and cubic spline curve fitting.
3. Time series analysis and forecasting models.
4. Portfolio optimization models.
5. Cox-Ross-Rubinstein (CRR) model.
6. Risk analysis models.
7. Pair wise sequence alignment using dynamic programming.
8. Multiple sequence alignment using Hidden Markovian models.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDAD SOFTWARE ENGINEERING


SOFTWARE PLANNING: Software Project Estimation - Different techniques of Project cost estimation Decomposition techniques - COCOMO & PUTNAM models. (4)


TUTORIAL PRACTICE:
Case Studies

Total L: 45+T:30=75

TEXT BOOKS:

REFERENCES:

15XDAE DESIGN PATTERNS

INTRODUCTION TO PATTERNS: Reusable object oriented software – Motivation - Best design practices of object oriented software - Benefits of patterns – Definition – Types - Pattern description - How design patterns solve design problems - Pattern Language - IDIOMS.


ARCHITECTURAL PATTERNS: From Mud to Structure: Layers - Pipes and Filters - Blackboard, Interactive Systems: Model View Controller (MVC), Case studies.


TUTORIAL PRACTICE:
1. ATM Simulation – Singleton pattern.
2. Image Viewer Application – Bridge pattern.
3. Address Book Maintenance – Prototype pattern.
4. US, Canada Tax and Freight charges – Factory Method pattern.
5. The Fast Food Franchise – Builder pattern.

Total: L: 45+ T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDAF APPLIED GRAPH ALGORITHMS

BASIC CONCEPTS: Graphs – representations, Planar graphs- Euler’s formula, crossing number, doubly connected edge list data structure, Algorithm complexity – time and space.

GEOMETRIC GRAPHS: Planar straight line graph, Euclidean minimum spanning tree algorithm, Art gallery problem, visibility graphs, Computing point visibility for polygons with and without holes.

VLSI PHYSICAL DESIGN: Manhattan distance, overlap graph, containment graph, interval graph, neighborhood graph, hypergraphs, Rectilinear minimum spanning tree, Rectilinear Steiner minimum tree, Kernighan-Lin partitioning algorithm, Partitioning based algorithms for floorplanning and placement, Lee’s algorithm for routing, Shadow propagation algorithm for compaction.
VERTEX-PURSUIT GAME: Graph homomorphism, retracts, cops and robbers - cop number \(k\), bounds, cop-win graphs. Polynomial algorithm for fixed \(k\), NP-hard with \(k\) not fixed. (10)

VORONOI DIAGRAMS: plane sweep algorithm, Voronoi Diagram – definition and properties, Fortune’s algorithm. Delaunay triangulation. (10)

TUTORIAL PRACTICE:
1. Storing planar graphs using doubly connected edge list.
2. Borůvka’s Euclidean minimum spanning tree algorithm.
3. Computing point visibility for polygons with and without holes.
4. Polynomial time approximation algorithms for vertex guarding.
5. Vertex guard algorithm using set cover.
7. Partitioning based algorithms for floorplanning and placement.
8. Lee’s algorithm for routing.
12. Fortune’s algorithm for Voronoi diagram.
13. Divide and conquer Delaunay triangulation.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDAG GAME THEORY

INTRODUCTION: Game theory the theory of rational choice – Interacting decision makers. (2)

NASH EQUILIBRIUM: Strategic games – Best response – Dominance – Examples from economics, business, environment, military - Symmetric games and symmetric equilibria. Illustrations: Cournot’s model of oligopoly, Electoral competition. (7)


EXTENSIVE GAMES WITH PERFECT INFORMATION: Strategies and outcomes – Nash equilibrium – Subgame perfect equilibrium - Stackelberg’s model of duopoly, Buying votes – Illustrations: Entry into a monopolized industry, Electoral competition with strategic voters, Committee decision making. (7)

GAMES WITH IMPERFECT INFORMATION: Bayesian games – Examples – Strategic information – Transmission – Agenda Control with imperfect Information – Signaling games - Education as a signal of ability. (6)


TUTORIAL PRACTICE:
Implement the following using GAMBIT Software.
1. Display the Normal Form game.
2. Find all strongly dominant strategies.
3. Find all weakly dominant strategies.
4. Find all very weakly dominant strategies.
5. Find strongly dominant strategy equilibrium, if one exists.
6. Find weakly dominant strategy equilibrium, if one exists.
7. Find very weakly dominant strategy equilibrium, if one exists.
8. Find all pure strategy Nash Equilibria, if they exist.
9. Displaying and solving the Extensive Form games.

**TEXT BOOKS:**

**REFERENCES:**

**15XDAH SOCIAL NETWORK DATA ANALYTICS**

**INTRODUCTION:** On line Social Networks – Terminologies - Research topics. (5)

**STATISTICAL PROPERTIES OF SOCIAL NETWORKS:** Static properties – Dynamic properties. (5)

**RANDOM WALKS IN SOCIAL NETWORKS** – Random walks on graphs – Algorithms – Applications. (5)

**COMMUNITY DISCOVERY IN SOCIAL NETWORKS:** Communities – Core methods – Applications. (8)

**NODE CLASSIFICATION IN SOCIAL NETWORKS:** Methods using local classifiers – Random walk based methods – Algorithms - Applications - Node classification to large scale social networks. (10)

**MODELS AND ALGORITHMS:** Social influence analysis – Expert location in social networks – link prediction. (12)

**TUTORIAL PRACTICE:**

Do the following on Twitter, Facebook or any social network data set.
1. Study of the different metrics of social network.
2. Visualization of social network.
3. Power law distribution of social data.
6. Usage of Graph laplacian.

**TEXT BOOK:**

**REFERENCES:**

**15XDAI ARTIFICIAL INTELLIGENCE**
INTRODUCTION: The foundations of AI - The History of AI - Intelligent agents - Agent based system. (3)


KNOWLEDGE REPRESENTATION AND REASONING: Logics – First order logic, Inference in first order logic, Knowledge representation. (4)

PLANNING: The planning problem - Planning with state space search - Partial order search - Planning with proportional logic - Planning and acting in the real world. Adversarial planning. (7)

UNCERTAIN KNOWLEDGE AND PROBABILISTIC REASONING: Uncertainty-Probabilistic reasoning - Semantics of Bayesian network - Approximate inference in Bayesian network, Exact inference in Bayesian network - Probabilistic reasoning over time. (9)

LEARNING: Learning from observation - Knowledge in learning - Statistical learning methods - Reinforcement learning. (8)

DECISION-MAKING: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications. (6)

ROBOTICS: Introduction (2)

TUTORIAL PRACTICE:
1. Implement A* / Hill Climbing algorithms for 8 - puzzle and Missionaries and Cannibals problem.
2. Logic based exercises.
3. Implementation of planning - Partial order planning.
4. Supervised, Unsupervised and Reinforcement algorithms.
5. Implementing decision problems and simple games.

Total: L: 45+T: 30 = 75

TEXT BOOKS:

REFERENCES:

15XDAJ CLOUD COMPUTING

INTRODUCTION TO PARALLEL AND DISTRIBUTED COMPUTING: Introduction, Architecture and Distributed computing models and technologies SOA, Web Services. (5)

GRID, CLUSTER AND UTILITY COMPUTING: Introduction, Architecture, Pros & Cons, Real time applications. (4)


ADVANCED WEB TECHNOLOGIES: AJAX and Mashup – Programming examples using applications. (4)
MAP REDUCE PARADIGMS: Introduction, GFS Architecture, HDFS Architecture, Hbase, Google big Table, Amazon’s (key value) pair storage and Microsoft’s Azure infrastructure, Map reduce programming examples. (6)

CLOUD COMPUTING FRAMEWORK: Amazon EC3, S3 storage revises, Aneka frame work, IBM blue Cloud. (7)

APPLICATIONS: Distributed search engine and distributed data mining in the cloud (7)

TUTORIAL PRACTICE:
1. Implement a distributed search engine.
2. Implement distributive data mining for an application.
3. Package to be developed using Virtualization and other cloud concepts.

Total: L: 45+T: 30 = 75

TEXT BOOK:

REFERENCES:

15XDAAK DATA VISUALIZATION


STATIC DATA VISUALIZATION – tools – working with various data formats (4)

DYNAMIC DATA DISPLAYS : Introduction to web based visual displays – deep visualization – collecting sensor data – visualization – D3 framework - Introduction to Many eyes and bubble charts (10)

MAPS – Introduction to building choropleth maps (3)

TREES – Network visualizations – Displaying behavior through network graphs (10)

BIG DATA VISUALIZATION – Visualizations to present and explore big data – visualization of text data and Protein Sequences (10)

TUTORIAL PRACTICE:
Note: Explore softwares like R, Python, Google Vision, Google Reline, and ManyEyes ; Data sets are available on Gap minder, Flowing data
1. Visualization of static data.
2. Visualization of web data.
3. Visualization of sensor data.
4. Visualization of protein data.

Total L: 45 + T: 30 = 75

TEXT BOOK:

REFERENCES:
OPEN ELECTIVES

15XDO1  COMPUTATIONAL FINANCE

INTRODUCTION: Law of one price – Risk neutral pricing – Arbitrage and Hedging – Financial Products and capital markets – Futures, Forwards and options – Options pricing problem and three types of solutions. (3)

MATHEMATICAL PRELIMINARIES: Conditional expectation – Sigma Algebra – Filtrations, Time series analysis – Covariance stationary – autocorrelations - MA(1) and AR(1) models, Stochastic Calculus - Random walk – Brownian motion – Martingales – Ito’s Lemma. (12)

PORTFOLIO THEORY: Introduction - Portfolio theory with matrix algebra - Review of constrained optimization methods, Markowitz algorithm, Markowitz Algorithm using the solver and matrix algebra – Portfolio choice and linear pricing – Statistical analysis of efficient portfolios. (10)


TUTORIAL PRACTICE:
1. Problems using Capital Asset Pricing model.
2. Problems using Auto correlation.
3. Plot time series data and find outliers
4. Problems using Autoregressive models
5. Problems using Moving average models
6. Monte Carlo Simulation of options pricing

Total L: 45+T:30 = 75

TEXT BOOKS:

REFERENCES:

15XDO2 COMPUTATIONAL GEOMETRY

MATHEMATICAL & GEOMETRICAL REVIEW: Algorithm analysis – sorting, binary search, balanced binary search, divide and conquer, plane sweep, Kd-trees, Dijkstra’s algorithm, points, lines and planes, basic geometric objects – polygons, polytopes, convexity, graphs - vertex coloring, planar, Euler’s formula. (2)

CONVEX HULLS: Definition, lower bounds, algorithms - Graham's scan, divide and conquer, Jarvis march, 3D hulls. (5)
LINE SEGMENT INTERSECTION: Plane sweep algorithm, Doubly-connected edge list, computing overlay of two subdivisions, Map overlay algorithm, half-plane intersection, arrangements of lines. (8)

POLYGON TRIANGULATION: Art gallery problem – introduction, triangulation, bounds, partition into monotone pieces, triangulating monotone polygon, placement of guards. (8)

ORTHOGONAL RANGE SEARCHING: 1-D and 2-D range searching, range trees. (4)

VORONOI DIAGRAMS: Properties, beach line, computing Voronoi diagram, Delaunay triangulations, computing Delaunay triangulations. (8)

ROBOT MOTION PLANNING: Work space and configuration space, point robot, free space, Minkowski sums for convex and nonconvex polygons, translational motion planning, motion planning with rotations, Point location and trapezoidal maps. Visibility graphs - Shortest paths for a point robot, computing visibility graph, shortest paths for a translating polygonal robot. (10)

TUTORIAL PRACTICE:

Implementation of various algorithms for the following problems.
1. Convex hull problems.
2. Line and half plane intersections.
3. Map overlay problems using Doubly-connected edge list.
4. Triangulation and Art gallery problem.
5. Orthogonal range searching (1D and 2D) using Kd-trees.
7. Translational algorithms for robot motion planning.

TEXT BOOKS:

REFERENCES:

15XDO3 RANDOMIZED ALGORITHMS

INTRODUCTION: Randomized algorithms, randomized quick sort, Karger’s min-cut algorithm Las Vegas and Monte Carlo algorithms, computational models and complexity classes. (5)

MOMENT, DEVIATION AND TAIL INEQUALITIES: Occupancy problem, Markov and Chebyshev inequalities- randomized selection- coupon collector’s problem, the Chernoff bound- routing in a parallel computer- a wiring problem. (7)

PROBABILISTIC METHODS: Overview of the method-maximum satisfiability - finding a large cut, Expander graphs. (5)

MARKOV CHAINS AND RANDOM WALKS: Markov chains, Random walk on graphs - connectivity in undirected graphs – Expanders and rapidly mixing random walks. (6)

DATA STRUCTURES AND GRAPH ALGORITHMS: Random Treaps, hashing – hash tables – perfect hashing, skip lists - Fast min-cut. (6)

ONLINE ALGORITHMS: Paging problem-adversary models- paging against an oblivious adversary-relating the adversaries-the adaptive online adversary, k-server problem. (5)

PARALLEL AND DISTRIBUTED ALGORITHMS: Sorting on a PRAM - Maximal Independent sets. (4)

NUMBER THEORETIC ALGORITHMS: Polynomial roots and factoring, primality testing. (3)

DERANDOMIZATION: The method of Conditional Probabilities – Derandomizing max-cut algorithm – Constructing pairwise independent values modulo a prime - Pairwise independent – large cut. (4)

TUTORIAL PRACTICE:
1. Implementation of randomized quick sort and solve real time problems using it.
2. Find solution for s-t min-cut problem adapting min cut algorithm.
3. Implementation of randomized selection and problems related to it.
4. Implementation of treap data structure.
5. Problems using randomized hash table.
6. Implement the shortest path and fast min-cut algorithms.
7. Implementation of randomized primality testing.
8. Implement the K-server on-line algorithms.

**TEXT BOOKS:**

15XDO4 PRINCIPLES OF MANAGEMENT AND BEHAVIOURAL SCIENCES

**PRINCIPLES OF MANAGEMENT:** Meaning, Definition and Significance of Management, Basic Functions of Management – Planning, Organizing, Staffing, Directing and Controlling. Organizational Environment – Social, Economic, Technological and Political. Corporate Social Responsibility - Case discussion.

**INDUSTRIAL AND BUSINESS ORGANIZATION:** Growth of Industries (Small Scale, Medium Scale and Large Scale Industries). Forms of Business Organizations. Resource Management – Internal and External Sources

**ORGANIZATIONAL BEHAVIOUR:** Significance of OB, Impact of culture on organization. Role of leadership and leadership styles. Personality and Motivational Theories. Attitudes, Values and Perceptions at work - Case discussion

**GROUP BEHAVIOUR:** Group dynamics, Group formation and development, group structure and group cohesiveness. Informal organization – Sociometry – Interaction analysis – Exercises

**GLOBALISATION:** Issues for global competitiveness, proactive and reactive forces of globalization. Cross cultural management – Management of work force diversity.

**HUMAN RESOURCE MANAGEMENT:** Objectives and Functions, Selection and Placement, Training and Development – Conflict management – Stress management - Human resource management in global environment - Human resource information system(HRIS) - Case discussion.

**TUTORIAL PRACTICE:**
Case studies

**TEXT BOOKS:**

**REFERENCES:**

15XDO5 ENTREPRENEURSHIP

**INTRODUCTION TO ENTREPRENEURSHIP:** Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. Seminar in R5 & R6. (5)

DEVELOPING AN EFFECTIVE BUSINESS MODEL: The Importance of a Business Model – Starting a small scale industry - Components of an Effective Business Model.


INTELLECTuAL PROPERTY PROTECTION AND ETH ICS: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges.

TUTORIAL PRACTICE: Case studies

TEXT BOOKS:


REFERENCES:


15XDO6 INFORMATION THEORY AND ERROR CONTROL CODING


CONTINUOUS CHANNELS: Definitions of different entropies – Mutual information – Maximization of the entropy of a continuous random variable – Entropy maximization problems – channel capacity under the influence of additive white Gaussian noise – parallel Gaussian channel.


TUTORIAL PRACTICE:
Case studies

TEXT BOOKS:

REFERENCES:

15XDO7 COMPUTATIONAL COMPLEXITY THEORY

INTRODUCTION: The computational model - Modeling computation and efficiency - Review of Turing machines - Universal Turing machines - Uncomputable functions – Deterministic time and the class P


POLYNOMIAL HIERARCHY AND ALTERNATIONS – The classes \( \Sigma_p^P \) and \( \Pi_p^P \) – The polynomial hierarchy – Alternating turing Machines – Time versus alternations – Defining the hierarchy via oracle machines

CIRCUITS – Boolean circuits – Karp Lipton theorem – Circuit lower bounds

RANDOMIZED COMPUTATION : Probabilistic Turing Machines (PTM) –Examples - RP (Randomized Polynomial) , BPP (Bounded Error probabilistic polynomial) ,Complement Randomized Polynomial (Co-RP) – Probabilistic Polynomial (PP) – Randomized logarithmic space polynomial time (RL) – Related problems.

COUNTING PROBLEMS – Counting classes – Complexity of counting problems – An approximate comparison procedure - Constructing A-Comp - Non-Uniform Classes – Oracles – Relativization

APPLICATIONS: Randomized decision tree – Pseudo random number generators

TUTORIAL PRACTICE:
Case studies

REFERENCES:

15XD08 ACCOUNTING AND FINANCIAL MANAGEMENT


GOALS AND FUNCTIONS OF FINANCIAL MANAGEMENT: Finance function - Importance of Corporation finance - objectives of Financial Management - organization of the finance function - concept of time value of money. (5)

PRINCIPLES OF CAPITAL BUDGETING: Kinds of capital Budgeting Decisions - Evaluation of proposals from the given cash inflows - Net present value versus Internal rate of return method problems. (5)

WORKING CAPITAL MANAGEMENT: Definition and importance of working capital - factors affecting working capital - Inventory management - simple problems - Receivables Management - cash Budget Preparation - Estimate of overall working capital requirements - Various sources of financing. (5)

TUTORIAL PRACTICE:
Case studies

Total L:45+T:30=75

TEXT BOOKS:

REFERENCES:

15XDO9 WIRELESS NETWORKS


WIRELESS PANs MANs – Physical and MAC layer details, Wireless PANs – Architecture of Bluetooth Systems, Physical and MAC layer details, Standards- WLAN deployment issues- Interference – Resource Allocation (6)


TUTORIAL PRACTICE:
1. Study of NS-2 simulator.
2. Simulation of a IEEE 802.11 LAN under various conditions using NS-2 simulator.
4. Simulation of different routing protocols using simulators.
5. Simulation of TCP over error-prone wireless network using NS-2 simulator.
6. Development of Mobile application using blue tooth.

TEXT BOOKS:

REFERENCES: