Department of Computer Science & Engineering
National Institute of Technology
(Formerly Regional Engineering College, Tiruchirappalli)
Tiruchirappalli – 620015
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Highlights of M. Tech. (CSE) Revised – Curriculum

1) Introduction of Core subject "Mathematical Foundation for Computer Science".
2) Introduction of Core subject "Service Oriented Architecture".
3) Introduction of two more labs:
    a. Hardware Lab - Semester-I
    b. Network Programming Lab - Semester-II
4) Introduction of new Elective subjects
    a. Digital Forensics
    b. Computer Graphics and Image Processing
    c. Data Warehousing and Data Mining
    d. Cloud Computing
5) Number of elective subjects increased from 8 to 13 in two semesters combined.
6) Number of laboratory subjects increased from 1 to 3 in two semesters combined
7) Number of Core subjects retained as 6.
8) The following two Core subjects have been moved to Electives:
    a. Advanced Digital Design
    b. Distributed Systems
9) Two credits have been assigned to "Seminar" in Semester II.
10) Two credits have been assigned to "Internship" in Semester II.
11) Latest editions of text and reference books added.
12) Old editions are retained if new editions not available.

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M. Tech. (CSE) – Curriculum (NITTPGCSE13)

I Semester

Core Subjects

Sl. No.	Subjects
1.	Advanced Algorithms and Data Structures (3)
2.	Advanced Concepts in Operating System (3)
3.	Parallel Computer Architecture (3)
4.	Elective – I (3)
5.	Elective – II (3)
6.	Advanced Programming Lab (2)
7.	Computer System Design Lab (2)

Odd Sem Elective Subjects

Sl. No.	Subjects
1.	Advanced Network Principles and Protocols (3)
2.	Design and Analysis of Parallel Algorithms (3)
3.	Digital Forensics (3)
4.	Principles of Cryptography (3)
5.	Computer Graphics and Image Processing (3)
6.	Imaging and Multimedia Systems (3)
7.	Open Source Programming (3)

II Semester

Core Subjects

Sl. No.	Subjects
1.	Mathematical Foundations for Computer Science (3)
2.	Service Oriented Architecture and Web Security (3)
3.	Advanced Database Management System (3)
4.	Elective – III (3)
5.	Elective – IV (3)
6.	Network Programming Lab (2)
7.	Advanced DBMS Lab (2)
8.	Seminar (2)
9.	Internship (2)

Even Sem Elective Subjects

Sl. No.	Subjects
1.	Distributed Systems (3)
2.	Wireless Sensor Networks (3)
3.	Advanced Digital Design (3)
4.	Real Time Systems (3)
5.	Mobile Network Systems (3)
6.	Network Security (3)
7.	Data Warehousing and Data Mining (3)
8.	Cloud Computing (3)

III Semester : Project Work: Phase – I : 12

IV Semester : Project Work: Phase – II : 12

Total Credits : 19 + 19 + 2 + 2 + 12+ 12 = 66

First Semester

CS601: Advanced Algorithms and Data Structures

Credit: 3

Objective

- To introduce and practice advanced algorithms and programming techniques necessary for developing sophisticated computer application programs
- To get accustomed with various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.
- To learn new techniques for solving specific problems more efficiently and for analyzing space and time requirements.

Unit I

Review of order rotation & growth of functions, recurrences, probability distributions, Average case analysis of algorithms, Basic data structures such as stacks, queues, linked lists, and applications.

Unit II

Direct access tables and hash tables, hash functions and relates analysis, Binary Search trees and Operations, AVL Trees and balancing operations, R B Trees, properties, operations.

Unit III

B – Trees – definition – properties, operations, data structures for disjoint sets, Graph algorithms, MST single source all pair shortest paths, BFS, DFS, topological sort, strongly connected components.

Unit IV

Quick sort randomized version, searching in linear time, More graph algorithms – maximal independent sets, coloring vertex cover, introduction to perfect graphs.

Unit V

Algorithmic paradigms Greedy Strategy, Dynamic programming, Backtracking, Branch-and-Bound, Randomized algorithms.

Outcome

- Students are familiar with algorithmic techniques such as brute force, greedy, and divide and conquer.
- Application of advanced abstract data type (ADT) and data structures in solving real world problems.
- Effectively combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem

Text Books

1. H. S. Wilf, Algorithms and complexity, Prentice hall.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice hall.
3. K. Vishwanathan Iyer, Lecture notes for classroom use.

CS603: Advanced Concepts in Operating Systems

Credit: 3

Objectives

- To study the characteristics of OS for Multiprocessor and Multicomputer.
- To learn the issues related to designing OS.
- To learn the latest trends in building Mobile OS.

UNIT I

Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- memory management.

UNIT II

Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection

UNIT III

Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement - Caching

UNIT IV

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms

UNIT V

Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management

Outcome

- Knowledge about advanced concepts in OS
- Ability to develop OS for distributed systems
- Ability to develop modules for mobile devices

TEXT BOOK:

1. M Singhal and NG Shivaratri , Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001

REFERENCE BOOK

1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010

CS605: Parallel Computer Architecture

Credit: 3

Objective

- To understand the principles of parallel computer architecture
- To understand the design of parallel computer systems including modern parallel architectures
- To assess the communication and computing possibilities of parallel system architecture and to predict the performance of parallel applications

Unit – I Fundamentals of Computer Design

Defining Computer Architecture – Trends in Technology – Trends in Power in Integrated Circuits – Trends in Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Basic and Intermediate concepts of pipelining – Pipeline Hazards – Pipelining Implementation issues.

Unit – II Instruction-Level Parallelism and Its Exploitation

Instruction-Level Parallelism: Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Prediction – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Algorithm and Examples – Hardware-Based Speculation – Exploiting ILP Using Multiple Issue and Static Scheduling – Exploiting ILP Using Dynamic Scheduling, Multiple Issue and Speculation – Studies of the Limitations of ILP – Limitations on ILP for Realizable Processors – Hardware versus Software Speculation – Using ILP Support to Exploit Thread-Level Parallelism

Unit – III Data-Level and Thread-Level Parallelism

Vector Architecture – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units – Detecting and Enhancing Loop-Level Parallelism – Centralized Shared-Memory Architectures – Performance of Shared-Memory Multiprocessors – Distributed Shared Memory and Directory Based Coherence – Basics of Synchronization – Models of Memory Consistency – Programming Models and Workloads for Warehouse-Scale Computers – Computer Architecture of Warehouse-Scale Computers – Physical Infrastructure and Costs of Warehouse-Scale Computers

Unit – IV Memory Hierarchy Design

Cache Performance – Six Basic Cache Optimizations – Virtual Memory – Protection and Examples of Virtual Memory – Ten Advanced Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – The Design of Memory Hierarchies

Unit – V Storage Systems & Case Studies

Advanced Topics in Disk Storage – Definition and Examples of Real Faults and Failures – I/O Performance, Reliability Measures and Benchmarks – Designing and Evaluating an I/O System – The Internet Archive Cluster

Case Studies / Lab Exercises: INTEL i3, i5, i7 processor cores, NVIDIA GPUs, AMD, ARM processor cores – Simulators – GEM5, CACTI, SIMICS, Multi2sim and INTEL Software development tools.

Outcome

- Students accustomed with the representation of data, addressing modes, and instructions sets.
- Students able to understand parallelism both in terms of a single processor and multiple processors
- Technical knowhow of parallel hardware constructs to include instruction-level parallelism for multi core processor design

Text Books

1. David.A.Patterson, John L.Hennessy, "Computer Architecture: A Quantitative approach", Elsevier, 5th Edition 2012.
2. K.Hwang, Naresh Jotwani, "Advanced Computer Architecture, Parallelism, Scalability, Programmability", Tata McGraw Hill, 2nd Edition 2010.

CS607: Advanced Programming Laboratory

Credit: 2

Objectives

- To explore the features of object oriented programming.
- To focus programming rather on programming language.
- To understand the OS internals.

Exercises using Linux tools – Grep, awk, tr
Exercises using system calls
Exercises in Python
Exercises in C++/ Java

Outcomes

- Ability to develop shell scripts for various applications.
- Gaining knowledge about OS internals.
- Understanding Object oriented concepts and developing software modules.

Reference Books

1. Arnold Robbins, Nelson H. F. Beebe, Classic Shell Scripting, O'Reilly Media 2005
2. H. Schildt Java: The Complete Reference, Eighth Edition, McGraw-Hill Education (India) Pvt. Limited, 2011.
3. H. Schildt C++: The Complete Reference, Fourth Edition, McGraw-Hill Education (India) Pvt Limited, 2003.
4. Mark Lutz Learning Python, 3rd Edition, O'Reilly Media, 2007

CS609: Computer System Design Laboratory

Credit: 2

Objective

- To understand the functionality of the various modules of a computer system.
- To build computer systems from components.

Exercises

1. Comparative study of motherboards from INTEL, AMD and ARM with focus on performance.
2. Study of GPUs using NVIDIA boards.
3. Study of memory sub systems with focus on performance.
4. Study of Reconfigurable hardware using FPGA boards.
5. Study of display cards, RAM, Sound cards, disk and I/o interfaces
6. Understanding BIOS and CMOS settings.

Outcome

- Ability to build computer systems from components for various specifications.
- Gaining knowledge on the architecture of the computer systems.

References

1. R. Kelly Campbell, "Introduction to Computer Hardware Lab Manual" Kendall Hunt, 1st Edition, 2010.
2. Michael Meyers, Lloyd Jeffries, "Mike Meyers' A Guide to PC Hardware", McGraw Hill Professional, 2004.

Second Semester

CS602: Mathematical Foundations for Computer Science

Credit: 3

Objective

- Study the fundamental concepts of logic, abstract algebra, linear algebra, probability and statistics, graph theory etc.

Unit I

Functional Logic: Proposition Logic, Resolution Proof system, Predicate logic. Congruences, Fermat's theorem, Euler function, Chinese remainder theorem.

Unit II

Groups, homomorphism theorems, cosets and normal subgroups, Lagrange's theorem, Ring. Field. Linear algebra: Vector Space, Basis, Matrices and Linear Transformations, Eigen values, Orthogonality.

Unit III

Counting, Probability, Discrete random variable, Continuous random variable, Moment generating function, Markov's inequality, Chebyshev's inequality, The geometric and binomial distributions, The tail of the binomial distribution.

Unit IV

Graphs, Euler tours, planar graphs, Hamiltonian graphs, Euler's formula, applications of Kuratowski's theorem, graph colouring, chromatic polynomials, trees, weighted trees, the max-flow min-cut theorem.

Unit V

Turing Machines, Recursive and Recursively Enumerable languages. Cantor's Diagonalization theorem. Complexity classes - NP-Hard and NP-complete Problems - Cook's theorem NP completeness reductions. Approximation algorithms.

Outcome

- Will be able to use mathematical foundations in many areas of computer science like algorithms, computer networks, cryptography, etc.

Text Books

1. Donald F. Stanat and David F. McAllister, Discrete mathematics in Computer Science.
2. Thomas Koshy, Elementary number theory with Applications, Elsevier
3. I.N.Herstein, Topics in Algebra.JOHN Wiley & SONS. 1990.
4. Sheldon M. Ross, Introduction to Probability Models, Elsevier.
5. H. Cormen, C. E. Leiserson, R. L. Rivest, C Stein, Introduction to Algorithms, Prentice Hall India.
6. Sara Baase and Alan Van Van Gelder. Computer Algorithms: Introduction to Design and Analysis. Addison – Wiley, 2000.
7. ***G. Chartrand*** and ***P. Zhang,*** Introduction to Graph Theory, McGraw-Hill Companies,
8. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India.
9. Linear Algebra 2nd Edition (Paperback) by Kenneth Hoffman, Ray Kunze, PHI Learning, 2009.

CS604: Service Oriented Architecture and Web Security

Credit: 3

Objective:

- To provide an overview of XML Technology and modeling databases in XML
- To provide an overview of Service Oriented Architecture and Web services and their importance
- To introduce Security solutions in XML and Web Services and to introduce Security standards for Web Services

UNIT I XML Technology

XML – XML and Web - Name Spaces – XML Document Structure - Structuring with Schemas and DTD - Modeling Databases in XML – XQuery

UNIT II SOA Basics

Service Oriented Architecture (SOA) – Comparing SOA with Client-Server and Distributed architectures - Characteristics of SOA – Benefits of SOA -- Principles of Service orientation – Service layers - Business Process management

UNIT III Web Services (WS)

SOA and Web Services – Web Services Protocol Stack – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI. Service-Level Interaction patterns – XML and Web Services - Enterprise Service Bus - .NET and J2EE Interoperability.

UNIT IV WS Technologies and Standards

Web Services Technologies - JAX-RPC, JAX-WS. Web Service Standards – WS-RM, WS-Addressing, WS-Policy. Service Orchestration and Choreography – Composition Standards - BPEL. Service Oriented Analysis and Design.

UNIT V XML and WS Security

XML Security Overview – Canonicalization – XML Security Framework – XML Encryption – XML Signature – XKMS Structure. Web Services Security - XACML - WS-Security.

Outcome:

- The students will understand the basics of XML
- The students will learn the concepts of SOA and Web services, some of the prevailing standards and technologies of Web Services
- The students will also learn the approaches for providing security for XML documents as well as messages exchanged among Web Services

Text Books:

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2008. (Unit 1 and 3)
2. Thomas Erl, " Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005 (Unit 2, 3, 4, and 5)
3. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002 (Unit 5)

Reference Books:

1. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Addison Wesley, 2005.
2. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2011.
3. Mark O' Neill, et al., "Web Services Security", Tata McGraw-Hill Edition, 2003.
4. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004

CS606: Advanced Database Management System

Credit: 3

Objective

- To understand the basic concepts and terminology related to DBMS and Relational Database Design
- To the design and implement Distributed Databases.
- To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports

Unit I

Formal review of relational database and FDs Implication, Closure, its correctness

Unit II

3NF and BCNF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans

Unit III

Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serialisability

Unit IV

Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees, Optimistic CC

Unit V

T/O based techniques, Multiversion approaches, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases

Outcome

- Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.
- Knowhow of the file organization, Query Optimization, Transaction management, and database administration techniques

Text Books

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. A. Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008.

Reference Books

1. K. V. Iyer, Lecture notes available as PDF file for classroom use.

CS608: Network Programming Laboratory

Credit: 2

Objective

- Create client and server applications using the "Sockets" API and the implementation of Data link layer protocol and TCP layer
- Ability to conduct computer communication network simulations. Development of computer network simulation and modeling techniques using OPNET simulation software.

Experiments

1. Exercises on Socket Programming using C and Java
2. Exercises using OPNET Network Simulator
    a. Setting up of various network topologies
    b. Implementation of various MAC protocols
    c. Measurement of routing protocols
    d. Analysis of TCP/IP protocol under various mechanisms
    e. Setting up of network that carries various application protocols and analyzing the performances
3. Creation of XML documents and verification using DTDs and Schemas.
4. Transformation of XML documents to XHTML documents for presentation using XSL.
5. Development and deployment of Web Services using Dot Net and J2EE technologies.
6. Composition of Web services using BPEL.

Outcome

- Understanding of the working principle of Socket programming
- Familiarization with the OPNET toolkit

References

1. UNIX Network Programming – Networking APIs: Sockets and XTI by W. Richard Stevens, Volume 1, 2nd Edition, 1998, Prentice Hall.
2. Computer Networks: A Systems Approach – Network Simulation Experiments in OPNET by L. Peterson and S. Davie, 4th Edition, 2008, Elsevier.

CS610: Advanced DBMS Laboratory

Credit: 2

Objective:

- To explore the features of a Database Management Systems
- To interface a database with front end tools
- To understand the internals of a database system

Experiments

- Basic SQL
- Intermediate SQL
- Advanced SQL
- ER Modeling
- Database Design and Normalization
- Accessing Databases from Programs using JDBC
- Building Web Applications using PHP & MySQL
- Indexing and Query Processing
- Query Evaluation Plans
- Concurrency and Transactions
- Big Data Analytics using Hadoop

Outcome:

- Ability to use databases for building web applications.
- Gaining knowledge about the internals of a database system.

References

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6th edition, Tata McGraw Hill, 2011
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 4th Edition, Pearson/Addision wesley, 2007

CS648: Seminar

Credit: 2

Objective

- To develop soft skill
- To understand research papers and prepare presentation material
- To improve oral communication skills through presentation
- To prepare original technical write up on the presentation

Methodology

- To choose the area of interest
- To identify current literatures
- To choose state of the art survey paper/research paper
- To consult and get confirmed with Seminar Coordinator (Faculty)
- To prepare the PPT
- To present as per schedule drawn by Seminar Coordinator
- To prepare a technical write up and submit to Seminar Coordinator

Outcome

- Improvement in proficiency in English
- Improvement in presentation skill
- Improvement in analytical and reasoning ability
- Improvement in technical writing

CS650: Internship*

Credit: 2

Objective

- To develop institute-industry interaction
- To know the industry practices
- To understand cutting edge technology in the chosen area

Methodology

- To identify industries offering internship by Training and Placement Office
- To identify industries offering internship by students in consultation with the Internship Coordinator (Faculty) and Training and Placement Office
- To avail during summer vacation (not more than 3 months)
- To submit a report based on the work done during internship to the Internship Coordinator

* Non-Industry Internship students will take up the internship with a faculty member

Outcome

- Exposure to industry practices
- Strengthened institute-industry relationship
- Bridging academic knowledge with industry input

Electives for First Semester

CS653: Advanced Network Principles and Protocols

Credit: 3

Objective

- Understand the architecture of the Internet protocols as a layered model
- To understand the fundamentals of data transmission, encoding and multiplexing
- To understand how the various components of wide area networks and local area networks work together

Unit-I

Introduction to Networks - Application of Networks - Architecture Topology Switching - SLIP, PPP -ALOHA protocols, CSMA/CD, IEEE 802.3, 802.4, 802.5

Unit-II

Network Layer Issues- Routing, Congestion control- Internetworking - Issues, Address Learning Bridges, Spanning tree, Source routing, Bridges, Routers, Gateway.

Unit-III

Network Protocol- IP datagram - hop by hop routing, ARP, RARP, DHCP -Sub net Addressing, Address Masking, ICMP, RIP, RIPV2, OSPF, DNS, LAN and WAN Multicast.

Unit-IV

Transport Layer- Design issues, Connection Management, Transmission Control Protocol (TCP) - User Datagram Protocol (UDP).

Unit-V

Application Layer Protocol- Telnet - TFTP - FTP - SMTP - Ping Finger, Bootstrap Network Time Protocol- SNMP.

Outcome

- Familiarization of the different layers of TCP/IP protocol stack
- Understanding of the working principle of different protocols at different layers

Text Books

1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th Edition, Pearson, 2011
2. William Stallings, "Data and Computer Communications”, 9th Edition, Pearson, 2011

Reference Book

1. W Richard Stevens and G. Gabrani, "TCP/IP Illustrated - Volume I, The protocols", Pearson Education, 2009

CS613: Design and Analysis of Parallel Algorithms

Credit: 3

Objective

- To learn about parallel computing models, design and analyze parallel algorithms for PRAM machines and Interconnection networks.

UNIT I

Structures and algorithms for array processors: SIMD Array Processors, Interconnection networks, Parallel algorithms for Array processors. Multiprocessor architecture- Interconnection networks-multiprocessor control and algorithms- parallel algorithms for multiprocessors.

UNIT II

Selection - broadcast- all sums- parallel selection. Searching a random sequence, sorted sequence on PRAM models, Tree and Mesh.

UNIT III

Merging - A network for merging - merging on PRAM models. Sorting on a linear array, EREW, CREW and CRCW SIMD models, MIMD Enumeration sort.

UNIT IV

Matrix operations- Transposition, Matrix by matrix multiplication, matrix by vector multiplication. Numerical problems- solving systems of linear equations, finding roots of non linear equations on PRAM models.

UNIT V

Graphs - Connected components- dense graphs- sparse graphs. Minimum spanning tree- Solli's algorithm, Biconnected components, Ear decomposition, Directed graphs.

Outcome:

- To enable the student to design and analyze parallel algorithms

Text book:

1. Kai Wang and Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1985.
2. S. G. Akl, "Designa and Analysis of Parallel Algorithms", Prentice Hall Inc., 1992.
3. Joseph Jaja, " An Introduction to parallel Algorithms", Addison Wesley, 1992.

CS655: Digital Forensics

Credit: 3

Objective

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.

Unit -I

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

Unit- II

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Unit-III

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Unit-IV

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

Unit-V

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Outcome

- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- To be well-trained as next-generation computer crime investigators.

Text Books:

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C**.**, **"**Guide to Computer Forensics and Investigations, 2nd **e**d**.**, Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

Reference Books:

1. Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

CS617: Principles of Cryptography

Credit: 3

Objective

- To gain knowledge about the mathematics of the cryptographic algorithms.
- To get an insight into the working of different existing cryptographic algorithms.
- To learn how to use cryptographic algorithms in security.

Unit-I

Algebra: Group, cyclic group, cyclic subgroup, field, probability. Number Theory: Fermat's theorem , Cauchy 's theorem, Chinese remainder theorem, primality testing algorithm, Euclid's algorithm for integers, quadratic residues, Legendre symbol, Jacobi symbol etc..

Unit-II

Cryptography and cryptanalysis, Classical Cryptography, substitution cipher, different type of attack: CMA,CPA,CCA etc, Shannon perfect secrecy, OTP, Pseudo random bit generators, stream ciphers and RC4.

Unit-III

Block ciphers: Modes of operation, DES and its variants, AES, linear and differential cryptanalysis.

Unit-IV

One-way function , trapdoor one-way function, Public key cryptography, RSA cryptosystem, Diffie-Hellman key exchange algorithm, Elgamal Cryptosystem.

Unit-V

Cryptographic hash functions, secure hash algorithm, Message authentication, digital signature, RSA digital signature, Elgamal digital signature.

Outcome

- Building a new unbreakable cryptosystem
- Blending the existing cryptographic algorithms with the existing communication protocols
- Analyzing and application of cryptography for secure eCommerce and other secret transactions

Textbook:

1. Stinson. D. Cryptography: Theory and Practice, third edition, Chapman & Hall/CRC, 2010.

Reference Books:

1. W. Stallings, Cryptography and Network Security Principles and practice, 5/e, Pearson Education Asia, 2012.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, second edition, Tata McGraw Hill, 2011
3. Thomas Koshy, Elementary Number Theory with applications, Elsevier India, 2005.

CS619: Computer Graphics and Image Processing

Credit: 3

Objective:

- To understand basic algorithms for computer graphics and image processing.
- To understand various filters, Point processing, and Arithmetic operations in image processing.
- To understand different applications of graphics and image processing.

UNIT I

Graphics Systems and Graphical User Interface: Pixel, Resolution, Video display devices - Types – Graphical devices – Direct screen interaction – Logical input function –GKS. User dialogue – Interactive picture construction techniques.

UNIT II

Geometric Display Primitives and Attributes: Geometric display primitives: Points, Lines and Polygons. Point display method – Line drawing: DDA 2D Transformations and Viewing: Transformations - types – matrix representation – Concatenation - Scaling, Rotation, Translation, Shearing, Mirroring. Homogeneous coordinates – Window to view port transformations. Windowing and Clipping: Point, Lines, Polygons - boundary intersection methods.

UNIT III

Digital Image Fundamentals: Image Formation and types – Basic geometric transformations – Fourier Transforms – Walsh – Hadamard – Discrete Cosine – Hotelling Transforms.

UNIT IV

Image Enhancement and Restoration: Histogram Modification Techniques – Image Smoothening – Image Sharpening – Image Restoration – Degradation Model – Noise Models – Spatial Filtering – Frequency Domain Filtering.

UNIT V

Image Segmentation and Recognition: Detection of Discontinuities – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Morphology operations. Pattern classification - Clustering and Matching - Knowledge representation and use for scene analysis and image understanding (2D and 3D) - Object recognition and identification – Case study of various applications.

Outcome

Students are able to develop software tools such as

- Games, Animation, and Recognition system

Text Book

1. Donald Hearn & M. Pauline Baker , and warren R. Carithers, "Computer Graphics", Prentice-Hall of India, Fourth edition 2011. (UNIT I & II)
2. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson Education, Third edition, 2011. (UNIT III, IV &V)

Reference Books

1. Newmann W.M. and Sproull R.F., "Principles of Interactive Computer Graphics", Tata McGraw-Hill, Second edition, 2008.
2. Foley J.D., Van Dam A, Fiener S.K. and Hughes J.F., "Computer Graphics", Second edition, Pearson education, 2008.
3. Anil Jain K, "Fundamentals of Digital Image Processing", Prentice-Hall of India, 2001.

CS621: Imaging and Multimedia Systems

Credit: 3

Objective

- To understand the basics of image processing and image security techniques
- To study various compression and file formats used in imaging and multimedia systems
- To analyze different media and design issues related to multimedia systems

Unit I Introduction

Introduction to Image Processing: Steps in Image Processing Systems –Image Acquisition – Sampling and Quantization – Pixel Relationships – Colour Fundamentals and Models.
Introduction to Multimedia: Multimedia Elements – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

Unit II Compression and File Formats

Compression and Decompression: Need for Data Compression – Types of Compression – Binary Image Compression Schemes – Image Compression – Video Compression – Audio Compression. Data and File Format Standards: Rich Text Format – TIFF File Format – Resource Interface File Format – MIDI File Format - JPEG DIB File Format – AVI Indeo File Format – MPEG Standards –TWAIN.

Unit III Image Computing and Security

Image computing: The basics of processing 2D images- Thresholding -Convolution-Edge detection-Mathematical Morphology and Shape Descriptors-Noise Reduction- Image Fusion. Image Security: Image Forensics - Steganography -Image Cryptography Techniques-Chaos based and Non-Chaos based methods.

Unit IV I/O Technologies

Input and Output Technologies: Multimedia I/O Technologies: Image Scanners – Digital Voice and Audio – Digital Camera – Video Images and Animation – Full Motion Video -Video Motion Analysis.

Unit V Application Design

Multimedia Application Classes – Types of Multimedia Systems – Virtual Reality – Components of Multimedia Systems -Multimedia Authoring Systems – Multimedia Authoring Tools - User Interface Design- Mobile Messaging – Hypermedia Message Components -Hypermedia Linking and embedding.

Outcome

- Technical know to develop new compression standards
- Acquire skill set to handle all multimedia components efficiently
- Develop Integrated and Collaborative multimedia systems

Text Books

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education, 2011.
2. Ralf Steinmetz, Klara Steinmetz, "Multimedia Computing, Communications & Applications", Pearson education, 2009.

References

1. A.K. Jain, Fundamentals of Digital Image Processing ,PHI, New Delhi, 2001.
2. William K Pratt, Digital Image Processing, John Willey , 2012.
3. Prabat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall India, 2007,New Delhi.
4. Tay Vaughan, "Multimedia Making It Work", McGraw Hill, 2011.
5. Parekh R "Principles of Multimedia" Tata McGraw-Hill, 2006.

CS623: Open Source Programming

Credit: 3

Objective

- To understand Open Source Programming concepts
- To build applications based on Open Source Softwares

UNIT I - INTRODUCTION

Introduction to open source programming languages, advantages and drawbacks of open source programming, threats and vulnerabilities in open source languages, Operating System – Ubuntu Linux – Introduction to shell programming.

UNIT II – PHP

PHP Language Basics, Functions - calling a function, variable function, and anonymous function, Strings - cleaning, encoding and escaping, and comparing strings, Arrays – storing data in arrays, extracting multiple values, traversing, and sorting arrays, Objects – creation, introspection, and serialization, Web Techniques – processing forms and maintaining state.

UNIT III – WEB DATABASE APPLICATIONS

Three-tier architecture, Introduction to Object oriented programming with PHP 5, Database basics, MYSQL - querying web databases, writing to web databases, validation with Javascript, Form based authentication, protecting data on the web.

UNIT IV – PERL, TCL, AND PYTHON

Numbers and Strings, Control Statements, Lists and Arrays, Files, Pattern matching, Hashes, Functions. Introduction to TCL/TK, Introduction to Python.

UNIT V – SECURITY IN WEB APPLICATIONS

Recognizing web application security threats, Code Grinder, Building functional and secure web applications, Security problems with Javascript, vulnerable GCI scripts, Code Auditing and Reverse Engineering, types of security used in applications.

Outcome

After successful completion of the course, students will be able to:

- develop codes in open source web applications
- understand the risks associated with the open source codes
- write secure CGI scripts

Text Book

1. Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, "Programming PHP", O'Reilly Media, 2012.
2. Michael Cross, "Developer's Guide to Web Application Security", Syngress Publishers, 2007.
3. Hugh E. Williams, David Lane, "Web Database applications with PHP and MYSQL", Second Edition, O'Reilly Media, 2004.

References

1. Tom Christiansen, Brian D Foy, Larry Wall, Jon Orwant, “Programming Perl”, Fourth Edition, O’Reilly Media, 2012.
2. Mark Lutz, “Programming Python”, Fourth Edition, O’Reilly Media, 2010.
3. Online Tutorials and Recent IEEE/ACM Journal Papers

Electives for Second Semester

CS612: Distributed Systems

Credit: 3

Objective

- To have a broad and up-to-date coverage of the principles and practice in the area of Distributed Systems.
- To understand the heterogeneous systems such as computers, mobile phones, other devices and Internet) and their functionalities.

UNIT I Basic Concepts

Definition of a distributed systems, Examples, Resource sharing and the Web, Challenges, System models, Architectural and fundamental models, Networking Interprocess communication, External data representation and marshalling, Client-server and Group communication.

UNIT II Distributed Objects and Process

Distributed objects and remote invocation, Communication between distributed objects, Remote procedure call, Events and notifications - The operating system layer, Protection, Processes and Threads, Communication and invocation, OS Architecture. Security techniques, Cryptographic algorithms, Access control, Digital signatures, Cryptography pragmatics, Needham-Schroeder, Kerberos, Securing electronics transaction, IEEE 802.11 WiFi.

UNIT III Operating System Issues

Distributed file systems - Name services, Domain name system, Directory and discovery services, Peer to peer systems, Napster file sharing system, Peer to peer middleware routing overlays – Clocks, Events and process states Clock Synchronization - Logical clocks Global states - Distributed debugging - Distributed mutual exclusion - Elections - Multicast communication.

UNIT IV Distributed Transaction Processing

Transactions - Nested transactions - Locks - Optimistic concurrency control - Timestamp ordering - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Overview of replication, Distributed shared memory and Web services.

UNIT V Distributed Algorithms

Synchronous network model - Algorithms: leader election, maximal independent set - Asynchronous system model: I/O automata, operations on automata, fairness - Asynchronous shared memory model - Mutual exclusion: model, the problem, stronger conditions, lockout-free mutual exclusion algorithms, lower bound on the number of registers - Asynchronous network model - Asynchronous network algorithms: leader election in a ring and an arbitrary network.

Outcome

- Developing skill set in developing a distributed system.
- Designing and evaluation of algorithms and protocols for various distributed systems.

Textbook

1. George Coulouris, Jean Dollimore, and Tim Kindberg, " Distributed Systems Concepts and Design", 5th ed., Pearson Education, 2011.
2. Andrew S. Tanenbaum, Maartenvan Steen, "Distributed Systems Principles and Paradigms", 2nd ed., Pearson Education, 2006.
3. Nancy A. Lynch, "Distributed Algorithms", Hardcourt Asia Pvt. Ltd., Morgan Kaufmann, 2000.

CS614: Wireless Sensor Networks

Credit: 3

Objective

- To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
- To study the various protocols at various layers and its differences with traditional protocols.
- To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Unit I

Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Unit II

Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

Unit III

MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

Unit IV

Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Unit V

QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Outcome

- Technical knowhow in building a WSN network.
- Analysis of various critical parameters in deploying a WSN

Text Book

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.

Reference Book

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education - 2004

CS616: Advanced Digital Design

Credit: 3

Objective

- To understand the basic building blocks, logic gates, adders, multipliers, shifters and other digital devices
- To apply logic minimization techniques, including Karnaugh Maps
- To learn techniques and tools for programmable logic design

Unit – I

Review of Combinational and Sequential logic design – Structural models of combinational logic – Propagation delay – Behavioral Modeling – Boolean equation based behavioral models of combinational logic – Cyclic behavioral model of flip-flop and latches – A comparison of styles for behavioral modeling – Design documentation with functions and tasks

Unit – II

Synthesis of Combinational and Sequential logic – Introduction to synthesis – Synthesis of combinational logic – Synthesis of sequential logic with latches – Synthesis of three-state devices and bus interfaces – Synthesis of sequential logic with flip-flops – Registered logic – State encoding – Synthesis of gated clocks and clock enables – Anticipating the results of synthesis – Resets – Synthesis of loops – Design traps to avoid – Divide and Conquer: partitioning a design.

Unit – III

Design and Synthesis of Datapath Controllers – Partitioned sequential machines – Design example: Binary counter – Design and synthesis of a RISC stored-program machine – Processor, ALU, Controller, Instruction Set, Controller Design and Program Execution – UART – Operation, Transmitter, Receiver.

Unit – IV

Programmable logic devices – Storage devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Programmability of PLDs – Complex PLDs – Introduction to Altera and Xilinx FPGAs – Algorithms – Nested loop programs and data flow graphs – Design Example of Pipelined Adder, Pipelined FIR Filter – Circular buffers – FIFOs and Synchronization across clock domains – Functional units for addition, subtraction, multiplication and division – Multiplication of signed binary numbers and fractions.

Unit – V

Postsynthesis Design Validation – Postsynthesis Timing Verification – Elimination of ASIC Timing Violations – False Paths – Dynamically Sensitized Paths – System Tasks for Timing Verificaion – Fault Simulation and Testing – Fault Simulation – Fault Simulation with Verifault-XL, lab exercises using Xilinx and Bluespec

Outcome

- Students understand the use standard digital memory devices as components in complex subsystems
- Technical knowhow to design simple combinational logic circuits and logic controllers
- Acquire skill set to develop the necessary software for basic digital systems

Text Book

1. Michael D. Ciletti, "Advanced Digital Design with the VERILOG HDL, 2nd Edition, Pearson Education, 2010.

Reference Books

1. Samir Palnitkar "Verilog HDL", 2nd Edition, Pearson Education, 2003.
2. Stephenbrown, "Fundamentals of Digital Logic with Verilog", McGraw-Hill-2007.

CS618: Real Time Systems

Credit: 3

Objectives

- To study issues related to the design and analysis of systems with real-time constraints.
- To learn the features of Real time OS.
- To study the various Uniprocessor and Multiprocessor scheduling mechanisms.
- To learn about various real time communication protocols.
- To study the difference between traditional and real time databases

UNIT I

Introduction to real time computing - Concepts; Example of real-time applications – Structure of a real time system – Characterization of real time systems and tasks - Hard and Soft timing constraints - Design Challenges - Performance metrics - Prediction of Execution Time : Source code analysis, Micro-architecture level analysis, Cache and pipeline issues- Programming Languages for Real-Time Systems

UNIT II

Real time OS – Threads and Tasks – Structure of Microkernel – Time services – Scheduling Mechanisms Communication and Synchronization – Event Notification and Software interrupt

UNIT III

Task assignment and Scheduling - Task allocation algorithms - Single-processor and Multiprocessor task scheduling - Clock-driven and priority-based scheduling algorithms- Fault tolerant scheduling

UNIT IV

Real Time Communication -Network topologies and architecture issues – protocols – contention based, token based, polled bus, deadline based protocol, Fault tolerant routing. RTP and RTCP.

UNIT V

Real time Databases – Transaction priorities – Concurrency control issues – Disk scheduling algorithms – Two phase approach to improve predictability.

Outcomes

- Knowledge about Schedulability analysis.
- Ability to learn Real-time programming environments.
- Knowledge about real time communication and databases.
- Ability to develop real time systems.

Text Book

1. C.M. Krishna, Kang G. Shin – " Real Time Systems", International Edition, McGraw Hill Companies, Inc., New York, 1997

Reference Books

1. Jane W.S. Liu, Real-Time Systems, Pearson Education India, 2000.
2. Philip A. Laplante and Seppo J. Ovaska, "Real-Time Systems Design and Analysis: Tools for the Practitioner'' IV Edition IEEE Press, Wiley. 2011

CS620: Mobile Network Systems

Credit: 3

Objective

- To understand the fundamentals of Mobile communication systems.
- To understand the different multiplexing scheme.
- To understand the significance of different layers in mobile system.

UNIT I - INTRODUCTION

Introduction to wireless, mobile and cellular mobile systems- cellular mobile telephone systems, analog and digital cellular systems- frequency reuse, co-channel interference.

UNIT II – MAC

Medium access control - MAC, SDMA, FDMA, TDMA, CDMA, Hand offs and dropped calls-initiation of handoff, power difference, mobile assisted cell-site and Intersystem handoff.

UNIT III – COMMUNICATION SYSTEMS

Mobile Telecommunication standards, GSM, DECT, TETRA, IMT-2000, CTEO, satellite systems – GEO, LEO and MEO, and broadcast systems –Digital audio and video broadcasting, IEEE 802.11, HIPERLAN, Bluetooth, Wireless ATM, WATM services.

UNIT IV – MOBILE NETWORK LAYER

Network support for mobile systems – Mobile IP- IP packet delivery- Agent discovery-tunneling and encapsulation, reverse tunneling, IPV6, DHCP.

UNIT V – MOBILE TRANSPORT LAYER

Mobile transport and application layer protocol - Review of traditional TCP, fast retransmit/fast recovery, transmission/timeout freezing, file systems, WWW, WAP.

Outcome

- Understand the concepts of mobile and wireless communications.
- Apply the knowledge gained in exploring, application and protocol development.

Text Book

1. Jochen Sciiiller, "Mobile Communications ", Pearson Education India, 2009.

Reference Book

1. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, 2/e, Pearson Education, 2010.
2. William C.Y Lee, "Mobile Cellular Telecommunications ", McGraw Hill International Editions, 1995.

CS652: Network Security

Credit: 3

Objective

- To understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite.
- To comprehend and apply authentication services, authentication algorithms
- To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.
- To understand the wireless network security threats.

Unit -I

Overview of Network Security, Security services, attacks, Security Issues in TCP/IP suite-Sniffing, spoofing, buffer overflow, ARP poisoning, ICMP Exploits, IP address spoofing, IP fragment attack, routing exploits, UDP exploits, TCP exploits.

Unit-II

Authentication requirements, Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - RIPEMD - HMAC Digital Signatures, Authentication protocols-Kerberos, X.509.

Unit-III

IP Security-AH and ESP, SSL/TLS, SSH, Web Security-HTTPS, DNS Security, Electronic Mail Security (PGP, S/MIME).

Unit-IV

Intruders, Viruses, Worms, Trojan horses, Distributed Denial-Of-Service (DDoS), Firewalls, IDS, Honey nets, Honey pots.

Unit-V

Introduction to wireless network security, Risks and Threats of Wireless networks, Wireless LAN Security (WEP, WPA).

Outcome

- Be able to determine appropriate mechanisms for protecting the network.
- Design a security solution for a given application, system with respect to security of the system

Text Books:

1. Yang Xiao and Yi Pan, "Security in Distributed and Networking Systems", World Scientific, 2007, Chapter 1.
2. W. Stallings, "Cryptography and Network Security: Principles and Practice", 5/E, Prentice Hall, 2013.
3. Aaron E. Earle, "Wireless Security Handbook", Auerbach publications, Taylor & Francis Group, 2006.

Reference Books:

1. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.

CS624: Data Warehousing and Data Mining

Credit: 3

Objective

- To understand the principles of Data warehousing and Data Mining.
- To be familiar with the Data warehouse architecture and its Implementation.
- To know the Architecture of a Data Mining system.
- To understand the various Data preprocessing Methods.
- To perform classification and prediction of data.

UNIT I

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT II

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT III

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT IV

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

UNIT V

Mining Object, Spatial, Multimedia, Text and Web Data:

Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Outcome

- Technical knowhow of the Data Mining principles and techniques for real time applications.

Text Book

1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.

Reference Books

1 Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.

2 K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

3 G. K. Gupta “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.

4 Pang-Ning Tan, Michael Steinbach and Vipin Kumar “Introduction to Data Mining”, Pearson Education, 2007.

CS626: Cloud Computing

Credit: 3

Objectives

- To define Cloud Computing
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to the frontier areas of Cloud Computing
- To motivate students to do programming and experiment with the various cloud computing environments
- To shed light on the Security issues in Cloud Computing
- To introduce about the Cloud Standards

UNIT I

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

UNIT II

Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs .

UNIT III

Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).

UNIT IV

Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment.

UNIT V

Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.

Outcomes

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Explain the core issues of cloud computing such as security, privacy, and interoperability.

- Provide the appropriate cloud computing solutions and recommendations according to the applications used.
- Collaboratively research and write a research paper, and present the research online.

Text Book

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012

Reference Books

1. Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009