SEMESTER I

21X101 CALCULUS AND ITS APPLICATIONS

3 2 0 4

FUNCTIONS AND CONTINUITY: Functions - Periodic functions - Graphs of standard functions - Limits and continuity - Piecewise continuous functions - Differentiability - Fundamental theorem of Calculus. (8+5)


INTEGRAL CALCULUS: Multiple integrals - Change of order of integration - Application of multiple integrals in finding area and volume - Beta and Gamma functions - Relation connecting Beta and Gamma functions - Evaluation of definite integrals. (10+7)


VECTOR CALCULUS: Vector differentiation - Gradient, Divergence, Curl and directional derivatives - Vector Integration - Line and surface integrals - Green's, Gauss divergence and Stoke's theorems (Statement only). (10+7)

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X102 COMBINATORICS

3 0 0 3

INTRODUCTION TO COMBINATORIAL PROBLEMS: Magic Square Problem – Four-Color Problem – Shortest-route problem – Perfect Covers of Chessboards. (4)

PERMUTATIONS AND COMBINATIONS: Sets and MultiSets - The Pigeonhole Principle - Simple and Strong Form - Generating Permutations - Inversions in Permutations - Generating Combinations - Generating r-Subsets. (9)

BINOMIAL COEFFICIENTS: Pascal's Triangle - The Binomial Theorem - Unimodality of Binomial Coefficients - The Multinomial Theorem - Newton's Binomial Theorem. (7)


RECURRENCES RELATIONS: Some Number Sequences - Generating Functions - Exponential Generating Functions - Solving Linear Homogeneous Recurrence Relations - Nonhomogeneous Recurrence Relations. (9)

SPECIAL COUNTING SEQUENCES: Fibonacci Numbers - Catalan Numbers - Stirling Numbers - Partition Numbers. (4)

COMBINATORIAL DESIGNS: Modular Arithmetic – Block Designs – Steiner Triple systems – Latin Squares. (4)

Total L:45

TEXT BOOKS:

REFERENCES:
21X103 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.

CONTROL STATEMENTS: While Statement - Do While Statement – For Loop – Nested Loop - If Else - Switch - Break - Continue - Comma Operator - Goto Statement -

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.

Total L: 60

TEXT BOOKS:

REFERENCES:

21X104 ANALOG AND DIGITAL ELECTRONICS

ANALOG: Diode theory-forward and reverse-biased junctions- Transistor fundamentals, transistor configurations, characteristics & parameters - Transistor as Amplifier and as switch - Basic idea of an OP-AMP - Inverting and non-inverting inputs – Adder -Subtractor - Integrator - Differentiator.

NUMBER SYSTEMS AND CODES: Introduction to decimal, binary, octal, hexadecimal number systems – Inter conversions of Number Systems – Binary Codes: BCD, Excess -3, Gray, ASCII Codes– 2’s complement addition, subtraction – BCD addition.

LOGIC GATES AND FAMILIES: AND, OR, NOT, NAND, NOR, Exclusive - OR and Exclusive - NOR- Implementations of Logic Functions using gates- NAND -NOR implementations.

BOOLEAN ARITHMETIC AND THEOREM: Boolean laws and theorems – Boolean expressions – Minimization - Sum of Products (SOP) -Product of Sums (POS) - Minterm - Maxterm - Canonical forms - Karnaugh map Minimization - two, three and four variable Karnaugh maps - Don't care conditions.


TEXT BOOKS:

REFERENCES:

21X105 ENGLISH

VOCABULARY BUILDING: The concept of Word Formation: Compounding, Backformation, Clipping, Blending - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives - Synonyms, antonyms, and standard abbreviations: Acronyms


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.

Basic Writing Skills: Importance of proper punctuation - Creating coherence: Arranging paragraphs & Sentences in logical order - Creating Cohesion: Organizing principles of paragraphs - Techniques for writing precisely - Nature and Style of sensible Writing: Describing, Defining, Classifying - Writing introduction and conclusion - Précis Writing - Essay Writing - Writing Letters: Formal, Informal - Writing E-mail

Listening Skills: Understanding listening - Listening Techniques - Listening short comprehension passages - Conversational practice in both social and professional contexts

Practicals: Oral presentation - Short speeches and conversation Practice - Listening integrated tasks

TEXT BOOK:

REFERENCES:

21X106 C PROGRAMMING LABORATORY

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 dynamic storage allocation.
7. Creating and processing data files.

Total L: 45
Total P: 60
21X107 WEB DESIGN LABORATORY

Exercises pertaining to the following concepts are to be implemented:
1. HTML formatting for images, text including list and link
2. HTML table formatting
3. Menus and frames
4. User interface using forms with audio and video
5. Dynamic web page using internal/external CSS
6. CSS involving text, color properties in tables
7. Bootstrap commands
8. Including internal/external JavaScript
9. JavaScript control structures
10. JavaScript functions
11. A complete web site development

Total P: 60

21X108 ANALOG AND DIGITAL ELECTRONICS LABORATORY

1. Verification of logic gates.
2. Realization of Boolean algebra.
3. Construction of half adder and full adder using XOR and NAND gates and verification of its operation.
4. Construction of half Subtracter and full Subtracter using XOR and verification of its operation.
5. Implementation of Binary to gray and Gray to binary code converter.
7. Construction of MUX/DEMUX.
8. Construction of different types of Flip-flops.
9. Implementation of Synchronous counter and asynchronous counter.

Total P: 60

SEMESTER II

21X201 LINEAR ALGEBRA

PREREQUISITES
- 21X101 CALCULUS AND ITS APPLICATIONS

LINEAR SYSTEMS: System of linear equations - Consistent and inconsistent systems - Geometric interpretation of linear system in 2 and 3 unknowns - Row reduction and Echelon forms - Vector equation - Matrix equation Ax=b - LU decomposition - Applications of linear systems. (6+4)

VECTOR SPACES: Euclidean n-space, General vector spaces, Subspaces, Linear independence, Basis and dimension, Row space, Column space and Null space, Rank and nullity – Change of basis – Similarity - Isomorphism. (10+7)

LINEAR TRANSFORMATIONS: Introduction, Properties-Kernel and range, Linear Transformation from R^n to R^m, Matrices of linear transformations. (9+5)


EIGEN VALUES AND EIGEN VECTORS: Eigen values and Eigen vectors - Diagonalization, Symmetric Matrices, Orthogonal Diagonalization – Singular Value Decomposition – Eigen values and linear transformations - Discrete Dynamical systems. (10+7)

Total L: 45 + T: 30 = 75
TEXT BOOKS:

REFERENCES:

21X203 COMPUTER ARCHITECTURE

PREREQUISITES
- 21X104 ANALOG AND DIGITAL ELECTRONICS

INTRODUCTION: Elements of a Computer system – Jon Von Newmann Architecture, Harvard Architecture - RTL (3)

ALU DESIGN: Arithmetic micro operations – Logic micro operations – Shift micro operations – Arithmetic, logic, shift units (5)

CONTROL UNIT: Computer Instructions - Instruction codes- Instruction Cycle –Timing & Control – Types of Instructions – Memory Reference, Register Reference , Input & Output, Interrupt Instructions (9)

CPU DESIGN: General Register organization–Stack Organization–Instruction formats–Addressing modes (6)

INPUT OUTPUT ORGANIZATION: I/O devices and interface – Asynchronous data transfer- Modes of data transfer- Direct Memory Access (DMA) – I/O processor. (7)

MEMORY ORGANIZATION: Memory hierarchy – Main memory – Auxiliary memory – Associative memory – Cache memory - Virtual memory. (8)

MULTIPROCESSOR: Characteristics – Interconnection structures –Parallel Processing-Pipelining. (7)
TEXT BOOKS:

REFERENCES:

21X204 DATA STRUCTURES

PREREQUISITES
- 21X103 C PROGRAMMING

INTRODUCTION: Data structures - Abstract data Types - Primitive data structures – Asymptotic Notations – Best and Worst case complexities.

ARRAYS: Operations - one, two, and multi- dimension arrays – Sparse matrices – Applications


QUEUES: Primitive operations - sequential implementation - Priority Queues - Dequeue - Applications


TREES: Terminologies - implementation - BINARY TREE: Properties - sequential and linked representation - binary tree operations - traversals - Expression trees - Infix, Postfix and Prefix expressions - Threaded trees - Tournament trees


SORTING AND SEARCHING: Insertion sort, Bubble sort, Selection sort, Radix sort – time complexity and analysis - linear search – Binary search

TEXT BOOKS:

REFERENCES:

21X205 OBJECT ORIENTED PROGRAMMING WITH C++

PREREQUISITES
- 21X103 C PROGRAMMING

FUNCTIONS IN C++: Function Prototyping - Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function overloading - Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory allocation for Objects - Static data members - Static Member Functions - Array of objects - Objects as Function Arguments - Friend Functions - Returning Objects - Const Member functions - Pointers to Members. (10)

CONSTRUCTORS: Parameterized Constructors - Multiple Constructors in a Class - Constructors with Default Arguments - Dynamic Initialization of Objects - Copy and Dynamic Constructors – Constructor overloading - Destructors (3)

OPERATOR OVERLOADING: Overloading Unary and Binary Operators - Overloading Binary Operators using Friend functions – Operator Type conversion. (3)


TEMPLATES & EXCEPTION HANDLING: Introduction to Templates, Generic Functions and Generic Classes – Exception Handling – Examples. (4)


REFERENCES:

TEXT BOOKS:

INTRODUCTION: Development Tools (IDE) – Python shell - Python Basics – Data types - Control flow.

CORE PYTHON LANGUAGE: Lists - Tuples - Dictionaries - Strings – Regular expressions - Functions - File input/output – Exception handling.

OBJECT-ORIENTED DESIGN: Inheritance – Polymorphism.


EXERCISES:
1. Test basic coding skills in Python using data types, control statements and iteration.
2. Implement Python data structures like lists, tuples, dictionaries, and sets.
3. General programming concepts such as functions, strings, regular expressions, reading / writing files and exceptions.
4. Implement object oriented concepts.
5. Packaging programs into reusable libraries.
6. Use libraries for numerical programming and data visualization.
7. Use libraries to perform the following:
   a) Plot 2D and 3D functions.
   b) Programs on differentiation and integration.
   c) Solving system of Linear equations.
   d) Determination of Vector space under given operations.
   e) Determination of linear independence and basis.
   f) Finding Row space, Column space and null space.
   g) Programs for Linear transforms on $\mathbb{R}^2$.
   h) Covert a standard basis into an orthonormal basis.
   i) Compute Eigen values and Eigen bases for a given system.
   j) Apply the orthogonal Diagonalization technique to reducing a Quadratic form.
TEXTBOOKS:

REFERENCES:

21X207 DATA STRUCTURES LABORATORY

1. Sparse Matrix operations using arrays.
2. Set operations.
4. Conversion of infix expression to postfix expression and evaluation.
5. Queues using array representation.
7. Linked Stacks and Queues.
8. Conversion and Manipulation of Expressions.
9. Binary trees and Threaded trees (with graphical representation).
11. Implementation and analysis of Table and Hash Table with collision handling.

21X208 OBJECT ORIENTED PROGRAMMING WITH C++ LABORATORY

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

1. Creating and processing array of objects of a class.
2. Usage of static member to count the number of instances of a class.
3. Illustration of the need of default arguments and function overloading.
4. Creation of a class having read-only member function and processing the objects of that class.
5. Initializing the object of a class using constructor and destroying the same using destructor.
6. Illustration of a data structure using dynamic objects.
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 stream operators and creation of user-defined manipulators.
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. Implementation of derived class which has direct access to both its own and public members of the base class.
13. Implementation of streams to store and maintain Library system, with the features of Book Issue and Book Return.

SEMESTER III

21X301 PROBABILITY AND STATISTICS

PREREQUISITES
- 21X101 CALCULUS AND ITS APPLICATIONS

**RANDOM VARIABLES**: Discrete and continuous random variables - probability mass function and density function - distribution function - Expectation and variance. Discrete distributions: Binomial, Poisson and Geometric - Continuous distributions: Uniform, Normal, Exponential and Weibull.

**JOINT PROBABILITY DISTRIBUTIONS**: Marginal and conditional distributions - statistical independence, Conditional expectation – Moments and moment generating functions.

**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 analysis.

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

**TEXT BOOKS**:

**REFERENCES**:

**21X302 DATABASE MANAGEMENT SYSTEMS**

**3003**

**PREREQUISITES**
- 21X204 DATA STRUCTURES
- 21X202 DISCRETE MATHEMATICS


**DATA MODELING**: Introduction – Data associations – Entities, attributes, relationships – Constraints - Design of Entity Relationship data models (ERD) – Generalization – Aggregation – Conversion of ERD into tables – Introduction to Network data model and Hierarchical data model.


**RELATIONAL MODEL**: Introduction to Relational Data Model – Basic concepts – Enforcing data Integrity constraints – Relational Algebra Operations – Extended Relational Algebra Operations.

**RELATIONAL DATABASE MANIPULATION**: Introduction to Structured Query Language (SQL) – SQL Commands for defining Database, Constructing database, Manipulations on database – Basic data retrieval operations – Advanced Queries in SQL – Functions in SQL – Aggregation – Categorization – Updates in SQL – Views in SQL – embedded SQL – Introduction to NoSQL Databases.


**DATABASE SECURITY, INTEGRITY CONTROL**: Security and Integrity threats – Defense mechanisms – Transaction and concurrency control mechanisms- ACID properties, Serializability and concurrency control. Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, Database recovery management.
TEXT BOOKS:

REFERENCES:

21X303 MICROPROCESSORS AND MICROCONTROLLER

PREREQUISITES
- 21X104 ANALOG AND DIGITAL ELECTRONICS
- 21X203 COMPUTER ARCHITECTURE

INTRODUCTION TO MICROPROCESSORS: Introduction to Microprocessors – Architecture of 8086 – Memory address space and Data organization - Generating memory address - Addressing modes – Bus cycles and timing diagram. (7)

ASSEMBLY LANGUAGE PROGRAMMING: Instruction Set Architecture (ISA) - Instruction format - 8086 Arithmetic and Logic Instructions – Control flow instructions and program structures - Array processing - String processing - Assembler directives - Procedures and Macros. (10)

INTERRUPT SYSTEMS: Introduction - Types of interrupts – Priorities of interrupt – Interrupt Instructions in 8086 - Implementing Interrupt schemes in 8086 processors – 8259 Programmable Interrupt Controller. (8)


MICROCONTROLLER ARCHITECTURE: Introduction- Architecture of 8051 – Special Function Registers (SFRs) - I/O pins ports and circuits – Instruction Set-Addressing modes – Assembly Language Programming. (7)


TUTORIAL PRACTICE:
1. Study of 8086 Emulator Tool
2. Familiarizing with Instruction Set
3. Exercises on Arithmetic, Logical and Branching Operations
4. Number System Conversions
5. Implementation of Control Structures
6. Programs using Arrays
7. Implementations of String Functions
8. Programs using Special Instructions
9. Programs Using INT 10h, 21h Functions
10. Package Implementation

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

26
21X304 OPERATING SYSTEMS

PREREQUISITES
- 21X203 COMPUTER ARCHITECTURE
- 21X204 DATA STRUCTURES

INTRODUCTION: Abstract view of an operating system - Operating Systems Objectives and Functions - Evolution of Operating Systems - Dual-mode operation - System calls - Structure of Operating System. (3)


PROCESS AND THREADS: Relationship between process and threads – Thread States – Thread Synchronization – Types of Thread – Multithreading model. (3)

PROCESS SCHEDULING: Scheduling basics - CPU-I/O interleaving - (non-)preemption - context switching - Types of Scheduling – Scheduling Criteria - Scheduling Algorithms – Algorithm evaluation – Real-time scheduling. (5)


DEADLOCK: Principles - Characterization – Methods for handling deadlock - Deadlock prevention, Avoidance, Detection, and recovery. (2)


VIRTUAL MEMORY MANAGEMENT: Need for Virtual Memory management – Demand Paging - Copy on write - Page Fault handling - Frame allocation - Thashing - working set model. (3)


Total L: 45

TEXT BOOKS:

REFERENCES:

21X305 ADVANCED DATA STRUCTURES AND ALGORITHMS ANALYSIS

PREREQUISITES
- 21X204 DATA STRUCTURES


SORTING: Quick sort – Merge sort – time complexity and analysis. (5)
HEAPS: Max heap - Min heap - Insertion and deletion of elements - Build-heap – Applications: Huffman codes - Priority Queue – Heap sort.

BINARY SEARCH TREES: Searching – Insertion and deletion of elements – Analysis.

AVL TREES: Definition – Height – searching – insertion and deletion of elements, AVL rotations

MULTIWAY SEARCH TREES: Indexed Sequential Access – m-way search tree - B-Tree – searching, insertion and deletion - B+ tree - searching, insertion and deletion - Tries


TEXT BOOKS:

REFERENCES:
5. Graphs – DFS & BFS
7. Dijkstra’s algorithm

Total P: 60

SEMESTER IV
21X401 COMPUTER NETWORKS

3 0 0 3

PREREQUISITES
- 21X203 COMPUTER ARCHITECTURE
- 21X206 PYTHON PROGRAMMING LABORATORY

INTRODUCTION: Network goals - Applications of Networks - Design issues for the layers - OSI Reference Model - Types of Network - Network Topologies - Network Performance Measures: Bit Rate, Baud Rate – Band width. (8)

PHYSICAL LAYER: Transmission media- SWITCHING: Circuit switching - Packet switching (6)


APPLICATIONS: SMTP, DNS, HTTP. (5)

Total L: 45

TEXT BOOKS :

REFERENCES :

21X402 JAVA PROGRAMMING

3 0 0 3

PREREQUISITES
- 21X205 OBJECT ORIENTED PROGRAMMING WITH C++
- 21X304 OPERATING SYSTEMS


INTERFACES AND PACKAGES: Interface - Defining and Implementing Interface - Applying Interface - Packages - Access protection - Importing packages. (8)

EXCEPTION HANDLING: Exception types - Uncaought Exception - Using Try and Catch - Multiple catch clauses - Nested try statements - Throw - Throws - Java Built-in Exception – Custom exception. (5)
MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Main thread – Creating threads - Synchronization – Interthread Communication - Deadlock. (8)

GUI PROGRAMMING- Applets - GUI Components - Event handling – Swing. (6)


JDBC: Establishing a Connection - Manipulating Data - Error Handling - Closing a Connection. (4)

Total L: 45

TEXT BOOKS:

REFERENCES:

21X403 SOFTWARE ENGINEERING

PREREQUISITES
- 21X205 OBJECT ORIENTED PROGRAMMING WITH C++


SOFTWARE PLANNING: Software Project Estimation - Decomposition Techniques –Empirical Estimation model - COCOMO & PUTNAM models. (5)

REQUIREMENTS ENGINEERING: Requirements Engineering –Establishing the Ground Work– Eliciting Requirements – Building the Analysis Model-Negotiating Requirements. (5)


CASE STUDIES: Project Scheduling and Tracking – Agile Framework-User story Scrum board, Sprint planning, Tools for Agile project management- JIRA ,Kanban. (4)

Total L: 45

TEXT BOOK:

REFERENCES:

30
PREREQUISITES

- 21X202 DISCRETE MATHEMATICS
- 21X204 DATA STRUCTURES

SYSTEMS PROGRAMMING: Need and working of Assemblers, Macro processors, Linkers, Loaders, Interpreters and Compilers.


SYNTAX DIRECTED TRANSLATION AND INTERMEDIATE CODE GENERATION: Semantic actions – Implementations of syntax directed translators – Intermediate code formats : Postfix notation, Quadruples, Triples, Indirect triples – Methods of translation of assignment statements, Boolean expressions and control statements - Representing information in a symbol table.

CODE OPTIMIZATION AND CODE GENERATION: Introduction to code optimization – Basic blocks – Loop optimization techniques - DAG representation – Error detection and recovery – A simple code generator.

TUTORIAL PRACTICE:
1. Implementing the transition diagram to strip off comment statements from a given source program.
2. Implementing the task of recognizing tokens from a given input program using LEX.
3. Using YACC to check the syntax of the statements in a given input program.
4. Using YACC to generate intermediate codes.
5. Designing a symbol table.

TEXT BOOKS:

REFERENCES:


TUTORIAL 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. Solving Decision theory problems
5. Solving Dynamic programming problems
6. To find the critical path for the given PERT and CPM networks
7. Solving problems under Random Search and Steepest descent method

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X406 COMMUNICATION SKILLS

PREREQUISITES
- 21X105 ENGLISH

SOFT SKILLS: Process of Communication - Types: Intra & Interpersonal Communication, Cross – Cultural Communication - Barriers
Verbal and Non-verbal Communication- Body language, Etiquette: Types - Business, Telephonic, Interview, Social and Dining Etiquette

PRESENTATION SKILLS: Professional Presentation - Public Speaking - Group Communication - Case Study based Presentation- - Meetings - Interview Techniques

READING SKILLS: Reading Comprehension and Techniques – Focus on Syntax, Vocabulary use, Discourse Markers, and Variety of expression

WRITING SKILLS: Professional Reports: Characteristics - Categories - Format and style and writing techniques, The 7Cs of Writing letters - Official and Business letters - Effective Email writing - Resume Writing practices

PRACTICALS: Professional Presentations - Group Discussions and Meetings - Mock Interviews

Total T: 60

TEXT BOOK:

REFERENCES

21X407 COMPUTER NETWORKS LABORATORY

1. Chat server implementation using TCP and UDP protocols
2. Explore the functionalities of various layers of the network stack using packet sniffing tools.
3. Simulate the simple VLAN scenario for the following:
   a. Switches
   b. Routers
   c. Hubs
   d. DNS server
   e. DHCP server
   f. Mail server
4. Configure the various routing protocol like distance vector routing and link state routing with simple VLAN scenario.

Total P: 60

21X408 JAVA PROGRAMMING LABORATORY

1. Working with classes and Objects
2. Perform runtime polymorphism
3. Implement interface
4. Create and implement packages
5. Handle checked, unchecked and user defined exceptions
6. Multiple threads and inter thread communication
7. Concurrent programming
8. Event driven programming with GUI framework
9. Exploring Collection Framework Objects
10. Implementing an application using JDBC

Total P: 60

SEMESTER V

21X501 MOBILE COMPUTING AND APPLICATION DEVELOPMENT

PREREQUISITES
- 21X401 COMPUTER NETWORKS
- 21X402 JAVA PROGRAMMING

INTRODUCTION: Introduction to mobile and wireless devices - wireless networking, Advantages and disadvantages of wireless networking, Evolution of mobile communication generations - Challenges in mobile computing – Vertical and horizontal mobile applications - Wireless LAN and Wireless WAN.


CELLULAR NETWORK: Cellular Concepts - Factors determining cell size and shapes - GSM - Mobile services - System architecture -- Handover – GPRS – Mobile services – System architecture – LTE Network architecture and interfaces


Total L: 45

TEXT BOOKS:
21X502 COMPUTER GRAPHICS AND MULTIMEDIA

3 0 0 3

PREREQUISITES

- 21X201 LINEAR ALGEBRA
- 21X204 DATA STRUCTURES


TWO-DIMENSIONAL GEOMETRIC TRANSFORMATIONS: Different types of transformations and their matrix representations, Homogeneous Coordinates, Composite Transformations, transformations between Coordinate Systems, Affine transformations, Window-to-Viewport Coordinate transformation, Clipping-Point, Line, Polygon, Curve and Text Clipping.

THREE-DIMENSIONAL CONCEPTS AND OBJECT REPRESENTATION: Three Dimensional Display Methods, Polygon Surfaces, Curved Lines & Surfaces, Quadric Surfaces, Spline Representations, Cubic Spline interpolation methods, Bezier Curves and Surfaces.

THREE DIMENSIONAL TRANSFORMATIONS AND VIEWING: Translation, Rotation, Scaling, Reflection, Shears, Composite Transformations, Projections- Parallel and Perspective, Projection Transformations, Clipping.


Total L: 45

TEXT BOOKS:

REFERENCES:

21X503 MACHINE LEARNING

3 0 0 3

PREREQUISITES

- 21X201 LINEAR ALGEBRA


Naïve Bayes Classifier - Maximum Likelihood Estimation – Maximum a Posteriori Estimate – Multivariate classification – K nearest neighbor classifier (6)


DIMENSIONALITY REDUCTION: Principal components analysis (PCA) – Linear discriminant analysis (LDA) - Independent components analysis (ICA) (5)

RECENT TRENDS: Overview - Federated Learning – Automated Machine Learning (2)

Total L: 45

TEXTBOOKS:

REFERENCES:

21X504 MOBILE COMPUTING AND APPLICATION DEVELOPMENT LABORATORY

1. Android SDK installation and study
2. Defining Layouts
3. Single Activity Application, Application with multiple activities
4. Application using GUI Widgets
5. Application with Notifications
6. Using Intents to Launch Activities
7. Creating and Saving Shared Preferences
8. Retrieving Shared Preferences
9. Usage of SQLite Databases for storage
10. Location based service creation
11. Android Automated Tested Frameworks
12. Case Studies: Dagger Framework for Android

Total P: 60

21X505 COMPUTER GRAPHICS AND MULTIMEDIA LABORATORY

1. OpenGL IDE and MINGW setup, Implementation of A sample program in OpenGL
2. Designing primitive objects in OpenGL
3. Applications for keyboard and mouse interactions
4. Line drawing algorithms – basic line equation method, DDA Algorithm
5. Bresenham Line drawing algorithms and simple primitives using Bresenham algorithm.
7. Basic 2D transformations and applications
8. Window – Viewport simulation, Line Clipping Algorithm Implementation
9. Polygon Clipping Algorithm Implementation
10. Drawing 2D curves using Bezier
11. Drawing 2D curve using B-Spline
12. Applications for 3D Transformation
13. Implementation of 3D Projections
14. Implementation of Back face detection (Visible Surface Detection)
15. Construction of Multimedia database
16. Data Compression and decompression on multimedia data.

Total P: 60

21X506 MACHINE LEARNING LABORATORY

0 0 4 2

Download the datasets from UCI machine learning repository / www.kaggle.com for regression, classification and clustering
1. Implement linear, polynomial and multiple regression and choose the best model for the given data.
2. Implement the following Classification algorithms for the above datasets.
   a. Naive Bayes Algorithm
   b. Decision tree
   c. SVM
   d. K nearest neighbor
   e. Logistic regression
   f. Simple perceptron
3. Do tenfold cross validation experiments and statistical validation using t-test and ANOVA.
4. Implement Backpropagation algorithm.
5. Implement different clustering techniques for image segmentation.
7. Implement Dimensionality reduction techniques for image compression.

Total P: 60

SEMESTER VI

21X601 DISTRIBUTED ENTERPRISE COMPUTING

3 2 0 4

PREREQUISITES
- 21X401 COMPUTER NETWORKS
- 21X402 JAVA PROGRAMMING


FRAMEWORKS: Introduction to Frameworks – Spring – Hibernate - Laravel (6)
TUTORIAL PRACTICE:
1. Implementation of two, three and multi-tier applications
2. Developing distributed environment applications
3. RMI communication between two application
4. Servlet programs
5. JSP programs
6. Database connectivity programs
7. Component development using JavaBeans
8. Application using any one of the frameworks

TEXT BOOKS:

REFERENCES:

21X602 SOFTWARE TESTING

PREREQUISITES
- 21X403 SOFTWARE ENGINEERING


TECHNIQUES FOR AUTOMATING TEST EXECUTION: Testing and test automation – the V model – common problems of test automation – limitations of automating software testing.

TUTORIAL PRACTICE:
1. Exercise for code review process.
2. Implementing Testing Techniques: White box testing, Basis Path, Looping, Black box methods.
3. Test the package for functional regression testing.
4. Preparation of test plan, test cases for developed package.
5. Design test cases using Rational test manager.
6. Use rational robot for functional testing for developed package.
7. Use Configuration management tool for recording test artifacts.
8. Testing the package for load test using load runner.
9. Test the package for coverage analysis using tools.
10. Test the package for reliability testing using tools.
11. Test the package for memory management using Open source tools.

Total L: 45 + T: 30 = 75

TEXT BOOK:
REFERENCES:

21X0A1 WEB SERVICES

PREREQUISITES
- 21X601 DISTRIBUTED ENTERPRISE COMPUTING


XML SCHEMAS: Validating XML documents using XML Schema – Comparison with DTD – Creation of Simple Types – Specifying attribute constraints and defaults – Creation of Complex type – Specifying different types of content using Complex Type – Specifying data types and restrictions in Schema. – XML Applications and Development. (7)

DOM AND SAX: Comparison –DOM and SAX parser – creation, Displaying and Filtering XML documents (4)

XML TECHNOLOGIES: XLINK, XPOINTERS, XQUERY, SVG, RDF. (4)


WSDL: WSDL Document structure – Types, Messages, Port types, Bindings, Ports, Services – SOAP binding – HTTP GET and POST Binding. (6)


APPLICATIONS: Real world examples and implementation (2)

TUTORIAL PRACTICE:
1. Validating XML using DTD and Schema
2. Formatting XML documents using CSS/XSLT
3. Implementation of Web Services Architecture
4. Creating Web Services communication in Windows Platform
5. Implementation of Web Services using Java Technology
6. Open source contributions

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X0A2 OPEN SOURCE SOFTWARE
PREREQUISITES

- 21X107 WEB DESIGN LABORATORY
- 21X601 DISTRIBUTED ENTERPRISE COMPUTING

INTRODUCTION: Proprietary Software, Free Software, Open Software, Licenses, Version Control, Explore GitHub – GitHub Workflows, Git Basics, Git Branching, Git on the Server, Distributed Git, GitHub, Git Tools, Customizing Git. (6)

PHP PROGRAMMING LANGUAGE: Basics – Data types – operators and flow control – String – Arrays – Functions – PHP with HTML – Client side validation – Working with Databases (9)

PYTHON PROGRAMMING LANGUAGE: Basic Syntax, Functions, Conditionals and Recursion, Iteration, Strings, Lists, Dictionaries, Tuples, Files, Classes and Objects, Inheritance, CGI, Multithreading, Networking, Python GUI - Tkinter, Distributing Python Modules, Python Standard Library, Django Framework. (9)


WEB SERVER: Application Server Vs Web server – Characteristics of Web server – Case Study: Apache Tomcat Web Server (5)

TUTORIAL PRACTICE:
1. Explore and contribute to GitHub
2. Working with PHP and MySQL
3. Exercises using NumPy/SciPy
4. Exercises in Ruby.

TEXT BOOKS:

REFERENCES:
3. Ivan Bayoss, Shranam shah, "PHP 5.1 for beginners", Shroff Publishers & Distributors Pvt Ltd, 2010

21X0A3 ARTIFICIAL INTELLIGENCE

PREREQUISITES

- 21X201 LINEAR ALGEBRA
- 21X301 PROBABILITY AND STATISTICS
- 21X405 OPTIMIZATION TECHNIQUES

INTRODUCTION: The foundations of AI - The History of AI - Intelligent agents - Agent based system. (2)


KNOWLEDGE REPRESENTATION AND REASONING: Knowledge representation - Logic - inference - Fuzzy logic: membership - Fuzzy rules and reasoning - Fuzzy inference (8)

UNCERTAIN KNOWLEDGE AND PROBABILISTIC REASONING: Uncertainty - Probabilistic reasoning - Semantics of Bayesian network - Exact inference in Bayesian network- Approximate inference in Bayesian network (10)
DECISION-MAKING: Basics of utility theory, Utility functions - Sequential decision problems - Markov decision process - Value iteration - Policy iteration - Decisions in Multi agent system: Multi agent decision theory - Group decision making. (10)

LEARNING: Learning from observation – Supervised Learning - Unsupervised - Reinforcement learning (5)

TUTORIAL PRACTICE:
2. Simple games – minimax and expectimax
3. Logic based exercises, Fuzzy Inference System.
4. Decision making: Implementing HMM models, sequential and multi agent decision making

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X0A4 DATA MINING 3 2 0 4

PREREQUISITES
- 21X503 MACHINE LEARNING

INTRODUCTION: Motivation for Data Mining – Importance – Definition – Kinds of data for Data Mining – Data Mining functionalities – Patterns – Classification of Data Mining Systems – Major issues in Data Mining. (5)

DATA PREPROCESSING: Types of data - Data cleaning – Data Aggregation – Data Discretization - Sampling – Data Reduction – LDA and PCA - Feature subset selection – Correlation analysis – Numerical attributes and Categorical attributes. (6)

MINING FREQUENT PATTERNS, ASSOCIATION AND CORRELATIONS: Basic concepts – Efficient and scalable frequent item set mining methods – Apriori, FP tree, ECLAT. (8)

ENSEMBLE OF CLASSIFIERS: Classification – Ensemble Learning – Bagging, Boosting, Cascading – Ensemble Pruning. (9)


MINING DATA STREAMS: Challenges-Mining time series databases and sequence data –Stationary data stream learning-Hoeffding trees- Evolving data stream mining. (4)

APPLICATIONS AND TRENDS IN DATA MINING: Spatial Data Mining –Graph Mining- Web Mining –Text Mining. (4)

TUTORIAL PRACTICE:
Implementation of the following:
1. Data preprocessing techniques
2. Association rule mining using Apriori and FP-tree algorithms
3. Classification algorithms
4. Evaluating the performance of classifiers
5. Clustering algorithms

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:
21X0A5 NATURAL LANGUAGE PROCESSING

PREREQUISITES
- 21X503 MACHINE LEARNING

INTRODUCTION: Natural language processing techniques - analysis in NLP: morphological – syntactic, semantic – pragmatic – Applications


CASE STUDIES: Mail spam, web spam detection, Fake news detection - Sentiment Analysis - Information extraction - Automatic summarization - Question answering - Named entity recognition and relation extraction - IE using sequence labeling - Open problems (4)

TUTORIAL PRACTICE:
1. Sentiment analysis and classification using n gram models, RNN and LSTM
2. Document classification / Radiology reports classification using RNN and LSTM
3. Visualization of text data
4. POS tagging on text data using HMM
5. Language modeling using n gram models
7. Optical character recognition using
8. Word sense disambiguation

Total L: 45+T: 30=75

TEXTBOOKS:

REFERENCES:

21X0A6 DESIGN AND ANALYSIS OF ALGORITHMS

PREREQUISITES
- 21X305 ADVANCED DATA STRUCTURES AND ALGORITHMS ANALYSIS
- 21X405 OPTIMIZATION TECHNIQUES
**INTRODUCTION:** Fundamentals of algorithmic problem solving, deciding an appropriate data structure and algorithm design technique – Methods of specifying an algorithm – proving the correctness – Review of analysis of algorithms, analysis of recursive algorithms – Master’s Theorem.

**DIVIDE AND CONQUER:** Binary search-merge sort-quick sort-Large 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-Longest common subsequence 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- 3 SAT and Independent Set- efficient certification and NP. NP hard and NP complete problems.

**COPING WITH NP-COMPLETENESS:** Backtracking-n queens problem, Graph coloring problem - Branch and bound - 0/1 Knapsack problem, Traveling salesman problem, Assignment problem- Approximation algorithm – Introduction – Traveling salesman problem.

**TUTORIAL PRACTICE:**
1. Problem using closest pair algorithm
2. Prims 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, longest common subsequence
6. Application of N Queens using back tracking
7. TSP. Assignment Problem using branch – and – bound

Total L: 45 + T: 30 = 75

**TEXTBOOKS:**

**REFERENCES:**

**21X0A7 CLOUD COMPUTING**

**3204**

**PREREQUISITES**
- 21X401 COMPUTER NETWORKS
- 21X402 JAVA PROGRAMMING
- 21X601 DISTRIBUTED ENTERPRISE COMPUTING


**CLOUD COMPUTING ARCHITECTURE:** Cloud Computing Stack - Comparison with traditional computing architecture (client/server) - Services at Various Levels - Role of Networks in Cloud computing - Role of Web Services - Service Models (XaaS) - Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS) - Deployment Models - Private Cloud, Public Cloud, Hybrid cloud, Community cloud.

MAP REDUCE PARADIGMS: Introduction, GFS Architecture, HDFS Architecture, HBase, Google Big Table, Hive, MongoDB as DaasS, Firebase - Map Reduce programming examples. 


CASE STUDY ON OPEN SOURCE AND COMMERCIAL CLOUDS: Amazon EC2, Amazon S3, Google Compute Engine, Microsoft Azure, Cloudfoundry, OpenStack. 

TUTORIAL PRACTICE:  
1. Hands on virtualization using VMware
2. Hands on containerisation using Docker
3. Deployment and Configuration options in Amazon (AWS)
4. Deployment and Configuration options in Google Cloud
5. Deployment and Configuration options in Microsoft Azure
6. Building and Deploying an application for the cloud

Total L: 45 + T: 30 = 75

TEXT BOOK:  

REFERENCES:  

21X0A8 DEEP LEARNING

PREREQUISITES  
• 20X503 MACHINE LEARNING

INTRODUCTION: Basic concepts – Convex sets, convex functions – loss functions – Gradient descent – Variants - Perceptron – Activation functions – Geometric representation – Perceptron Convergence theorem  

FEED FORWARD NETWORKS: Multi layer Perceptron – back propagation - Learning XOR – Auto encoder - Deep neural networks


CONVOLUTIONAL NETWORKS: Structure – properties – Region based CNN - LeNet – Alex net


DEEP LEARNING RESEARCH : Linear Factor Models, variants of Autoencoders, Representational Learning, Structured probabilistic models for deep learning, Monte Carlo Methods, Generative adversarial networks – Deep generative models

APPLICATIONS :Natural language processing, Big Data, Brain Computer Interface, Vision, IoT

TUTORIAL PRACTICE:  
1. Collect data sets from the url : http://deeplearning.net/datasets/
2. Use TensorFlow library for visualization of data sets in different domains and analysis:
   a. Given a set of images of handwritten digits from MNIST, classify the images into digits
   b. Do image captioning using RCNN
   c. Text classification using CNN
   d. Language modeling using RNN
   e. Speech processing
   f. Optical character recognition using CNN and RNN

   Total L: 45 + T: 30 = 75

TEXTBOOKS:

REFERENCES:

21X0A9 BIG DATA ANALYTICS

3 2 0 4

PREREQUISITES
- 21X302 DATABASE MANAGEMENT SYSTEMS
- 21X305 ADVANCED DATA STRUCTURES AND ALGORITHMS ANALYSIS


MINING DATA STREAMS: Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream.


DATA MODELING FOR BIG DATA: Big Data and Challenges, NoSQL data models, Basic principles of NoSQL models, SQL databases Vs NoSQL databases.

NOSQL DATABASES: Key - Value Stores: Oracle Coherence – Amazon DynamoDB, Key -Value Stores (in-memory) :Redis Key-value Stores (B-tree): Berkeley DB, Column Oriented Store: Google BigTable, Apache Cassandra - Hbase. Document Oriented Stores – MongoDB - Apache CouchDB - XML databases, Graph databases: Neo4J - OrientDB, Object Database: Db4o

Data Visualization

TUTORIAL PRACTICE:
1. Map Reduce Algorithm.
2. Shingling of Documents.
5. NoSql Databases
6. Adwords Implementation.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:
21X0AA GRAPH THEORY

PREREQUISITES

- 21X202 DISCRETE MATHEMATICS
- 21X301 PROBABILITY AND STATISTICS


CONNECTIVITY: Vertex and edge connectivity, Vertex and edge cuts, relationship between vertex and edge connectivity, bounds for connectivity. Harary’s construction of k-connected graphs.

EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs, Route inspection problem, Hamiltonian graphs, Dirac’s and Ore’s theorems, Gray codes, traveling salesman problem.


COLORING & PLANAR GRAPHS: Vertex-coloring – chromatic number, bounds, sequential and largest degree first algorithms – Chromatic Polynomial. Plane and Planar graphs, dual graphs, Kuratowski’s graphs, Euler’s formula, Characterization of Planar Graphs, Planarity testing.

TUTORIAL PRACTICE:
1. Constructing spanning tree
2. Minimum Spanning Tree
3. Shortest path problem
4. Implementation of Harary’s construction of k-connected graphs
5. Chinese Postman Problem
6. Travelling Salesman Problem
7. Augmenting path algorithm for matching
8. Sequential and largest degree first algorithm for vertex coloring
9. Planarity testing

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X0AB SOFTWARE PATTERNS

PREREQUISITES

- 21X205 OBJECT ORIENTED PROGRAMMING WITH C++
- 21X403 SOFTWARE ENGINEERING

INTRODUCTION: Reusable Software, Reusable object oriented software, Patterns, Definition, Overview & motivation, Categories, Relationship between patterns, Pattern description.


REFACTORING AND CODE SMELLS: Refactoring, Principles in Refactoring, Bad smells in Code, A Catalog of Refactoring with examples.

Idioms: Antipatterns in Software development, Pattern mining, Pattern Language.

TUTORIAL PRACTICE:
1. Identifying any of the 23 GOF design patterns in the given design problem.
2. Design and Implementation of the patterns using Java with appropriate case studies.
3. Creating reusable solution to a design problem using a case study.
4. Use architecture styles like MVC, Pipes and Filters, and Layers to develop computational system.

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X0AC MODERN DATABASE MANAGEMENT SYSTEMS

PREREQUISITES
- 21X302 DATABASE MANAGEMENT SYSTEMS
- 21X305 ADVANCED DATA STRUCTURES AND ALGORITHMS ANALYSIS


OBJECT DATABASES: Introduction to Object Relational Data Model - Complex data types- Structured types and Inheritance- Nesting - unnesting of Relations – Query Processing in ORDBMS- Object oriented data model - Object Identity - Persistent Programming Languages - Type and Class Hierarchies and Inheritance - Complex Objects - Object Oriented Database Design - Query Processing in object oriented database-Comparison of Object Oriented and Object Relational databases.

SPATIAL DATABASES: Fundamentals of GIS - Spatial Data Types- Spatial relations – Spatial Queries -Spatial indexing techniques - R-trees, KD trees - Quad trees-Applications of spatial databases

PARALLEL AND DISTRIBUTED DATA BASES: Architecture of parallel databases – Parallel query evaluation, Paralyzing individual operations, Parallel query optimization - Homogeneous and Heterogeneous databases - Architecture of distributed data bases - Storing data in distributed data bases, Distributed Transactions - Concurrency control in Distributed databases - Distributed query processing.

MODERN NOSQL DATABASES: Key - Value Stores – Amazon's DynamoDB, Key -Value Stores (in-memory) : Redis , Wide Column Store: Cassandra, Google BigTable - Document Oriented Stores – MongoDB - Graph databases: Neo4J.


TUTORIAL PRACTICE:
1. Object Relational Databases - including object orientation features in relational databases and creation of nested relations. Projects using OR databases.
2. Spatial databases – Creation and querying of spatial databases
3. Mini projects in distributed databases to acquire hands on practice in fragmentation and replication strategies
4. Document store : Learning to understand document data model with MongoDB
5. Graph database – Handling highly connected data and querying using Cypher QL with Neo4j.
TEXT BOOKS:

21X0AD EMBEDDED SYSTEM AND DESIGN 3 2 0 4

PREREQUISITES
- 21X303 MICROPROCESSORS AND MICROCONTROLLER


Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.


Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers. An example of RTOS.

TUTORIAL PRACTICE:
1. Design RTS program using Round Robin method.
2. Design RTS program using semaphore.
3. Design RTS program which uses message queue, mail box, pipe.

REFERENCES:

21X0AE INFORMATION RETRIEVAL AND WEB SEARCH 3 2 0 4

PREREQUISITES
- 21X201 LINEAR ALGEBRA
- 21X301 PROBABILITY AND STATISTICS
- 21X305 ADVANCED DATA STRUCTURE AND ALGORITHMS ANALYSIS

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.

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.


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

WEB SEARCH: IR Systems and the WWW - Search Engines: Spidering, Meta Crawlers and near duplicate pages, Question answering, ; Link analysis: Hubs and Authorities, Google PageRank, Duplicate Detection.

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.

INFORMATION EXTRACTION AND INTEGRATION: Extracting data from text; Basic Techniques: Named Entity Recognition, Co-reference Resolution, Relation Extraction, Event Extraction; Extracting and Integrating specialized information on the Web, Web Mining and Its Applications.

TUTORIAL PRACTICE:
1. Different retrieval models - Boolean, Vector space and Probability based retrieval.
2. Query refinement techniques
3. Evaluation of the set based and ranked retrieval algorithms.
4. Dimension Reduction techniques
5. Classification and Clustering techniques
6. Web based retrieval - Link based retrieval, combining content and link information
7. Recommender systems- Collaborative and Content Based Filtering
8. Information Extraction techniques

TEXTBOOKS:

REFERENCES:

21X0AF AUGMENTED AND VIRTUAL REALITY

PREREQUISITES
- 21X502 COMPUTER GRAPHICS AND MULTIMEDIA
- INTRODUCTION TO VR AND AR: Overview of class, logistics, history of VR/AR.

THE GRAPHICS PIPELINE AND OPENGL: Overview and Transformations: rotation, translation, scaling, model view matrix, projection matrix, Lighting and Shading.

OPENGL SHADING LANGUAGE (GLSL): GLSL vertex and fragment shaders.

THE HUMAN VISUAL SYSTEM: Perception of depth, color, contrast, resolution, Stereo Rendering.

HEAD MOUNTED DISPLAY OPTICS: Magnifier designs, stereo rendering for HMDs, lens distortion correction, advanced HMD optics.

INERTIAL MEASUREMENTS UNITS: gyros, accelerometers, magnetometers, sensor fusion, complementary filter, Arduino

POSITIONAL TRACKING: Tracking with the light house, advanced positional tracking – Spatial Sound.

CREATING CONTENT IN VR AND AR: Assessing design software – Capturing real life – Assessing development Software-Distributing content – Applications of AR and VR

TUTORIAL PRACTICE:
1. Lab: Hello, WebGL!
2. Lighting and shading with GLSL
3. Stereo rendering, anaglyph
4. Building Own Head Mounted Display
5. Build Your Own IMU, Arduino Programming
6. Positional Tracking
7. Spatial Sound
8. Content creation with unity (Optional)

Total L: 45+P: 30=75

TEXT BOOKS:

REFERENCES:

21X0AG COMPUTER VISION

3 2 0 4

PREREQUISITES
- 21X502 COMPUTER GRAPHICS AND MULTIMEDIA


DIGITAL IMAGE ANALYSIS: Preprocessing, Binary Image Analysis, Edge detection - First order derivative, Second order detection, Color edge detection, Pyramid edge detection, Edge linking and boundary detection, Segmentation - Region based segmentation, clustering techniques, boundary detection, thresholding. (10)


IMAGE FEATURE ANALYSIS: Overview, Feature Extraction - Shape, histogram, color, spectral, textural features, feature Analysis. (6)

MORPHOLOGICAL OPERATIONS: Binary Dilation, Erosion, Opening and Closing, Hit-or-Miss Transform, Basic Morphological Algorithms, Extension to Gray-Scale Images. (5)

IMAGE COMPRESSION - Basic requirements, Types of compression, Coding Algorithms. (5)

APPLICATIONS – Image Classification, CBIR, CBVR, Object Recognition, Biometrics, Document processing, Augmented Reality. (8)

TUTORIAL PRACTICE:
1. Implementation of Image segmentation and edge detection.
2. Implementation of feature extraction.
3. Implementation of image classification and clustering.
4. Developing simple image analysis applications Lab: Hello, WebGL!

Total L: 45+P: 30=75

TEXTBOOKS:

REFERENCES:

21X0AH DEVOPS

3 2 0 4
PREREQUISITES

- 21X403 SOFTWARE ENGINEERING

DEVOPS - Introduction – Need for DevOps - DevOps Perspective - DevOps and Agile - Team Structure – Barriers (3)

THE CLOUD AS A PLATFORM: Introduction – Features of Cloud – DevOps Consequences of the unique cloud Features (3)


BUILDING AND TESTING: Moving a System through Deployment pipeline – Production – Incidents – Deployment – Monitoring. (9)


SUPPORTING MULTIPLE DATACENTERS: Implementing a continuous deployment pipeline for Enterprises - Migrating to Microservices - Operators as a process - The Future of DevOps. (12)


TUTORIAL PRACTICE:
1. Continuous Deployment - using VSTS Release Management
2. Infrastructure as Code - using PowerShell Desired State Configuration
3. Configuration Management using Azure Automation and PowerShell
4. Deployment Pipelines using Jenkins and Visual Studio Release Management
5. Cloud hosting on both Azure and AWS
6. Automated Testing using Visual Studio
7. Automated Monitoring using OMS, Application Insights
8. Phoenix Project Simulation

Total L: 45+T: 30=75

TEXTBOOKS:

REFERENCES:

OPEN ELECTIVES

21X001 CRYPTOGRAPHY

PREREQUISITES

- 21X202 DISCRETE MATHEMATICS
- 21X301 PROBABILITY AND STATISTICS

MATHEMATICS OF CRYPTOGRAPHY: Fundamental theorem of arithmetic (statement only) - Divisibility - Euclidean and Extended Euclidean algorithms, Primes - Euler totient function- Fermat’s little theorem, Modular arithmetic- Computing modular inverse – modular exponentiation - efficient algorithms, generators and primitive roots in groups - Solving linear congruence’s - Chinese remainder theorem. (9)

BASIC CRYPTOGRAPHIC TECHNIQUES: Encryption and Decryption, Classical ciphers- Substitution ciphers - Monoalphabetic ciphers -Polyalphabetic ciphers – one time pad – transposition ciphers – Cryptanalysis. (8)

SYMERIC KEY CRYPTOGRAPHY: Stream ciphers – Block ciphers – DES – Modes of operation. (6)

PUBLIC KEY CRYPTOGRAPHY: Concept of public key cryptography – Hard problem - Factorization Problem - Discrete Log Problem - RSA cryptosystem - ElGamal cryptosystem – Cryptanalysis. (6)


TUTORIAL PRACTICE:
1. Implementation of Extended Euclidean algorithms
2. Implementation of modular inverse – modular exponentiation
4. Implementation of one time pad
5. Implementation of RSA cryptosystem
8. Implementation of RSA signature scheme.
9. Implementation of Fiat Shamir protocol
10. Implementation of Diffie-Hellman key pre-distribution

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

21X002 NUMERICAL ANALYSIS

PREREQUISITES
• 21X201 LINEAR ALGEBRA
• 21X202 DISCRETE MATHEMATICS

TYPES OF ERRORS: Different types of errors.


EIGENVALUES AND EIGENVECTORS: Power method, inverse power method, Jacobi method

FINITE DIFFERENCES AND INTERPOLATION: Finite difference operators – Interpolation: Newton’s divided difference formula, Lagrange’s interpolation formula, Newton’s - Gregory forward and backward interpolation.


TUTORIAL PRACTICE:
1. Solution of Non-linear equations (Bisection method, Regula Falsi method, Graeffe’s method, Bairstow’s method)
2. Solution of system of linear equations (Gauss-Jordan elimination, Gauss Jacobi and Gauss Seidel methods)
3. Finding Eigenvalues and Eigenvectors(Power method and Jacobi method)
4. Interpolation (Newton forward, Newton backward, Newton divided difference, Lagrange’s interpolation)
5. Numerical integration (Trapezoidal rule, Simpson’s one-third rule, Gaussian quadrature)
6. Solution of ordinary differential equations(Trapezoidal rule, Simpson’s one-third rule, Gaussian quadrature)

Total L: 45 + T: 30 = 75

TEXT BOOKS:
21X003 CYBER SECURITY

PREREQUISITES

- 21X202 DISCRETE MATHEMATICS
- 21X301 PROBABILITY AND STATISTICS
- 21X405 OPTIMIZATION TECHNIQUES


CYBERCRIME FUNDAMENTALS & ISSUES: Unauthorized access to computers, Internet hacking & Cracking, Viruses & malicious code, Software piracy - Cyberstalking - Social media crimes - Understanding social media marketing - Best practices with use of Social marketing tools - Case studies.


INVESTIGATION: Cybercrime Investigations - Evidence handling - Collection & Preservation - E-mail & Mobile tracking - IP tracking - Password cracking and Evidence recovery.

DEFENSE AND ANALYSIS TECHNIQUES: Threat, Types of Threat, Vulnerabilities, Controls and Counter measures, Attacks examples – Reconnaissance attack, Access attacks, Masquerading, IP Spoofing, and Denial of Service attack, Distributed Denial of Service – Honeypots – DNS-Firewall.

LAWS & ACTS: Legal perspective - India & global, IT ACT, CrPC, IPC, IPR in cyberspace, Cyber ethics, Evidence Act & Privacy Act - Guidelines and computer usage policy.

TUTORIAL PRACTICE:

1. Hacking web applications
2. Hacking web server
3. Network hacking
4. Database hacking
5. Password cracking
6. Mobile device tracking
7. IP tracking

Total L: 45 + T: 30 = 75

TEXT BOOKS:


REFERENCES:

INTRODUCTION TO ENTREPRENEURSHIP: Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance of 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. (5)

APPRAISAL OF PROJECTS: Importance of Evaluating Various options and future investments- Entrepreneurship incentives and subsidies – Appraisal Techniques. (8)

FORMS OF BUSINESS ORGANIZATION: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. (4)


THE MARKETING FUNCTION: Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process. (5)

INTELLECTUAL PROPERTY PROTECTION AND ETHICS: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges. (4)

TUTORIAL PRACTICE:
Case studies

Total L: 45+T: 30=75

TEXT BOOKS:

REFERENCES:

21X005 HUMAN COMPUTER INTERFACE DESIGN

INTRODUCTION: Human – Machine – Interaction – Paradigms


Task Analysis: Introduction - Task Decomposition – Knowledge Based Analysis – ER based Techniques – Uses


Utilities: Groupware – Ubiquitous Computing and Augmented Realities – Hypertext, Multimedia and WWW
TUTORIAL PRACTICE:
1. Analyzing a Usability Problem on Machines
2. Information Visualization
3. Time and Motion Study of GUI
4. Widget Survey
5. Sketch People and Task Decomposition

TEXT BOOKS:

REFERENCES:

21X006 INTERNET OF THINGS

PREREQUISITES
• 21X303 MICROPROCESSORS AND MICROCONTROLLER

INTRODUCTION TO IoT: Introduction to Internet of Things (IoT) – Machine to Machine (M2M) — Features and Definition of IoT – Recent Trends in the Adoption of IoT – Societal Benefits.

IoT ARCHITECTURE: Functional Requirements - IoT Enabling Technologies – IPv6 - Basic Architecture - Components of IoT: Embedded Computation Units, Microcontrollers, System on Chip (SoCs) - Sensors – Actuators – Communication Interfaces


APPLICATIONS IN IoT: Smart homes – Energy – Health Care – Smart Transportation – Smart Living – Smart Cities- Smart Grid – Smart Agriculture.


TUTORIAL PRACTICE:
1. Simulating Wireless Sensor Networks
2. Connected Vehicle applications
3. Traffic Signal Monitoring & Control System
4. Smart home automation
5. IOT Based Person/Wheelchair Fall Detection
6. Gas Pipe Leakage Detector using Robot
7. Smart Energy Meter Monitoring
8. IOT Based Fire Department Alerting System

Total L: 45 + P: 30 = 75

TEXTBOOKS:

REFERENCES:

21X007 ENVIRONMENTAL SCIENCE AND GREEN COMPUTING

3 2 0 4

NATURAL RESOURCES, ECOSYSTEMS AND BIODIVERSITY: Environment, Definition, Scope and importance, Forest resources, Use and overexploitation, Water resources: Use and over utilization. Eco system; Structure and functions of an eco system, energy flow in the eco system. Bio Diversity; values of biodiversity, biodiversity at global, national and local levels – threats to bio diversity. Conservation of bio diversity – In-situ & Ex-situ conservation. (9)


ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT: Definition – causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and nuclear hazards. Disaster management - floods, earthquake, cyclone and landslides. Solid waste management - causes, effects and control measures of municipal solid wastes (Biomedical wastes, hazardous wastes). Role of an individual in prevention of pollution. (9)


TUTORIAL PRACTICE:
Case studies

Total L: 45+ P: 30=75

TEXT BOOKS:

REFERENCES: