10 Computer Application

TRIMESTER WISE DISTRIBUTION OF COURSES

I TRIMESTER

		L	P
CA 502	INTRODUCTION TO COMPUTER APPLICATION	1	1
CA 551	MATHEMATICAL FOUNDATIONS IN COMPUTER APPLICATION	4	0
CA 552	COMPUTER ORIENTED NUMERICAL METHODS	2	1
CA 560	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0
CA 561	PRINCIPLES OF COMPUTER PROGRAMMING	2	1
CA 565	COMPILER CONSTRUCTION	2	1
CA 569	WEB TECHNOLOGIES AND APPLICATIONS	2	1
CA 570	COMPUTER GRAPHICS	2	1
CA 575	ARTIFICIAL INTELLIGENCE	2	1
CA 611*	DESIGN AND ANALYSIS OF ALGORITHMS	2	1
CA 621*	ADVANCES IN DATA MINING	2	1
CA 691	SEMINAR	1	0

II TRIMESTER

CA 501	COMPUTER FUNDAMENTALS AND PROGRAMMING	3	1
CA 562	OBJECT ORIENTED ANALYSIS AND DESIGN	2	1
CA 564	DATA STRUCTURES AND ALGORITHMS	2	1
CA 566	DATA BASE MANAGEMENT SYSTEM	2	2
CA 568	SOFTWARE ENGINEERING	2	0
CA 572	GIS AND REMOTE SENSING TECHNIQUES	2	1
CA 573	DATA WAREHOUSING	2	1
CA 574	MULTIMEDIA AND APPLICATIONS	1	1
CA 577	DATA MINING AND SOFT COMPUTING	2	1
CA 578	INFORMATION SECURITY	2	1
CA 612*	FUZZY SETS AND ROUGH SETS	2	1
CA 691	SEMINAR	1	0

III TRIMESTER

CA 503	STATISTICAL COMPUTING IN AGRICULTURE	1	2
CA 563	OPERATING SYSTEM	2	1
CA 567	COMPUTER NETWORKS	2	1
CA 571	MODELING AND SIMULATION	2	1
CA 613*	ARTIFICIAL NEURAL NETWORKS	2	1
CA 614*	KNOWLEDGEBASE SYSTEMS FOR SEMANTIC WEB	2	1
CA 622*	ADVANCES IN DATA WAREHOUSING	2	1
CA 691	SEMINAR	1	0

Core Courses

M.Sc.: CA 552, CA 560, CA 561, CA 562, CA 563, CA 564, CA 565, CA 566, CA 567 and CA 568
Ph.D.: CA 571, CA 572, CA 573, CA 575, CA 577, CA 611. Core courses prescribed for M.Sc., if not taken already during MCA/M.Sc./M.Tech./ME shall also have to be taken. offered only after the introduction of Ph.D. in the discipline

COMPUTER APPLICATION

Major Field : Computer Application

Minor Fields : M.Sc. student shall take one minor (9 credits of course work) from any of the other fields outside his/her own major field.
The total minimum credit requirements of course work for M.Sc. in Computer Application is 55 including Minor field (s).

DESCRIPTION OF COURSES

CA 501 COMPUTER FUNDAMENTALS AND PROGRAMMING (3L+1P) II

Objective

This course builds an understanding of the structure of computers and how they execute programs, data representation and computer arithmetic. The course is also aimed to develop problem-solving strategies, techniques and skills to help students develop the logic, ability to solve the problems efficiently using C programming.

Theory

UNIT I
Computer Fundamentals - Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, character representation: ASCII, EBCDIC. Functional units of computer, I/O devices, primary and secondary memories.

UNIT II
Programming Fundamentals - Algorithm development, techniques of problem solving, flowcharting, stepwise refinement; Representation of integer, character, real, data types; constants and variables; Arithmetic expressions.

UNIT III
Assignment statement, logical expression; Sequencing, alteration and iteration; Arrays, string processing.

UNIT IV
Sub-programs, recursion, files and pointers.

UNIT V
Structured programming concepts; Top down design, development of efficient programs; Program correctness; Debugging and testing of programs.

Practicals

Conversion of different number types; Creation of flow chart, conversion of algorithm/flowchart to program; Mathematical operators, operator precedence; Sequence, control and iteration; Arrays and string processing; Pointers and File processing.

Suggested Readings

Balaguruswamy, E. 2002. *Programming with ANSI C.* Tata McGraw Hill, New Delhi.

Gottfried, B. 2006. *Programming with C, Schaum Outline Series.* Tata McGraw Hill, New Delhi.

Malvino, A.P. and Brown, J.A. 1999. *Digital Computer Electronics.* Tata McGraw Hill, New Delhi.

Mano, M. M. 1999. *Digital Logic and Computer Design.* Prentice Hall of India, New Delhi.

Kanetkar, Y.1999. *Let Us C.* BPB Publications, New Delhi.

CA 502 INTRODUCTION TO COMPUTER APPLICATION (1L+1P) I

Objective

The course is aimed to provide fundamentals of networking and application protocols with emphasis on developing web based applications.

Theory

UNIT I
Computer organization; Software - System software and Application software.

UNIT II
Networking fundamentals, types of networking, network topology; File Transfer Protocol (FTP), Telnet, Simple Mail Transfer Protocol (SMTP).

UNIT III
Internet basics; Hyper Text Markup Language (HTML).

UNIT IV
Web designing; Web servers.

Practicals

Network and mail configuration; Using Network Services; Browsing of Internet; Creation of web pages; Creation of websites using HTML and Creation of websites using DHTML.

Suggested Readings

Buyens, Jim. 2002. *Microsoft FrontPage -Inside Out.* Microsoft Press.

Cox, V., Wermers L. and Reding E. E. 2006. *HTML Illustrated Complete.* Course Technology.

Niederst, J. 2001. *Web Design in a Nutshell.* O'Reilly Media, Inc.

Tanenbaum, A.S. 2003. *Computer Networks*. Prentice Hall of India, New Delhi.

CA 503 STATISTICAL COMPUTING IN AGRICULTURE (1L+2P) III

(Pre-requisite: CA-501 or CA-561)

Objective

This course will provide insight of data analysis through the use of statistical packages that will help the students in data analysis for their research as well as in their professional career.

Theory

UNIT I
Use of Software packages for: Summarization and tabulation of data; Descriptive statistics; Graphical representation of data.

UNIT II

Fitting and testing the goodness of fit of probability distributions; Testing of hypothesis; t-test, Chi-square test and F-test.

UNIT III

Concept of analysis of variance and covariance of data for one-way and multi-classified experiments.

UNIT IV

Analyzing crossed and nested classified designs; Analysis of mixed models; Estimation of variance components; Testing the significance of contrasts.

UNIT V

Correlation and regression including multiple regression.

UNIT VI

Multivariate Analysis Techniques: Principal component analysis, Factor analysis, Canonical Correlation Analysis, Cluster Analysis, Discriminant function; Analysis of time series data etc.

Practicals

Use of SPSS, SAS and other statistical packages, Exploratory data analysis, Box-Cox plots; Fitting of distributions, testing of hypothesis based on exact sampling distributions ~ chi square, t and F; Analysis of variance; Correlation and regression analysis, Multivariate Analysis Techniques: Principal component analysis, Factor analysis, Canonical Correlation Analysis, Cluster Analysis, Discriminant function; Analysis of time series data .

Suggested Readings

Anderson, T.W. 1958. *An Introduction to Multivariate Statistical Analysis.* John Wiley.

Dillon, W.R. and Goldstein, M. 1984. *Multivariate Analysis - Methods and Applications.* John Wiley.

Goon, A.M., Gupta, M.K. and Dasgupta, B. 1977. *An Outline of Statistical Theory.* Vol.1. The World Press Pvt. Ltd., Calcutta.

Goon, A.M., Gupta, M.K. and Dasgupta, B. 1983. *Fundamentals of Statistics.* Vol.1. The World Press Pvt. Ltd., Calcutta.

Hoel, P.G. 1971. *Introduction to Mathematical Statistics.* John Wiley.

Hogg, R.V. and Craig, T.T. 1978. *Introduction to Mathematical Statistics.* Macmillan.

Morrison, D.F. 1976. *Multivariate Statistical Methods.* McGraw Hill.

CA 551 MATHEMATICAL FOUNDATIONS IN COMPUTER APPLICATION (4L+0P) I

Objective

This course is designed to give basic foundations in mathematics that are needed to complement and improve the understanding of courses based on algorithm and problem solving.

Theory

UNIT I

Matrix algebra: Basic operations on matrices, Rank and inverse of matrices.

UNIT II

System of linear equations, Characteristic roots and equations, Eigen values and eigen vectors; Basic Differentiation, Integration and Differential Equations; Vector algebra: Double and Triple Product of vectors.

UNIT III

Coordinate geometry: circles and conic sections; Three dimensional geometry: point, straight line, plane and sphere.

UNIT IV

Sets: Set theory, subsets, operations on sets, set cardinality and counting; Functions: Bijective functions, pigeon-hole principle, Boolean functions, permutation functions, Boolean algebra, recursion relations.

UNIT V

Number Theory: Binary arithmetic, exponentiation, induction, sequences, Fibonacci sequence, big-oh notation, GCD, Euclidean algorithm, partially ordered sets, congruence and equivalence relation, encryption scheme, linear homogenous recurrence relations with constant coefficients.

UNIT VI

Graph Theory: Graphs, trees, LAN, Eulerian cycles, Hamiltonian cycles, graph coloring, graph algorithms; Mathematical Logic: Propositional calculus, proposition, logic connectives and compound statements, conjunction, disjunction, truth tables, duality, tautologies and fallacies; Turing Machine: DFA, NFA.

Suggested Readings

Abertson, M.O. and Hutchinson, J.P. 1988. *Discrete Mathematics with Algorithms.* John Wiley.

Deo, N. 1984. *Graph Theory with Application to Engineering and Computer Science.* Prentice Hall of India, New Delhi.

Knuth, D.E. 1968. *Art of Computer Programming, Vol. I. Fundamental Algorithms.* Addison Wesley.

Tremblay, J.P. and Manohar, R.P. 1975. *Discrete Mathematical Structures with Applications to Computer Science.* McGraw Hill.

CA 552 COMPUTER ORIENTED NUMERICAL METHODS (2L+1P) I

Objective

The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use.

Theory

UNIT I

Introduction to complex variables; Basic concepts: Floating point number system, Implication of finite precision, Rounding off errors.

UNIT II

Interpolation: Polynomial interpolation, Inverse interpolation, Spline interpolation; Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rules; Ordinary differential equations: Runge-Kutta methods, Predictor - corrector methods.

UNIT III

Linear system of equations: Gaussian's elimination, Operation counts, Implementation including pivoting and scaling, Direct factorization methods, Iterative techniques and their analysis.

UNIT IV

Linear Difference equations; Non-linear equations: Bisection, Newton Raphson, false positions, Secant methods, Iterative methods.

UNIT V

Inverse of Matrices; Computation of eigen values and eigen vectors: Error estimates, the power methods – Jaccobi and Householder Method.

UNIT VI

Exposure to mathematical software packages.

Practicals

Interpolation formula, Numerical integration, Runge-Kutta methods, Gaussian elimination, Non-linear equations, Inverse of Matrices, Computation of eigen values and eigen vectors.

Suggested Readings

Atkinson, K. E. 1978. *An Introduction to Numerical Analysis.* John Wiley.

Atkinson, K.E and Han, W. 2003. *Elementary Numerical Analysis.* John Wiley.

Jain M.K., Iyengar, S.R.K. and Jain, R.K. 2007. *Numerical Methods for Scientific and Engineering Computation.* New Age International Publishers.

Kennedy, W. J. and Gentle, J.E. 1980. *Statistical Computing.* Marcel Dekker.

Krishnamurthi, E.V. and Sen, S.K. 1986. *Computer – Based Numerical Algorithms.* East West Publishing, New Delhi.

Yakowitz, S. and Szidarovszky, F. 1986. *An Introduction to Numerical Computation.* MacMillan.

CA 560 COMPUTER ORGANIZATION AND ARCHITECTURE (3L+0P) I

Objective

This course builds an understanding of the structure of computers and how they execute programs. The course introduces data representation, computer arithmetic, and machine instruction set design. It then introduces the common physical components of a computer, their interconnections, and the processes underlying program execution.

Theory

UNIT I

Number systems; Boolean algebra - minimization of Boolean function using Karnaugh Map.

UNIT II

Logic Gates, Combinational circuits – multiplexer, demultiplexer, encoder, decoder; Sequential circuits: Flip-flops, Half and Full adder, Shift register, Counters.

UNIT III

Organization of CPU, Control Unit- Instruction and Execution cycle in CPU, Register Organization, The Instruction Cycle, Instruction Pipelining.

UNIT IV

Memory organisation - Internal memory: Semiconductor Main Memory (RAM, ROM, EPROM), Cache Memory, Advanced DRAM Organization; External Memory - Magnetic Disks, RAID, Optical Memory, Magnetic Tape.

UNIT V

Basic structure of computer hardware and system software - Addressing methods and machine programme sequencing; Input-output organisations - accessing I/O devices - direct memory access (DMA) interrupts.

UNIT VI

Introduction to microprocessors – CISC and RISC Architecture, Study of functional units of microprocessors.

Suggested Readings

Gear, C.W. 1974. *Computer Organization and Programming.* McGraw Hill.

Hayes, J.P. 1988. *Computer Architecture and Organisation.* McGraw Hill.

Malvino, A.P. and Brown, J.A. 1999. *Digital Computer Electronics.* Tata McGraw Hill, New Delhi.

Mano, M. M. 1999. *Digital Logic and Computer Design.* Prentice Hall of India, New Delhi.

Mano, M. M. 2007. *Computer System Architecture.* Prentice Hall of India, New Delhi.

Stallings, W. 2006. *Computer Organization and Architecture: Designing for Performance.* Pearson Education.

CA 561 PRINCIPLES OF COMPUTER PROGRAMMING (2L+1P) I

Objective

The course is aimed to develop problem-solving strategies, techniques and skills, to help students develop the logic, ability to solve the problems efficiently using object oriented programming.

Theory

UNIT I

Techniques of problem solving, Algorithm development, Flowcharting, Stepwise refinement.

UNIT II

Structured programming; Object oriented programming, classes, objects, Abstract data types, Data types, Operators (Arithmetic, Logical and Comparison) and expressions.

UNIT III

Branching and iteration, Arrays, Object/Message paradigm.

UNIT IV

Data encapsulation- modules and interfaces; Polymorphism - Static and dynamic binding, Inheritance: class and object inheritance.

UNIT V

Object oriented software design; Generic and reusable classes, Debugging and testing of programs.

Practicals

Programming constructs, control statements: branching and looping, file operations, Creation of classes with features - overloading, inheritance, data abstraction, polymorphism and a case study using and Object oriented language.

Suggested Readings

Balaguruswamy, E. 1998. *Programming with ANSI C.* Tata McGraw Hill, New Delhi.

Balaguruswamy, E. 2001. *Programming with Object Oriented Programming using C++.* Tata McGraw Hill, New Delhi.

Sethi, R. 1996. *Programming Language Concepts.* Addison Wesley.

Arnold, Ken and Gosling, James 1996. *The Java Programming Language. The Java Series.* Addison Wesley.

Bergin, J. 1994. Data Abstraction: *The Object-Oriented Approach Using C++.* McGraw Hill.

Stroustrup, B. 1997. *The C++ Programming Language.* Addison Wesley.

CA 562 OBJECT ORIENTED ANALYSIS AND DESIGN (2L+ 1P) II

(Pre-requisite: CA-561)

Objective

Object oriented analysis and design has emerged as a new paradigm of analysis and design of the systems. This course is designed to give exposure to basic concepts of object-oriented technology so as to program using object-oriented paradigm.

Theory

UNIT I

Introduction to Object Oriented Analysis, Introduction to Unified Modelling Language (UML), Process Models, Rational Unified Process.

UNIT II

Describe Use-Case Modelling, Use-case and Use-case relationships, Object Diagrams and Composite Structure Diagrams, Relationships between classes.

UNIT III

Concepts of Association and Aggregation, Reflexive and Package relationships and application of generalization and specialization principles, Design Relationships, Attribute and Method Visibility.

UNIT IV

Refining the Use Case Model, Modelling Class Interactions, Behaviours, Updating the Object Model to Reflect the Implementation Environment.

UNIT V

Object Reusability and Design Patterns, State diagrams, State transition diagrams, Discovering Object Interactions.

UNIT VI

Working with Activity Diagrams, Component and Deployment Diagrams, Case Studies.

Practicals

Case studies and scenarios describing Use-Case Modelling, Use-case and Use-case relationships, Object Diagrams and Composite Structure Diagrams, Relationships between classes, State diagrams, State transition diagrams, Discovering Object Interactions, Activity Diagrams, Component and Deployment Diagrams.

Suggested Readings

Deacon, John. 2005. *Object-oriented analysis and design: a pragmatic approach.* Pearson Education Ltd.

Edward Yourdon, Carl Argila. 1996. *Case studies in object-oriented analysis and design.* Prentice Hall.

Grady Booch. 2006. *Object-Oriented Analysis & Design.* Pearson Education.

Holzner, S. 1997. *The Visual C++ Programming Language.* Prentice Hall of India, New Delhi.

Johnsonbaugh, R. and Kalin, M. 1995. *Object Oriented Programming in C++.* Prentice Hall.

Khoshafian, S. and Abnous, R. 1995. *Object Orientation Concepts, Languages, Databases, User Interfaces.* John Wiley.

Mike O'docherty. 2009. *Object-Oriented Analysis & Design.* Wiley.

Sengupta, S. and Korobkin, C.P. 1994. *C++ Object Oriented Data Structures.* Springer.

Troelsen, A. 2005. *Pro C# 2005 and the .NET 2.0 Platform.* Apress.

CA 563 OPERATING SYSTEM **(2L+ 1P) III**

(Pre-requisite: CA-560, CA-561)

Objective

The main objective of this course is to provide core knowledge of Operating Systems features, functions and techniques.

Theory

UNIT I

Operating system overview: operating system as an extended machine and resource manager; Operating system classifications; Operating system modes and system calls.

UNIT II

Operating system architecture; Process model, Process synchronization, Concurrent processes, Process scheduling criterion and algorithms.

UNIT III

Problem of mutual exclusion; Deadlock and prevention; Race conditions; Semaphores; Monitors; Process allocation.

UNIT IV

Memory management; Multi-programming with fixed and variable number of tasks; Continuous allocation; Paging, Demand paging, Page fault; Virtual memory; Fragmentation; Segmented memory management, Shared segments; Segmented and demand paged management, Overlays and swapping, Thrashing.

UNIT V

Multi processor system, Master slave scheduling; Homogeneous scheduling; Device management system; Dedicated share and virtual devices.

UNIT VI

File Management System- Input-Output file protection; Remote Procedure Call; Distributed operating system (Course to be taught in accordance to the Unix Operating System).

Practicals

Problems using system calls for process management, signalling, file management, directory management, protection; Critical section problem; Solution to mutual exclusion by Peterson method; Producer consumer problem with fatal race conditions; Comparison of various CPU scheduling algorithms and Paging, segmentation and demand paging.

Suggested Readings

Bach, M.J. 2008. *Design of the UNIX Operating System.* Pearson Education.

Deitel, H.M. 1990. *An Introduction to Operating System.* Addison Wesley.

Dhamdhere, D.M. 2007. *Operating Systems: A Concept Based Approach.* Tata McGraw Hill, New Delhi.

Kernighan, B.W. and Pike, R. 1996. *The UNIX Programming Environment.* Prentice Hall of India, New Delhi.

Peterson, J. and Silberschatz, A. 1991. *Operating System.* Addison Wesley.

Stallings, W. 2006. *Operating Systems: Internals and Design Principals.* Prentice Hall of India, New Delhi.

Silberchatz, A., Galvin, P.B. and Gagne, G. 2006. *Operating System Principals.* Wiley India.

Tanenbaum, A.S. 2001. *Modern Operating Systems.* Prentice Hall of India, New Delhi.

CA 564 DATA STRUCTURES AND ALGORITHMS (2L+ 1P) II

(Pre-requisite: CA-561)

Objective

The learner should be well versed with the various data structures, fundamentals of algorithms, different sorting and searching techniques so as to use them appropriately as per need during development of programs.

Theory

UNIT I

Representation of character, string and their manipulation.

UNIT II

Linear list structure; Stacks; Queues; Heaps.

UNIT III

Sorting algorithms; Searching algorithms.

UNIT IV

Representation and processing of linear linked lists; Multiple linked structures; Sparse arrays.

UNIT V

Tree Structures: Representation of tree structures and different tree traversal algorithms.

UNIT VI

Graph and geometric algorithms.

Practicals

Implementation of various types of structures - linked lists, doubly linked lists, circular linked lists, queue, dequeue, stack and tree; String processing; Searching and sorting techniques; Graph and geometric algorithms and Case studies.

Suggested Readings

Aho, A.V., Hopcroft, J.E. and Ullman, J.D. 1983. *Data Structures and Algorithms.* Addison Wesley.

Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C. 2006. *Introduction to Algorithms.* Prentice Hall of India, New Delhi.

Goodrich, M.T., Tamassia, R. and Mount, D. 2004. *Data Structures and Algorithms in C++.* John Wiley.

Horowitz, E. and Sahani, S. 1983. *Fundamentals of Data Structures.* Galgotia Publishers, New Delhi.

Kleinberg, J. and Tardos, E. 2006. *Algorithm Design.* Pearson Education.

Knuth, D.E. 1968. *Art of Computer Programming, Vol. I. Fundamental Algorithms.* Addison Wesley.

Knuth, D.E. 1973. *Art of Computer Programming, Vol. III. Sorting and Searching.* Addison Wesley.

Kruse, R.L. and Ryba, A.J. 1998. *Data Structures and Program Design in C++.* Prentice Hall.

Langsam, Y. Augenstein, M.J. and Tanenbum, A. S. 1999. *Data Structures Using C and C++.* Prentice Hall of India, New Delhi.

Tremblay, J.P. and Sorenson, P.G. 1976. *An Introduction to Data Structures with Applications.* McGraw Hill.

Weiss, M.A. 1994. *Data Structures and Algorithm Analysis in C++.* Benjamin/Cummings Publishing Co.

CA 565 COMPILER CONSTRUCTION (2L+1P) I

(Pre-requisite: CA-561)

Objective

The purpose of the course is to acquaint various phases of compiler writing which will help an application/system programmer working on other projects besides compilers.

Theory

UNIT I

Introduction to Compiler, Compilation Process, Compiler Structure.

UNIT II

Programming Language Grammars, Elements of a Formal Language Grammar, Derivation, Reduction & Syntax Trees, Ambiguity Regular Grammar & Regular Expression – Context Free Grammar.

UNIT III

Introduction to Finite Automata, Deterministic Finite Automata.

UNIT IV

Non-deterministic Finite Automata; Scanning & Parsing Techniques – The Scanner, Regular Grammar and FSA, Top Down Parsing, Parsing Algorithm, Top Down Parsing Without Backtracking, Predictive Parsers, Bottom Up Parsing, Parsing, LR Parsers, Shift Reduce Parsing ; Symbol Table.

UNIT V

Organization, Memory Allocation – Static & Dynamic Memory Allocation, Compilation Control Transfer, Procedure Calls, Conditional Execution, Iteration Control Construct; Lexical Syntax Errors, Semantic, Major Issues In Optimization, Optimizing.

UNIT VI

Transformations, Local Optimization, Program Flow Analysis, Global Optimization.

Practicals

Design of a lexical analyser for regular expression; Design of a finite state machine;

Program for - magic squares, context free grammar, shift reduce parsing, operator precedence parsing, recursive decent parsing, predictive parser, simple LR parser and Postfix form for intermediate code.

Suggested Readings

Aho, A.V. and Ullman, J.D. 1993. *Principles of Compiler Design Theory.* Narosa Publishing House, New Delhi.

Galles, G. 2007. *Modern Compiler Design.* Pearson Education.

Holab, A. 2006. *Compiler Design in C.* Prentice-Hall of India, New Delhi.

Lewis, P.M., Rosenkrantz, D.J. and Stearns, R.E. 1978. *Compiler Design Theory.* Addison Wesley.

Tremblay, J.P. and Sorenson, P.G. 1985. *The Theory and Practice of Compiler Writing.* McGraw Hill.

CA 566 DATA BASE MANAGEMENT SYSTEM (2L+ 2P) II

(Pre-requisite: CA-561)

Objective

Database systems are backbone of any information system, enterprise resource planning, research activities and other activity that require permanence of data storage. This course provides the basic introduction to database system technologies; design, concurrency, security and backup/recovery issues of database management systems. The major focus in this course is the Relational database model.

Theory

UNIT I

Database system - Operational Data, Characteristics of database approach, architecture.

UNIT II

Overview of DBMS; Data associations - Entities, Attributes and Associations, Relationship among Entities, Representation of Associations and Relationship, Data Model classification.

UNIT III

Entity Relationship model; Relational Data Structure- Relations, Domains and Attributes, Relational Algebra and Operations, Retrieval Operations.

UNIT IV

Relational Database Design - Anomalies in a Database, Normalization Theory and Normal forms; Query processing and optimization; Security, backup and recovery.

UNIT V

Distributed Databases- concepts, architecture, design; Object Oriented databases; Structured Query Language (SQL) - Data Definition Language (DDL), Data Manipulation Language (DML), Query by example.

UNIT VI

PL/SQL - Stored procedure, Database triggers; Relational Data Base Management Package.

Practicals

E-R diagram construction; SQL - Command Syntax, Data types, DDL Statements, DML Statements, integrity constraints; Triggers, creating stored procedures/ functions; Normalization of database and case study on a database design and implementation.

Suggested Readings

Date, C.J. 2000. *Introduction to Database System.* Addison Wesley.

Desai, B. C. 2000. *Introduction to Database Systems.* Galgotia Publications, New Delhi.

Elmasri and Navathe. 2006. *Fundamentals of Database Systems.* Addison Wesley.

Garcia-Molina, H., Ullman, J.D. and Widom J. 2002. *Database Systems: The Complete Book.* Prentice Hall.

Rob, P. and Coronel, C. 2006. *Database Systems: Design, Implementation and Management.* Thomson Learning.

Silberschartz, A., Korth, H. F. and Sudarshan, S. 1997. *Database Systems Concepts.* Tata McGraw Hill, India.

CA 567 COMPUTER NETWORKS **(2L+1P) III**

(Pre-requisite: CA-560, CA-561)

Objective

This course addresses the principles, architectures and protocols that have gone into the development of the Internet and modern networked applications. The course examines network design principles, underlying protocols, technologies and architectures such as naming, data transport, routing and algorithms for networked applications including messaging, encryption and authentication.

Theory

UNIT I

The importance of Networking, Types of Networking, Network Topology, Transmission Media, Data communication: Concepts of data, signal, channel, bandwidth, bit-rate and baud-rate; Maximum data-rate of channel; Analog and digital communications, asynchronous and synchronous transmission.

UNIT II

Network adapters card, Multiplexer (FDM, TDM, STDM), Hub, Repeater. Network References Models: Layered architecture, protocol hierarchies, interface and services.

UNIT III

ISO-OSI references model, TCP/IP reference model; Datalink layer function and protocols: Framing, error-control, flow control; sliding window protocol; HDLC, SLIP and PPP protocol.

UNIT IV

Network layer - routing algorithms, congestion control algorithms; Internetworking: bridges and gateway; Transport layer - connection management, addressing; Flow control and buffering, multiplexing.

UNIT V

Session layer – RPC; Presentation layer - abstract syntax notation.

UNIT VI

Application layer - File Transfer Protocol (FTP), Telnet, Simple Mail Transfer Protocol(SMTP); World Wide Web(WWW) - Wide Area Indexed Servers (WAIS), WAP; Network Security; Data compression and cryptography.

Suggested Readings

Arick, M.R. 1994. *The TCP/IP Companion - A Guide for Common User*. Shroff Publishers and Distributors Pvt. Ltd., Mumbai.

Freer, J. 1990. *Computer Communication and Networks.* Affiliated East West Press, New Delhi.

Hayes, J. 2001. *Modelling and Analysis of Computer Communication Networks.* Khanna Publishers, New Delhi.

Tanenbaum, A.S. 2003. *Computer Networks,* Prentice Hall of India, New Delhi.

CA 568 SOFTWARE ENGINEERING (2L+0P) II

Objective

The objective of the course is to acquaint the students with all the phases of Software Development Life Cycle so that they work efficiently as a software engineer.

Theory

UNIT I

Software engineering definition; Software Development: Phases, Process models, Project structure, Project team structure, Role of metrics, Measurement, Software quality factors.

UNIT II

Planning and Software Project: Requirement analysis, Cost estimation, Project Scheduling, Quality Assurance Plan, and Project Monitoring Plans, Gantt charts, PERT and CPM.

UNIT III

System Design: Design Objectives, Design Principles, Design Tools, and Techniques, Prototyping.

UNIT IV

Structured Programming Coding: Programming practices, Verification, Monitoring and Control.

UNIT V

Testing: Testing Fundamentals, Functional Testing, Structural Testing, Test Plan activities, Unit testing, Integration Testing.

UNIT VI

Reliability: Concept of Software Reliability, Reliability Models, Limitations of Reliability Models, Software Maintenance. CASE tools.

Suggested Readings

Aggarwal, K.K. and Singh, Y. 2006. *Software Engineering.* New Age International Publishers.

Awad, E. M. 1993. *System Analysis and Design.* Galgotia Publishers, New Delhi.

Fairley, R. 1999. *Software Engineering Concepts.* Tata McGraw Hill, New Delhi.

Jalote, P. 2005. *An Integrated Approach to Software Engineering.* Narosa Publishing House.

Kerzner, H. 1998. *Project Management: A System Approach to Planning, Scheduling and Controlling.* CBS Pub. and Distributors, New Delhi.

Mall, R. 2006. *Fundamentals of Software Engineering.* Prentice-Hall of India, New Delhi.

Pressman, R.S. 2006. *Software Engineering: A Practitioner's Approach.* McGraw Hill.

Sommerville, I. 2004. *Software Engineering.* Pearson Education.

CA 569 WEB TECHNOLOGIES AND APPLICATIONS (2L+1P) I

(Pre-requisite: CA 562 and CA 566)

Objective

The main objective of the course is to introduce the whole range of web technologies. Through the various examples, the course will describe how to design a specific page, dynamic web pages, forms and frames and interaction with a database.

Theory

UNIT I

Web designing – Hyper Text Markup Language, Cascading Style Sheets.

UNIT II

Scripting languages - JavaScript, VBScript.

UNIT III

Web servers and its administration– IIS, Apache, Tomcat; Web designing tools- MS FrontPage/ Dreamweaver, Visual Studio/Java IDE; Web application development using ASP.NET/ JSP/ PHP.

UNIT IV

Database connectivity through ADO.NET/ JDBC; Report Generation.

UNIT V

Extensible Markup Language, XML Stlyesheet Language (XSL), XML Stlyesheet Language Transformation (XSLT).

UNIT VI

Advanced JavaScript – AJAX; Web Services.

Practicals

Designing static website with features like tables, hyperlink among pages, pictures, frames and layers; Client side scripting for user interface validation; development of business logic for server side processing and database integration, Designing of an information system.

Suggested Readings

Ayers, D., Bergsten, H., Bogovich, M., Diamond, J., Ferris, M., Fleury, M. Halberstadt, a., Houle, P., Mohseni, P., Patzer, A., Philips, R., Li, S., Vedati, K., Wilcox, M. and Zeiger, S. 1999. *Professional Java Server Programming.* Wrox Press Ltd.

Boudreaux 2005. *PHP 5: Your Visual Blueprint for Creating Open Source, Server-side Content.* Visual.

Ellis, M.D. 2007. *ASP.NET AJAX Programming Tricks*. Magma Interactive, LLC.

Esposito, D. 2007. *Introducing Microsoft ASP.NET AJAX (Pro - Developer)*. Microsoft Press.

Evjen, B., Hanselman, S. and Rader, D. 2008. *Professional ASP.NET 3.5: In C# and VB (Programmer to Programmer)*. Wrox Press Ltd.

Haefel-Monson, Richard. 2003. *Enterprise JavaBeans.* O'Reilly & Associates, Inc.

Naughton, P. and Schildt, H. 2001. *The Complete Reference, Java 2.* Tata McGraw Hill, New Delhi.

Neimke, D. 2006. *ASP.NET 2.0 Web Parts in Action: Building Dynamic Web Portals (In Action).* Manning Publications.

Walther, S. 2008. *ASP.NET 3.5 Unleashed.* Sams.

CA 570 COMPUTER GRAPHICS **(2L+1P) I**

(Pre-requisite: CA 561)

Objective

This course examines the principles of computer graphics, with a focus on the mathematics and theory behind 2D and 3D graphics rendering.

Theory

UNIT I

Introduction, Application of Graphics, Elements of Graphics Workstation, Graphics I/P Devices; Development of computer graphics: Basic graphics system and standards.

UNIT II

Raster scan and random scan graphics; Continual refresh and storages displays; Display processors and character generators; Colour display techniques.

UNIT III

Frame buffer and bit operations, Concepts in raster graphics; Points, Lines and Curves; Scan conversion; Line-drawing algorithms; Circle and ellipse generation; Polygon filling; Conic-section generation.

UNIT IV

Anti-aliasing; Two-dimensional viewing: Basic transformations; Co-ordinate systems; Windowing and clipping; Segments; Interactive picture-construction techniques; Interactive input/output devices.

UNIT V

Three-dimensional concepts: 3-D representations and transformations; 3-D viewing; Algorithm for 3-D volumes, Spline curves and surfaces.

UNIT VI

Fractals; Quadtree and Octree data structures; Hidden line and surface rendering and animation

Practicals

Implementation of algorithms for drawing geometrical figures, rotation, charts; Pixel handling on screen; Clipping – Line clipping – Polygon Clipping, Windowing; Use of primitive transformations and/or their combinations; Implementation of 3D Object Representation and Fractal programming and animation.

Suggested Readings

Hearn, D. and Baker, M.P. 2004. *Computer Graphics.* Prentice and Hall of India, New Delhi.

Marshal, G. 1983. *Programming with Graphics.* Granada Publishing, London.

Newman, W. M. and Sproull, R. F. 1981. *Principles of Interactive Computer Graphics.* McGraw Hill.

Prince, D. M. 1979. *Interactive Graphics for Computer Aided Design (CAD).* Addison Wesley.

Rogers, D.F. 2001. *Procedural Elements in Computer Graphics.* McGraw Hill.

CA 571 MODELING AND SIMULATION (2L+ 1P) III

(Pre-requisite: CA 501 or CA 561)

Objective

The courses aims at teaching simulation and modeling technique for conducting experiments on models that describe the behaviour, uncertainty and structure of real world systems. This course will help in simulation of agricultural research problems and systems.

Theory

UNIT I

Uses and purposes of simulation; Classification of models.

UNIT II

Generation and testing of random numbers.

UNIT III

Simulation of stochastic events and processes, Discrete event simulation.

UNIT IV

Design of simulation experiments, Analysis of data generated by simulation experiments, Verification and validation of simulation models.

UNIT V

Simulation languages.

UNIT VI

Simulation of agricultural problems and systems.

Practicals

Generation of random numbers; Testing randomness of generated random numbers; Generation of random variates following Normal, Beta, Gamma, Exponential, Chi-square, Student's-t, F, Weibull, Binomial, Poisson distributions with the given parameters; Discrete event simulation and Simulation from specific models applicable in agriculture.

Suggested Readings

Averill M. L. and Kelton, D. 2005. *Simulation, Modelling and Analysis.* Tata McGraw Hill, New Delhi.

Banks, J. 1998. *Handbook of Simulation.* John Wiley.

Brately, P., Fox, B.L. and Scharge, L.E. 1987. *A Guide to Simulation.* Springer.

Deo, N. 1987. *System Simulation with Digital Computer.* Prentice and Hall of India, New Delhi.

Flannery, W. H., , B. P., Tenkolsky, S. A., and Vetterling, W. T. 1986. *Numerical Recipes: The Art of Scientific Computing.* Cambridge University Press.

Gentle, G.E. 2005. *Random Number Generation and Monte Carlo Methods.* Springer.

Gordan, G. 2007. *System Simulation.* Pearson Education.

Jerry Banks, John S. CarsonII, Barry L. Nelson and David M. Nicol. 2007. *Discrete-Event System Simulation.* Pearson Education.

Kennedy, W. J. and Gentle, J.E. 1980. *Statistical Computing.* Marcel Dekker.

Kleijnen, J. P. C. 1974. *Statistical Techniques in Simulation (In two parts).* Marcel Dekker.

Knuth, D.E. 1968. *Art of Computer Programming, Vol. I. Fundamental Algorithms.* Addison Wesley Press.

Law, Averill M., and Kelton, W. David. 2005. *Simulation Modeling & Analysis.* McGraw-Hill.

Ripley, B.D. 1987. *Stochastic Simulation.* John Wiley.

Taha, H.A. 2003. *Operations Research: An Introduction.* Prentice Hall of India, New Delhi.

CA 572 GIS AND REMOTE SENSING TECHNIQUES (2L + 1P) II

(Pre-requisite: CA-566)

Objective

The basic objective of this course is to teach concepts of GIS and remote sensing with specific applications in agriculture related statistics.

Theory

UNIT I

Introduction to Geographical Information System; Components of a GIS; Data Models in GIS-Raster and Vector.

UNIT II

Spatial Data Analysis- Raster and Vector. Data input, verification, storage and output.

UNIT III

Introduction- maps and spatial information; manual and automatic digitizing process; Spatial and non-spatial data linking; preparation of thematic maps. Data errors in GIS; Spatial modeling; Spatial interpolation; Current and potential uses of GIS in agricultural planning; GIS in India.

UNIT IV

Physics of remote sensing, Satellites and their characteristics; Satellite Remote Sensing and Sensors; Spectral signatures of earth surface features, spectral characteristics of vegetation, soil and water.

UNIT V

Data acquisition Data Reception, Transmission, Processing and data storage; Visual and digital image interpretation; Digital image processing. Applications of Remote Sensing in Agriculture.

UNIT VI

Basics of GPS; Observables and Biases; Errors and Limitations; Type and applications of GPS.

Practicals

Digitization of a map with the help of a digitizer; Map editing; Geo-referencing and map projections; Creation of attribute database and linking with spatial data; General analysis of the data with the help software; Applications of digital elevation models using GIS; Spatial interpolations using GIS; Visual interpretations of remote sensing data; Geometric corrections of remote sensing digital data; Methods for improving quality of digital data and Techniques of image classifications.

Suggested Readings

Annadurai, S. and Shanmugalakshmi, R. 2007. *Fundamentals of Digital Image Processing.* Pearson Education.

Burrough, P.A. 1986. *Principles of Geographic Information System for Land Resources Assessment.* Oxford University Press.

Curran, P.J. 1985. *Principles of Remote Sensing.* Longman Inc., New York.

Heywood, D. Ian, Murray, M. E. G. and Heywood, Ian. 2002. *An Introduction to Geographical Information Systems.* Prentice Hall.

Jensen, J.R. 1996. *Introductory Digital Image Processing.* Prentice Hall.

Lillesand, T.M. and Kiefer, R.W. 1987. *Remote Sensing and Image Interpretation.* John Wiley.

Peuquet, D. J. and Marble, D. F. 1990. *Introductory Readings in Geographic Information System.* Taylor and Francis, London.

CA 573 DATA WAREHOUSING **(2L + 1P) II**

(Pre-requisite: CA-566)

Objective

The basic objective of this course is to familiarize students about this state of art of setting data warehouse for business intelligence in relation to agricultural research, development and planning.

Theory

UNIT I

Concepts and principles of data warehousing; Project management and requirements.

UNIT II

Dimensional modelling; Data warehousing architecture; System process and process architecture.

UNIT III

Data warehousing design; Database schema; Data staging.

UNIT IV

Partitioning strategy; Aggregations; Data marts; Meta data management; OLAP Modelling, Query management.

UNIT V

Data warehouse security; Backup and recovery; Building end-user Applications; Capacity planning; Testing the warehouse.

UNIT VI

Implementation and maintenance of data warehouse; Case study.

Practicals

Data warehouse design, selection of schema; Normalization and renormalization; Query plan strategy; Performance tuning, backup and recovery of data warehouse; Dynamic reports and OLAP Reports.

Suggested Readings

Gupta, G.K. 2006. *Introduction to Data Mining with Case Studies.* Prentice Hall of India, New Delhi.

Han, J and Kamber, M. 2006. *Data Mining: Concepts and Techniques.* Morgan Kaufman.

Inmon, B. 2005. *Building the Data Warehouse.* John Wiley.

Kelly, S. 1997. *Data Warehousing in Action.* John Wiley.

Kimball, R. 2000. *The Data Webhouse Toolkit: Building the Web-Enabled Data Warehouse.* John Wiley.

Kimball, R. 2002. *The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling.* John Wiley.

Kimball, R. 2004. *The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data.* John Wiley.

Kimball, R. 2005. *The Microsoft Data Warehouse Toolkit: With SQL Server 2005 and the Microsoft Business Intelligence Toolset.* John Wiley.

Kimball, R. 2008. *The Data Warehouse Lifecycle Toolkit: Practical Techniques for Building Data Warehouse and Business Intelligence Systems.* John Wiley.

Lee, K. H. 2005. *First Course on Fuzzy Theory and Applications.* Springer.

CA 574 MULTIMEDIA AND APPLICATIONS (1L + 1P) II

(Pre-requisite: CA 560)

Objective

This course introduces students to current practices, technologies, methodologies, and authoring systems in the design and implementation of systems that incorporate text, audio, images, animation and full-motion video.

Theory

UNIT I

Introduction to Multimedia Technology - Computers, communications and entertainment; Framework for multimedia systems.

UNIT II

M/M devices, presentation devices and the user interface, M/M presentation and authoring.

UNIT III

Digital representation of sound and transmission; Brief survey of speech recognition and generation; Digital video and image compression; JPEG image compression standard; MPEG motion video compression.

UNIT IV

DVD technology, Time based media representation and delivery; M/M software environment; Limitation of workstation operating systems.

UNIT V

M/M systems services; OS support for continuous media applications; Media stream protocol; M/M file system and information representation.

UNIT VI

Data models for M/M and Hypermedia information.

Practical

Script Writing and Story Boards; Hot Spots and Buttons, Layouts and designing of visuals, Basics of colors; Working with text, presentations, charts and putting animations; Creating interactive presentations; Adobe Photoshop – Introduction, Working with images, Image editing and cleaning; Macromedia Flash - Introduction, Creating shapes, Inserting text, Concepts of colors, layers, frames and timelines; Creating Animation - Creating scenes, creating movie, testing and playing movie; Adobe Acrobat –Overview, Creating Adobe PDF e-Books; Macro Media Director Basics.

Suggested Readings

Furhet, B. 1998. *Multimedia Technologies and Applications for the 21st Century.* Kluwer Academic Pub.

Gibbs, S.J. and Tsischritziz, D.C. 1995. *Multimedia Programming - Objects, Environment & Framework.* Addison-Wesley.

Kerman, P. 2002. *Teach Yourself Macromedia Flash MX.* Sams Publishing.

Luther, A.C. 1994. *Authoring Interactive Multimedia.* Academic Press.

Parekh, R. 2006. *Principles of Multimedia.* Tata McGraw-Hill, New Delhi.

Vaughan, T. 2003. *Multimedia-Making it Work.* McGraw-Hill.

CA 575 ARTIFICIAL INTELLIGENCE (2L + 1P) I

(Pre-requisite: CA 564)

Objective

The primary objective of this course is to provide an introduction to the basic principles and applications of Artificial Intelligence that includes problem solving, knowledge representation, reasoning, decision making, planning, perception & action, and learning.

Theory

UNIT I

Introduction to Artificial Intelligence (AI); Scope of AI: Games, theorem proving, natural language processing, robotics, expert system.

UNIT II

Knowledge: General concept of knowledge, Knowledge based system, Representation of knowledge, Knowledge organization and manipulation, Acquisition of knowledge.

UNIT III

Symbolic approach: Syntax and Semantics for Prepositional Logic (PL) and First order predicates logic (FOPL), Properties of well formed formulas (wffs), Conversion to clausal form, Inference rules, Resolution principle, Non deductive inference methods.

UNIT IV

Search and Control strategies: Blind search, Breadth- first search, Depth – First search, Hill climbing method, Best – First search, Branch and Bound search.

UNIT V

Learning: Concept of learning, learning automation, genetic algorithms, learning by induction.

UNIT VI

Expert System: Introduction to expert system, Characteristics features of expert system, Applications, Importance of Expert system, Rule based system architecture; Software Agents.

Practicals

Search and Control strategies: Blind search, Breadth- first search, Depth – First search, Hill climbing method, Best – First search, Branch and Bound search; Learning by induction; Genetic algorithms; Case study of a rule based expert system and Construction of Decision tree.

Suggested Readings

Akerkar, R. 2005. *Introduction to Artificial Intelligence.* Prentice-Hall of India.

Giarratano, J. and Riley, G. 1998. *Expert Systems - Principles and Programming.* PWS Publishing Company.

Gonzalez, A. and Dankel, D. 2004. *The Engineering of Knowledge-Based Systems.* Prentice Hall.

Hill, E.F. 2003. *Jess in Action.* Manning Publications.

Jackson, P. 1999. *Introduction to Expert Systems.* Addison Wesley.

Nilson, N. J. 2000. *Artificial Intelligence: A New Synthesis.* Maurgan Kaufman Publishers, San Francisco.

Nilson, N.J. 2001. *Principles of Artificial Intelligence.* Narosa publishing House.

Rich, E. and Knight, K. 2002. *Artificial Intelligence.* Tata McGraw Hill, New Delhi.

Russell, S. and Norvig, P. 2003. *Artificial Intelligence: A Modern Approach.* Prentice Hall.

CA 577 DATA MINING AND SOFT COMPUTING (2L + 1P) II

(Pre-requisite: CA 564)

Objective

Data Mining and Soft Computing is oriented towards pattern discovery from large datasets. Size of the agricultural data is increasing at exponential rate. Therefore there is a need to supplement traditional data analytical techniques with new innovative techniques. The present course aims to cover data mining and soft computing techniques which can be used for analysis of large datasets.

Theory

Data Mining

UNIT I
Introduction to Data Mining and its Tasks, Data Pre-processing, Data Discretization.

UNIT II
Classification and Prediction, Decision Tree, Naive Bayes' Classifier.

UNIT III
Output and Knowledge Representation, Evaluation and Credibility, Association Rule Mining.

UNIT IV
Clustering: Similarity measures, Hierarchical Clustering, k-Means Clustering.

Soft Computing

UNIT V
Introduction to Soft Computing, Fuzzy sets, Rough sets.

UNIT VI
Neural Network, Support Vector Machines, Genetic Algorithm.

Practicals

Introduction to Data Mining software, Data Pre-processing, Discretization, Decision Tree: D3, Naïve Bayes' Classifier, Association Rule Mining: Apriori Algorithm, Clustering: Hierarchical Clustering, K-Means; Fuzzy set, Rough set, ANN, SVM, Genetic Algorithm.

Suggested Readings

Goldberg, D.E. 1989. *Genetic Algorithms in Search, Optimization, and Machine Learning.* Addison Wesley.

Gupta, G.K. 2006. *Introduction to Data Mining with Case Studies.* Prentice Hall of India, New Delhi.

Han, J and Kamber, M. 2006. *Data Mining: Concepts and Techniques.* Morgan Kaufman.

Hand, D., H. Mannila, P. Smyth. 2001. *Principles of Data Mining.* Prentice Hall of India, New Delhi.

Haykin, Simon 1998. *Neural Networks: A Comprehensive Foundation.* Prentice Hall.

Jang, J. R., Sun, C. and Mizutani, E. 1996. *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence.* Prentice Hall.

Kecman, V. and Kecman, Vojislav. 2001. *Learning and Soft Computing: Support Vector Machines, Neural Networks, and Fuzzy Logic Models.* MIT Press.

Lee, K.H. 2005. *First Course on Fuzzy Theory and Applications.* Springer.

Mirkin, B. 2005. *Clustering for Data Mining: Data Recovery Approach,* Chapman & Hall/CRC.

Mitra, S. and Acharya, T. 2003. *Data Mining: Multimedia, Soft Computing, and Bioinformatics.* John Wiley.

Mitra,S., T. Acharya. 2004. *Data Mining: Multimedia, Soft Computing, and Bioinformatics.* John Wiley & Sons.

Sivanandam, S. N., Deepa, S. N. 2007. *Principles of Soft Computing.* Wiley.

Witten, H. E. Frank. 1999. *Data Mining: Practical Machine Learning Tools and Techniques with Java Implementation.* Morgan Kaufmann Publishers.

CA 578 INFORMATION SECURITY **(2L+ 1P) II**

(Pre-requisite: CA 567)

Objective

The field of information security has grown and evolved significantly in recent years. Issues like globalization and free trade have made the matter of information security more sensible. In addition to the legislation with respect to information security, pressure coming from industrial piracy, liability, public image and advancement of technology have put a lot of pressure on business to address the information as an asset to be protected. Students are required to understand the principles and techniques of information security to build secure systems.

Theory

UNIT I

Basic concepts of information security; Program security: malware, types of attacks, intrusion detection and prevention.

UNIT II

Cryptographic techniques: conventional cryptography, public-key cryptography, and digital signatures, steganography.

UNIT III

Security services: message integrity, confidentiality and authentication, certification and key management.

UNIT IV

Access control in computer networks: authentication protocols and services (Kerberos).

UNIT V

Firewalls and Virtual Private Networks (VPNs).

UNIT VI

Network security applications: IP security (IPsec), Web security (SSL, TLS, SET), Electronic mail security (PGP, S/MIME), and SNMP security.

Practicals

Malware and their removal, Types of attacks and their detection, Cryptography algorithms, Web security, E-mail security, Firewall, Port blocking, VPN.

Suggested Readings

Amoroso, E. 1994. *Fundamentals of Computer Security Technology.* Prentice-Hall.

Chapman, B. and Zwicky, Elizabeth D. 2000. *Building Internet Firewalls.* O'Reilly.

Charles P. Pfleeger. 2006. *Security in Computing.* Prentice Hall.

Easttom William Ii, Chuck Easttom. 2005. *Computer Security Fundamental.* Prentice Hall

Elizabeth D. Zwicky, Simon Cooper, and D. Brent Chapman. 2000. *Building Internet Firewalls.* O'Reilly and Associates.

Ford, W. 1994. *Computer Communications Security.* Prentice Hall.

Pfleeger, Charles P. 2006. *Security in Computing.* Prentice Hall.

Pieprzyk, J. 2008. *Fundamentals of Computer Security.* Springer.

Stallings, W. 2003. *Cryptography and Network Security: Principles and Practice.* Prentice Hall.

CA 611* DESIGN AND ANALYSIS OF ALGORITHMS (2L + 1P) I

(Pre-requisite: CA 564)

Objective

This course provides a theoretical foundation in designing algorithms. The focus is on the advanced analysis of algorithms and on how the selections of different data structures affect the performance of algorithms.

Theory

UNIT I

Algorithm Analysis – Time Space Tradeoff – Asymptotic Notations – Conditional asymptotic notation – Removing condition from the conditional asymptotic notation - Properties of big-Oh notation – Recurrence equations – Solving recurrence equations – Analysis of linear search.

UNIT II

Divide and Conquer: General Method – Binary Search – Finding Maximum and Minimum – Merge Sort – Greedy Algorithms: General Method – Container Loading – Knapsack Problem.

UNIT III

Dynamic Programming: General Method – Multistage Graphs – All-Pair shortest paths – Optimal binary search trees – 0/1 Knapsack – Travelling salesperson problem.

UNIT IV

Backtracking: General Method – 8 Queens problem – sum of subsets – graph coloring – Hamiltonian problem – knapsack problem.

UNIT V

Graph Traversals – Connected Components – Spanning Trees – Biconnected components – Branch and Bound: General Methods (FIFO & LC) – 0/1 Knapsack problem – Introduction to NP-Hard and NP-Completeness.

Practicals

Solving recurrence equations, Analysis of linear search., Programming Divide and Conquer Algorithms and their analysis, Programming Greedy Algorithms and their analysis, Implementing Dynamic Programming and their analysis, Implementing Backtracking examples, Implementing Graph Traversals, Implementing Spanning Trees.

Suggested Readings

Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman. 1999. *The Design and Analysis of Computer Algorithms.* Pearson Education.

Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran. 2007. *Computer Algorithms/ C++.* Universities Press.

T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein. 2003. *Introduction to Algorithms.* Prentice Hall of India, New Delhi.

CA 612* FUZZY SETS AND ROUGH SETS **(2L + 1P) II**

(Pre-requisite: CA-611)

Objective

Fuzzy sets and Rough sets are used to represent vagueness in everyday life. These theories provide an approximate and yet effective means for describing the characteristics of a complex system. In this course, focus is on the advanced methods for handling uncertainty using rough sets and fuzzy sets. The techniques are useful for hybridization of data mining algorithms, feature selection and rule generation, dependencies and other applications.

Theory

Unit I

Introduction to Fuzzy Sets, Basic Notions, Concepts of Fuzzy Sets.

Unit II

Operations of Fuzzy Set, Fuzzy Relation and Composition, Fuzzy Numbers, Fuzzy Functions, Fuzzy Inference, Applications of Fuzzy Theory.

Unit III

Introduction to Rough Set Theory, Knowledge representation, Information systems.

Unit IV

Exact Sets, Rough sets, approximations, Logical aspects of rough sets & dependencies, Decision System.

Unit V

Knowledge reduction, Reduct via boolean reasoning, discernibility approach, reduct in decision system, rough membership functions, Generalized and approximate reduct: Frequency based reduct, Local reduct, Dynamic reduct, generalized dynamic reduct, Genetic and hybrid algorithms in reduct computation.

Practicals

Fuzzy system software overview, Applications of Fuzzy Theory, Rough set software overview, Algorithms for reduct computations, Reduct Computation methods, Rule Formulation, Applications of Rough set theory.

Suggested Readings

Dubois, D. and Prade, H. (1990). *Rough fuzzy sets and fuzzy rough sets*. International Journal of General Systems 17: 191–209.

Kwang H. Lee. 2004. *First Course on Fuzzy Theory and Applications*. Springer-Verlag, Berlin and Heidelberg.

Mukaidono, Masao, Kikuchi, Hiroaki. 2001. *Fuzzy Logic for Beginners.* World Scientific Pub Co.

Pal, S. K., Skowron A. (Eds.). 1999. *Rough Fuzzy Hybridization: A New Trend in Decision Making*. Springer-Verlag New York, Inc.

Pawlak. Z. (1991). *Rough sets, Theoretical Aspects of Reasoning about Data.* Kluwer Academic Publishers, Dordrecht.

Pedrycz Witold and Gomide Fernando. 2004. *An Introduction to Fuzzy Sets: Analysis and Design.* Prentice Hall of India, New Delhi.

Polkowski, L., Skowron, A. 1998. *Rough Sets in Knowledge Discovery 1: Methodology and Applications.* Heidelberg: Physica-Verlag.

Polkowski, L., Tsumoto, S., Tsau Young Lin. 2000. *Rough Set Methods and Applications: New Developments in Knowledge Discovery in Information Systems (Studies in Fuzziness and Soft Computing)*. Physica-Verlag GmbH Heidelberg, Germany.

Zimmermann, H.-J. (1991). *Fuzzy Set Theory and its Applications.* Kluwer Academic Publishers, Dordrecht.

CA 613* ARTIFICIAL NEURAL NETWORKS (2L +1P) III

(Pre-requisite: CA 611)

Objective

This course presents an overview of the theory and applications of artificial neural network to various applications with emphasis on data mining and knowledgebase systems. The objective of this course is on the understanding of various neural networks. The students will be encouraged to use existing software having ANN capabilities as well as to program basic ANN algorithms.

Theory

Unit I

Introduction: History of Neurocomputing. Analogy to the Biological Prototype, The Neural Node, The Perceptron, Linear Separable Function, Adaline and Madaline.

Unit II

Learning Algorithms: Supervised, Reinforcement, Unsupervised, Competitive, Self Organizing Feature Maps, Bayesian, Temporal, Spatiotemporal

Unit III

Associative Networks: Feed-forward and Recurrent networks, Linear Associator, Hopfield, Bidirectional Associative Memory

Unit IV

Neural network architectures: Multilayer networks, Kohonen networks, Counter propagation Networks, GMDH (Group Method of Data Handling), Hamming Networks, Radial Basis Function networks

Unit V

Frontiers of Neurocomputing: Hybridization of neural networks with other soft computing techniques, Neurocomputing Applications,

Practicals

ANN Software, Perceptron, Linear Separable Function, Multilayer Perceptron, Radial Basis Function, Self Organizing Map Networks, Counter propagation Networks, GMDH (Group Method of Data Handling), Hamming Network, Neurocomputing Applications.

Suggested Readings

Anderson, J. and E. Rosenfeld (Eds.). 1988. *Neurocomputing.* MIT Press.

Carpenter G.A. and Grossberg S . 1991. *Pattern Recognition by Self-organizing Neural Networks.* Cambridge, MA MIT Press.

D.E.Rumelhart and McCelland, J.L.. 1986. *Parallel Distributed Processing*: Vol. 1& 2, (Ed) MIT Press.

Grossberg, S. (Ed.). 1988. *Neural Networks and Natural Intelligence.* MIT Press.

IEEE Computer. 1988. *Artificial Neural Systems: Special Issue*.

Igor Alek Sander & Helen Morton. 1990. *Introduction to Neural Computing.* Chapman & Hall.

Jacek M. Zurada. 1999. *Introduction to Artificial Neural System.* Jaico Publishing House, New Delhi.

James A. Anderson. 1998. *An Introduction to Neural Networks.* Prentice Hall of India, New Delhi.

Robert Hecht-Nieisen. 1990. *Neurocomputing*. Addison-Wesley.

Robert J. Schalkoff. 1997. *Artificial Neural Networks.* McGraw Hill.

Simon Haykin. 1999. *Neural Networks- A comprehensive Foundation*. Pearson Education.

Vemuri, V.(Ed.). 1989. *The Computing Neuron*, R.Durbin, C.Miall, G.Mitchison(Eds.) Addison-Wesley Publishing Company, Reading, MA.

Vimuri, V. (Ed.). 1988. *Artificial Neural Networks: Theoretical Concepts.* IEEE Computer Society Press, NJ.

Wasserman, P.D. 1989. *Neural Computing: Theory & Practice*. Van Nostrand Reinhold, NY.

Yegnanarayana, B. 1999. *Artificial Neural Networks.* Prentice Hall of India, New Delhi.

CA 614* KNOWLEDGEBASE SYSTEMS FOR SEMANTIC WEB (2L + 1P) III

(Pre-requisite: CA 575)

Objective

This course is an introduction to knowledge representation for Semantic Web, ontology, semantic web and knowledgebase systems for Semantic Web. This course aims to provide basic understanding of technologies supporting e-governance. It examines Ontologies and the Semantic Web in the context of developing ontology based systems. It also presents a case study of ontology based system.

Theory

UNIT I

Knowledge Representation for Semantic Web, Ontology Languages, Resource Description Framework (RDF)/RDF Schema, Ontology web Language (OWL).

UNIT II

Ontology building methodologies. Ontology Editors, Querying RDF/OWL through SPARQL.

UNIT III

Introduction to Description Logics, Knowledge representation in Description Logics, Description Logic Reasoning, Reasoning with OWL.

UNIT IV

API for building and querying Ontologies, Ontology based systems.

Practicals

Resource Description Framework (RDF)/RDF Schema, Ontology web Language (OWL), Ontology Editors, Querying RDF/OWL through SPARQL, API for building and querying Ontologies, Reasoning with OWL, Ontology based systems.

Suggested Readings

Antoniou G., and Harmelen F. V.2004. *A Semantic Web Primer.* MIT Press.

Baader F., Calvanese D., McGuiMess D., Nardi D., Patel-Schneider P.F. 2002. *The Description Logic Handbook.* Cambridge University Press.

Cardoso J., Sheth A.P.2006. *Semantic Web Services, Processes and Applications,* Springer.

Sheth A., Lytras M. 2007. *Semantic Web-Based Information Systems,* Cybertech Publishing.

CA 621* ADVANCES IN DATA MINING (2L +1P) I

(Pre-requisite: CA 577)

Objective

Size of the agricultural data is increasing at exponential rate. Therefore there is a need to supplement traditional data analytical techniques with new innovative techniques. Data Mining is oriented towards pattern discovery from large datasets. The present course aims to cover data mining techniques in length. Focus of the course will be on application of data mining techniques on agricultural datasets.

Theory

UNIT I

Review of data mining techniques and challenges, Classification: Decision Tree Classifiers, Bayesian Classifiers, Instance-Based Learners, Support Vector Machines.

UNIT II

Clustering: Distance measures and Symbolic Objects, Scalable Clustering Algorithms, Clustering with Categorical Attributes, Conceptual Clustering, Cluster Validity Indices.

UNIT III

Rule based mining, Candidate Generation and Test Methods, Interesting Rules, Multilevel Rules, Other Variants.

UNIT IV

Hybridization techniques in data mining: Rough set based classification, Rough set based clustering, Fuzzy Decision Trees, Fuzzy c-means, Fuzzy Association Rules.

UNIT V

Web Mining: Concept of web mining, search engines, approaches for web mining; Text Mining: Keyword-based search and mining, Text analysis and retrieval, Similarity- based matching for documents and queries, Latent semantic analysis; Applications in Bioinformatics, Applications in Agriculture.

Practicals

Decision Tree Classifiers, Bayesian Classifiers, Instance-Based Learners, Support Vector Machines, Clustering Algorithms, Rule based mining, Hybridization techniques in data mining, Applications with case studies in agriculture.

Suggested Readings

Goldberg, D.E. 1989. *Genetic Algorithms in Search, Optimization, and Machine Learning.* Addison Wesley.

Gupta, G.K. 2006. *Introduction to Data Mining with Case Studies.* Prentice Hall of India, New Delhi.

Han, J and Kamber, M. 2006. *Data Mining: Concepts and Techniques.* Morgan Kaufman.

Hand, D., H. Mannila, P. Smyth. 2001. *Principles of Data Mining.* Prentice Hall of India, New Delhi.

Haykin, Simon 1998. *Neural Networks: A Comprehensive Foundation.* Prentice Hall.

Jang, J. R., Sun, C. and Mizutani, E. 1996. *Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence.* Prentice Hall.

Kecman, V. and Kecman, Vojislav. 2001. *Learning and Soft Computing: Support Vector Machines, Neural Networks, and Fuzzy Logic Models.* MIT Press.

Lee, K.H. 2005. *First Course on Fuzzy Theory and Applications.* Springer.

Mirkin, B. 2005. *Clustering for Data Mining: Data Recovery Approach,* Chapman & Hall/CRC.

Mitra, S. and Acharya, T. 2003. *Data Mining: Multimedia, Soft Computing, and Bioinformatics.* John Wiley.

Mitra,S., T. Acharya. 2004. *Data Mining: Multimedia, Soft Computing, and Bioinformatics.* John Wiley & Sons.

Sivanandam, S. N., Deepa, S. N. 2007. *Principles of Soft Computing.* Wiley.

Witten, H. E. Frank. 1999. *Data Mining: Practical Machine Learning Tools and Techniques with Java Implementation.* Morgan Kaufmann publishers.

CA 622* ADVANCES IN DATA WAREHOUSING (2L + 1P) III

(Pre-requisite: CA 573)

Objective

The course provides a theoretical foundation in designing an efficient data warehousing solution with efficient query processing including indexing, data compressions and data management. The course will also provide the students to think in the direction of taking research studies in the data warehousing schema design and development, query management techniques, partitioning techniques etc.

Theory

UNIT I

Introduction to Data Warehousing: Heterogeneous information; The integration problem; The Warehouse Architecture; Data Warehousing; Handling of large datasets; Real time data warehousing; Spatial Data warehousing.

UNIT II

ERP-Resource Management Perspective: Functional and Process of Resource Management; Modules of ERP System: HRD, Personnel Management, Training and Development, Skill Inventory, Material Planning and Control, Inventory, Forecasting, Manufacturing, Production Planning, Scheduling and Control, Sales and Distribution, Finance, Resource Management in global scenario.

Unit III

Data Warehouse Models and OLAP Operations: Data Marts; The Multi-Dimensional data model; Dimensional Modelling; Criterion for OLAPs; Star, snowflake and any other schemas; Roll-up, Slicing, and Pivoting.

Unit IV

Issues in Data Warehouse Design: Monitoring; Wrappers; Integration; Data Cleaning; Data Loading; Materialized Views; SQL and Aggregations; Aggregation functions; Grouping; Warehouse Maintenance; OLAP Servers; Metadata.

Unit V

Data Compression, Query Processing and Partitioning of Database/Table: Data compression and various techniques of Data compression, Partitioning techniques, Indexing and advanced query processing and optimization.

Practicals

Case Study: Design and Development a prototype model of the data warehouse with the implementation and query strategies.

Suggested Readings

Bret Wagner, Ellen Monk. 2008. *Enterprise Resource Planning.* Publisher: Course Technology.

Ellen Monk, Bret Wagner. 2005. *Concepts in Enterprise Resource Planning.* Publisher Course Technology.

Harry Singh. 1998. *Data warehousing: Concepts, Technologies, Implementations, and Management*. Prentice and Hall, New Delhi.

Joseph Brady, Ellen Monk and Bret Wagner. 2001. *Concepts in Enterprise Resource Planning.* Publisher: Course Technology.

Marianne Bradford. 2009. *Modern ERP: Select, Implement and Use Today's Advanced Business Systems.* Publisher: lulu.com

Mark Humphries, Michael W. Hawkins, Michelle C. Dy. 1999. *Data warehousing: architecture and implementation Harris Kern's Enterprise computing institute Solutions for IT Professionals.* Prentice Hall.

Mark Nelson, Jean-Loup Gailly. 1995. *The Data Compression Book.* Publisher M&T Books.

Mary Sumner. 2004. *Enterprise Resource Planning.* Prentice Hall.

Paul Westerman. 2001. *Data warehousing: using the Wal-Mart model. The Morgan Kaufmann Series in Data Management Systems Series IT Pro collection.* Morgan Kaufmann.

Ralph Kimball, Margy Ross. 2002. *The Data Warehouse Toolkit: The Complete Guide to Dimensional Modelling.* Wiley.

Tom Hammergren. 1996. *Data warehousing: building the corporate knowledge base ITCP Computer Science Series.* International Thomson Computer Press.