



MASTER OF COMPUTER APPLICATIONS

RULES AND REGULATIONS
SCHEME OF INSTRUCTION AND SYLLABI
of
B.Tech. Programs

NATIONAL INSTITUTE OF TECHNOLOGY

WARANGAL 506 004

MASTER OF COMPUTER APPLICATIONS**COURSE STRUCTURE****I Year I Semester**

S. No.	Course No.	Course Name	(L - T - P)	C
1.	MA5011	Probability Statistics and Queuing Theory	(4 - 0 - 0)	4
2.	SM5301	Managerial Economics	(4 - 0 - 0)	4
3.	CS5301	Mathematical Logic Combinatorics and Graph Theory	(4 - 0 - 0)	4
4.	CS5302	Computer Organization	(4 - 0 - 0)	4
5.	CS5303	Problem Solving and Programming	(4 - 0 - 0)	4
6.	CS5304	Problem Solving and Programming Laboratory	(0 - 0 - 3)	2
7.	CS5305	Free and Open Software Systems Laboratory	(0 - 0 - 3)	2
Total			20 - 0 - 6	24

I Year II Semester

S. No.	Course No.	Course Name	(L - T - P)	C
1	SM5351	Accounting and Financial Management	(3 - 0 - 0)	3
2	CS5351	Introduction to Data Structures	(4 - 0 - 0)	4
3	CS5352	System Software	(4 - 0 - 0)	4
4	CS5353	Object Oriented Programming	(4 - 0 - 0)	4
5	CS5354	Algorithm Analysis and Design	(3 - 0 - 0)	3
6	CS5355	Data Structures Laboratory	(0 - 0 - 3)	2
7	CS5356	System Software Laboratory	(0 - 0 - 3)	2
8	CS5357	Object Oriented Programming Laboratory	(0 - 0 - 3)	2
Total			18 - 0 - 9	24

II Year I Semester

S. No.	Course No.	Course Name	(L - T - P)	C
1	CS6301	Operating System Concepts	(4 - 0 - 0)	4
2	CS6302	Principles of Database Systems	(4 - 0 - 0)	4
3	CS6303	Web Technologies	(4 - 0 - 0)	4
4	CS6304	Database Systems Laboratory	(0 - 0 - 3)	2
5	CS6305	Web Technologies Laboratory	(0 - 0 - 3)	2
6	CS6306	Operating Systems Tools Laboratory	(0 - 0 - 3)	2
7		Elective - 1	(3 - 0 - 0)	3
8		Elective - 2	(3 - 0 - 0)	3
Total			18 - 0 - 9	24

II Year I Semester

S. No.	Course No.	Course Name	(L - T - P)	C
1	CS6351	Principles of Data Warehousing and Data Mining	(4 - 0 - 0)	4
2	CS6352	Computer Communications and Networking	(4 - 0 - 0)	4
3	CS6353	Software Engineering Principles	(4 - 0 - 0)	4
4	CS6354	Knowledge Engineering Laboratory	(0 - 0 - 3)	2
5	CS6355	Computer Communications and Networking Laboratory	(0 - 0 - 3)	2
6	CS6356	Software Engineering Tools Lab	(0 - 0 - 3)	2
7		Elective - 3	(3 - 0 - 0)	3
8		Elective - 4	(3 - 0 - 0)	3
Total			18 - 0 - 9	24

III Year I Semester

S. No.	Course No.	Course Name	(L - T - P)	C
1	CS7301	Network Programming and Security	(4 - 0 - 0)	4
2	CS7302	Ubiquitous Computing	(3 - 0 - 0)	3
3	CS7303	Software Testing Techniques	(3 - 0 - 0)	3
4	CS7304	Network Programming and Security Laboratory	(0 - 0 - 3)	2
5	CS7305	Software Testing Laboratory	(0 - 0 - 3)	2
6	CS7341	Seminar	(0 - 0 - 3)	2
7	CS7342	Comprehensive Viva-voce	(0 - 0 - 0)	2
8		Elective - 5	(3 - 0 - 0)	3
9		Elective - 6	(3 - 0 - 0)	3
Total			16 - 0 - 9	24

III Year II Semester

S. No.	Course No.	Course Name	(L - T - P)	C
1.	CS7399	Project Work	24 weeks	20
Total				20
Grand Total of credits				140

LIST OF ELECTIVES

CS6311	Information Systems Management
CS6312	Organizational Structures and Personal Management
CS6313	Computer Graphics
CS6321	E-Commerce Technologies and Management
CS6322	Multimedia Systems
CS6323	Advanced Data Structures
CS6361	Neural Networks
CS6362	Object Oriented Analysis and Design
CS6363	Modeling and Simulation
CS6364	Information Security
CS6371	Distributed Operating Systems
CS6372	Image Processing
CS6373	Parallel Computing
CS6374	Protocol Engineering
CS7311	Middleware Technologies
CS7312	Cloud Computing
CS7313	Performance Evaluation of Computer Systems and Networks
CS7314	Service Oriented Architecture
CS7321	Design Patterns and Software Architecture
CS7322	Advanced Database Systems
CS7323	Sensor Networks
CS7324	ERP and Supply Chain Management

Syllabus**MASTER OF COMPUTER APPLICATIONS**

CS5301 **MATHEMATICAL LOGIC COMBINATORICS AND GRAPH THEORY** (4-0-0) 4

Sets, Relations, Functions - Fundamentals of Logic - Quantified propositions - mathematical Induction - Combinations and Permutations - Enumerations - Recurrence Relations - Generating Functions - Binary Relations - Lattices - Directed Graphs - Graphs - Spanning Trees - Planar Graphs - Euler Circuits - Hamiltonian Graphs.

Reading:

1. Mott, Kandel, Baker, *Discrete Mathematics for Computer Scientists and Mathematicians*, 2nd Edition, PHI, 2001.
2. John Harris, Jeffry L. Hirst and Michael Mossinghoff, *Combinatorics and Graph Theory*, 2nd Edition, Springer, 2010.

CS5302 **COMPUTER ORGANIZATION** (4-0-0) 4

Basic Structure - Functional units - Bus structure - Addressing Methods - Machine program Sequence - 68000 example - Instructions - Assembly language program - Flow Control - Power PC example - Processing Unit - Hardwired control - Micro programmed Control - Memory - Performance Considerations - Arithmetic and Branching Conditions - Computer Peripherals.

Reading:

1. Hamacher, Vranesic, Zaky, *Computer Organization*, 5th Edition, MGH, 2002.
2. William Stallings, *Computer Organization and Architecture Designing for Performance*, 8th Edition, Pearson Education, 2010.

CS5303 **PROBLEM SOLVING AND PROGRAMMING** (4-0-0) 4

Problem Solving - Algorithm - Procedural Abstraction - Functions - Parameter Passing - Recursion- Structures - Classes - Arrays - Pointers - Inheritance - polymorphism - Overloading - Templates.

Reading:

1. Walter Savitch, *Problem Solving with C++*, 2nd Edition, Pearson, 2002.
2. Cay Horstmann, Timothy Budd, *Big C++*, Wiley, Indian Edition, 2006.

CS5304 **PROBLEM SOLVING AND PROGRAMMING LABORATORY** (0-0-3) 2

Familiarization - Editing - Expressions - Series Evaluation - Functions - Recursion - Arrays - Pointers - Structures - Classes - Inheritance - polymorphism - Overloading - Templates.

CS5305 **FREE AND OPEN SOURCE SYSTEMS LABORATORY** (0-0-3) 2

Linux-Globus/PGSA - Open Office - GIMP - Apache AIX - Open LDAP - Apache - MySQL - Open CMS - CVS.

CS5351 **INTRODUCTION TO DATA STRUCTURES** (4-0-0) 4

Order Lists-Stacks-Queues - Trees - Search Trees - BST, AVL - Hashing - Hash Tables - Priority Queues - Sorting - Internal, External - Disjoint Sets - Graph Algorithms - Shortest Paths - Spanning Trees.

Reading:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, 2nd Edition, Pearson, 2004.
2. Sartaj Sahni, *Data Structures, Algorithms and Applications in C++*, 2nd Edition, University Press, 2005.

CS5352	SYSTEM SOFTWARE	(4-0-0) 4
PC Hardware - Assembly Language Basics - Program Logic and Control - Keyboard and Screen Processing - Macro working and Linking - Advanced Screen and Keyboard Processing - Disk Processing - DOS Memory Management - Assemblers - Macro processors - Linkers - Loaders.		
<i>Reading:</i>		
1. Peter Abel, <i>IBM PC Assembly Language and Programming</i> , 5th Edition, Pearson Education, 2003.		
2. Sivarama P. Dandamudi, <i>Introduction to Assembly Language Programming</i> , 1st Edition, Springer, 2003.		
CS5353	OBJECT ORIENTED PROGRAMMING	(4-0-0) 4
Object Oriented Thinking - Messages and Methods - OO Design - Software Components - Design Paradigms - Inheritance - Mechanisms for software reuse - Polymorphism - AWT Classes - Input output Streams - Design Patterns - Exception handling.		
<i>Reading:</i>		
1. Timothy Budd, <i>Understanding Object Oriented Programming with Java</i> , Pearson Education, 1999.		
2. Herbert Schildt, <i>Java 2 Complete Reference</i> , 5th Edition, TMH, 2010.		
CS5354	ALGORITHM ANALYSIS AND DESIGN	(3-0-0) 3
Algorithm Analysis - Asymptotic notation- Greedy method - Divide and conquer - Dynamic programming - example problems in each case of design methods - Sorting Algorithms - Graph Algorithms - Shortest path, search algorithms, Minimum spanning tree - Strings and Pattern matching Algorithms - Backtracking, and Branch and Bound methods - P, NP, NP - hard, NP-complete classes.		
<i>Reading:</i>		
1. M T Goodrich, Roberto Tamassia, <i>Algorithm Design</i> , John Wiley & Sons, 2001		
2. Horowitz, Sartaj Sahni, S Rajasekaran, <i>Computer Algorithms</i> , 2nd Edition, Silicon Pr., 2007		
CS5355	DATA STRUCTURES LABORATORY	(0-0-3) 2
Implementation of ordered lists - Generic Queues - conversion of expressions, evaluation, expression trees - Search Trees - BST - AVL Trees - Splaying - Sorting algorithms - Graph traversals - Shortest paths - Spanning Trees.		
CS5356	SYSTEM SOFTWARE LABORATORY	(0-0-3) 2
Fixed Point Arithmetic - Text Processing - Keyboard and screen processing - Macro writing - Disk Processing - Memory Resident Programs - DOS file Management - Copy Protection schemes - Implementation of a simple editor - Construction of Assemblers, Macro processors - Adding Syntax directed facilities to an editor		
CS5357	OBJECT ORIENTED PROGRAMMING LABORATORY	(0-0-3) 2
CRC Case studies - Inheritance - Implementation of graphical Programs Using Java AWT classes - Exception Handling in Java.		
CS6301	OPERATING SYSTEMS CONCEPTS	(4-0-0) 4
Batch, iterative, time sharing and real-time systems - Operating system structure - Concurrent processes - Synchronization - CPU scheduling - Deadlocks - Memory management - Virtual memory - Secondary storage management - File systems - I/O systems - Mass-storage structure - Protection - Security.		
<i>Reading:</i>		
1. A. Silberschatz, Galvin, Gagne, <i>Operating System Concepts</i> , 8th Edition. John Wiley & Sons, 2009		
2. Andrew S Tanenbaum, <i>Modern Operating Systems</i> , 3rd Edition, Pearson Education, 2007		
CS6302	PRINCIPLES OF DATABASE SYSTEMS	(4-0-0) 4
Entity Relationship model, Relational model - structure and operations, query languages - relational algebra - relational calculus - Mapping ER model to relation form. Features of SQL. Functional Dependencies - normalization process. Multi valued dependencies. Query optimization Transaction processing concepts. Concurrency Control and recovery. Security and Authorization.		

Reading:

1. Elamsri, Navathe, Somayajulu and Gupta, *Database Concepts*, Pearson Edition, 2006
2. Adhsakkdi Y Raghuram Krishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, TMH, 2007.

CS6303 **WEB TECHNOLOGIES** (4-0-0) 4

Creating home pages -Dynamic HTML - JavaScript - Cascading Style Sheets - Including Multimedia - Web Servers-PHP: String Processing and Regular Expressions, Form Processing and Business Logic, Dynamic Content - Database Connectivity - Applets and Servlets- JDBC Connectivity - JSP and Web development.

Reading:

1. Deitel, Deitel & Nieto, *Internet and Worldwide Web - How to Program*, 5th Edition, PHI, 2011.
2. Bai and Ekedhi, *The Web Warrior Guide to Web Programming*, 3rd Edition, Thomson, 2008.

CS6304 **DATABASE SYSTEMS LABORATORY** (0-0-3) 2

Familiarization of Oracle RDBMS. Features of SQL*Plus. Design and development database using Oracle, implementation of application with GUI. Implementation of relational operators using C/C++. DSL. Front end development. Case study/project.

CS6305 **WEB DESIGN LABORATORY** (0-0-3) 2

Creating home pages - Online shopping - online examination - chat system - mailing system.

CS6306 **OPERATING SYSTEMS TOOLS LABORATORY** (0-0-3) 2

Study of race conditions - Use of semaphores to solve concurrency problems - Implementation of critical region construct, monitor - Comparison of different scheduling algorithms - Implementation of Dekker's algorithm - Implementation of memory manager.

CS6351 **PRINCIPLES OF DATA WAREHOUSING AND DATA MINING** (4-0-0) 4

Data Warehouse vs Databases - KDD Process - Data preprocessing - Data Warehousing and OLAP technologies - Multi Dimensional modeling, data warehouse architecture - Data Mining techniques - Association, Classification, Clustering, Sequential Patterns.

Reading:

1. Jiawei Han and Kamber, M, *Data Mining Concepts and Techniques*, 2nd Edition, Elsevier Publications, 2006.
2. Vipinkumar, Michael Steinbach, *Introduction to Data Mining*, 1st Edition, Addison-Wesley, 2006.

CS6352 **COMPUTER COMMUNICATION AND NETWORKING** (4-0-0) 4

Network structures - Network Architecture - OSI model - LAN protocols - IEEE standard 802 - Ethernet - Token Bus and Token Ring - Error Detection and Correction - Sliding Window protocols - Routing algorithms - Congestion control algorithms - Internetworking - Network Layer in Internet IP - Transport Layer in Internet - UDP, TCP - Remote Procedure Call - Implementation and semantics of RPC - E-mail Protocol and File Transfer Protocol.

Reading:

1. A. S Tanenbaum, *Computer Networks*, 4th Edition, PHI, 2003.
2. Larry L Peterson, Bruce S Davis, *Computer Networks*, 5th Edition, Elsevier, 2012.

CS6353 **SOFTWARE ENGINEERING PRINCIPLES** (4-0-0) 4

The Software Process - Requirements, Specification, Design, Implementation and Maintenance - Cohesion - Data Encapsulation - Reusability - Software Life Cycle - Use-case modeling - Data flow Analysis - Transaction Analysis - 4GL - Coding Standards - Module reuse - Module Testing - CASE tools for integration and Complete Software Process.

Reading:

1. Stephen R Schach, *Object Oriented and Classical Software Engineering*, 5th Edition, TMH, 2010.
2. Ian Sommerville, *Software Engineering*, 9th Edition, Pearson, 2010.

CS6354 **KNOWLEDGE ENGINEERING LABORATORY** (0-0-3) 2

This laboratory provides hands on exposure on building of warehouse, analyzing the data using OLAP tools, and implementation of mining techniques using mining tools like SPSS, Weka etc.

CS6355 **COMPUTER COMMUNICATION AND NETWORKING LABORATORY** (0-0-3) 2

Error Correction and Detection - IP address Conversion functions - Client Server example using Pipes, FIFOs, Message Queues, Shared Memory - Connection Oriented Client Server with TCP - Connectionless Client Server with UDP - Concurrent Server - Multi-protocol Server - Internet Super Server - Chat Server - Mail Server.

CS6356 **SOFTWARE ENGINEERING TOOLS LABORATORY** (0-0-3) 2

Problem Analysis and Project Planning - Software Requirement Analysis - Modeling - Software Developments and Debugging - Software Testing.

CS7301 **NETWORK PROGRAMMING AND SECURITY** (4-0-0) 4

Network programming - communication protocols - OSI protocols - Protocol comparisons - Sockets - Socket Programming - Security - Attacks - Encryption - Encryption Algorithms - Data Encryption - Public key - RSA Algorithm - Diffie-Hellman Key Exchange - Key management.

Reading:

1. Richard Stevens, *Unix Network Programming*, PHI 2001.
2. William Stallings, *Cryptography and Network Security: The Principles and Practice*, 2nd Edition, Pearson, 2007.

CS7302 **UBIQUITOUS COMPUTING** (3-0-0) 3

Elements of Ubiquitous computing - Architecture - New devices - Overview of Mobile Technologies - Anatomy of a Mobile Device - Application Design Elements - Mobile Web - Development Environments - Objective-C - The Model-View-Controller Model - The Delegate Pattern - The HTML5, iPhone, Android, and Blackberry SDKs- iOS - Windows Mobile - Cellular networks - Wireless (802.11) - TCP/IP in the mobile setting- The iPhone Human Interface Guidelines - Common User Interface Guidelines - Distributed Computing - Security Issues - Upcoming Technologies - Convergence of Media and Communication Devices.

Reading:

1. Stefan Poslad, *Ubiquitous Computing: Smart Devices, Environment and Interactions*, John Wiley & Sons, 2009.
2. Frank Adelstein, Sandeep K S Gupta, Golden G Richard III and Loren Schwiebert, *Fundamentals of Mobile and Pervasive Computing*, MGH, 2005.
3. T. Mikkonen, *Programming Mobile Devices: An Introduction for Practitioners*, Wiley, 2007.
4. S. Hashimi, S. Komatineni, D. MacLean, *Pro Android 2*, Apress, 2010.

CS7303 **SOFTWARE TESTING TECHNIQUES** (3-0-0) 3

Introduction, Flow graphs and Path testing, Transaction Flow Testing, Dataflow testing, Domain Testing, Paths, Path products and Regular expressions, Logic Based Testing, Specifications, State, State Graphs and Transition testing ,Graph Matrices and Application.

Reading:

1. Baris Beizer, *Software Testing Techniques*, 2nd Edition, Dreamtech, 1990.
2. Perry, *Effective Methods of Software Testing*, John Wiley, 2006.

CS7304	NETWORK SECURITY LABORATORY	(0-0-3) 2
Advanced Socket I/O Functions - Asynchronous I/O - Passing File Descriptors - Routing Algorithms - IP Spoofing - IP Tunneling - Email Gateways - Protocol Conversions - Policy Control Table		
CS7305	SOFTWARE TESTING LABORATORY	(0-0-3) 2
Case studies on Different Testing Tools - Simulate Verification and Validation Environment - Implementing the structured system Techniques - Simulate a software testing Suite which performs the functionalities of different Phase testing of SDLC - Using of Testing Tools to carry out the Functional Testing, Load/Stress Testing - Using any automated testing Tools to Automate Testing Using of Open Source Testing Tools for databases, Web applications and Networks etc.		
CS6311	INFORMATION SYSTEMS MANAGEMENT	(3-0-0) 3
Organization and Information Systems- Kinds of information systems- System Analysis and Development and Models- Manufacturing and Service Systems Information systems- Enterprise System Enterprise Resources Planning- Choice of IT Nature of IT decision- Security and Ethical Challenges Ethical responsibilities of Business Professionals.		
<i>Reading:</i>		
1. Kenneth J Laudon, Jane P.Laudon, <i>Management Information Systems</i> , 10th Edition, Pearson/PHI, 2007.		
2. W. S. Jawadekar, <i>Management Information Systems</i> , 3rd Edition, TMH, 2004.		
CS6312	ORGANIZATIONAL STRUCTURES AND PERSONAL MANAGEMENT	(3-0-0) 3
Management - Functions - Principles - Organization Concept - Planning Process - Decision Making - Communication - Information flows - Reporting - Dynamics of Organizational behavior - Theories of Motivation - Management Models - Prediction monitoring and Control		
<i>Reading:</i>		
1. Koontz Harold, Weihrich Heinz, <i>Essentials of Management</i> , 7th Edition, TMH, 2008.		
2. Martand T Telsang, <i>Industrial Business Management</i> , 1st Edition, S. Chand, 2002.		
CS6313	COMPUTER GRAPHICS	(3-0-0) 3
Overview of Graphics Systems - Output Primitives - Attributes - Two-dimensional Geometric Transformations - Viewing - Modeling - GUI - Three-dimensional Concepts - Representations - Transformations - Viewing - Visible Surface Detection Methods - Multimedia Systems - Media and Data Streams - Multimedia OS - Synchronization - Abstractions for Programming - Applications.		
<i>Reading:</i>		
1. Hearn, Baker, <i>Computer Graphics - C Version</i> , 2nd Edition, Pearson, 1997.		
2. David F Rogers, J Alan Adams, <i>Mathematical Elements for Computer Graphics</i> , 2nd Edition, TMH, 2002.		
CS6321	E-COMMERCE TECHNOLOGIES AND MANAGEMENT	(3-0-0) 3
Overview - E-commerce Infrastructure - Wireless Technology - Web Architecture - Data interchange - Web content delivery - Access Security - Public Key Encryption - Electronic Payment System - Mass Personalization - Search Engines - Data Mining and Privacy - Intelligent Agents - Auction Models.		
<i>Reading:</i>		
1. Kenneth C Loudon, <i>E-Commerce: Business, Technology, Society</i> , 7th Edition, PHI, 2011.		
2. Turban, <i>Electronic Commerce 2010: A Managerial Perspective</i> , 6th Edition, Pearson, 2010.		
CS6322	MULTIMEDIA SYSTEMS	(3-0-0) 3
Multimedia Systems - Media and Data Streams - Multimedia OS - Synchronization - Abstractions for Programming - Applications.		

Reading:

1. Ralf Steinmetz and Klara Nahrstedt, *Multimedia: Computing, Communications and Applications*, PH, 1995.
2. Ashok Banerji and Ananda Ghosh, *Multimedia Technologies*, 1st Edition, TMH, 2009.

CS6323

ADVANCED DATA STRUCTURES

(3-0-0) 3

Height Balanced Trees - Priority Queues - Amortized Analysis - Binomial Queues - Top down Splay Trees - Red-black Trees - Skip Lists -overview of greedy, divide and conquer, dynamic programming methods, sorting, graph algorithms - Algorithms for parallel computers - Number theory and cryptographic algorithms - String matching - Network flow and routing Algorithms - Internet Algorithms.

Reading:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, *Algorithm Design.*, John Wiley, 2002.

CS6361

NEURAL NETWORKS

(3-0-0) 3

Introduction - Learning processes - Single layer perceptron. - Multi layer perceptron - Radial basis function networks - Principle component analysis - Self organizing maps - Neurodynamics.

Reading:

1. Simon Haykin, *Neural Networks: A Comprehensive Foundation*, 3rd Edition, Pearson Education, 2008.
2. Satish Kumar, *Neural Networks: A Class Room Approach*, 3rd Edition, TMH, 2007.

CS6362

OBJECT ORIENTED ANALYSIS AND DESIGN

(3-0-0) 3

Object model - Classification - Class Diagrams - Process Diagrams - Management and Planning - Quality Assurance and Metrics - Benefits and Risks of Object Oriented Design - Applications - Client Server Computing.

Reading:

1. Grady Booch, *Object Oriented Analysis and Design*, 3rd Edition, Pearson, 2009.
2. Deacon, *Object Oriented Analysis and Design*, 1st Edition, Pearson, 2009.

CS6363

MODELING AND SIMULATION

(3-0-0) 3

Probability theory - Discrete and continuous random variables and distributions - Poisson process - Markov chains - Stochastic process - Building blocks of Simulation - Analysis of Simulation results.

Reading:

1. Sheldon M. Ross, *Introduction to Probability Models*, 7th Edition, Academic Press, 2002
2. Donald E. Knuth, *The Art of Computer Programming - Volume 2: Semi Numerical Algorithms*, 2nd Edition, Addison Wesley, Reading MA, USA 2000.
3. Louis G Birta and Gilbert Arbez, *Modelling and Simulation: Exploring Dynamic System Behavior*, Springer Publishers, 2010.

CS6364

INFORMATION SECURITY

(3-0-0) 3

Information Security-Security Problems in Databases - Security Controls - Database Security - Security Models - Secure DBMS Design - Design of Secure Databases - Statistical Database Security - Intrusion Detection - Expert systems-based approach - MIDAS - Security Models for next generation Databases - SORION Model.

Reading:

1. Silvana Castano, *Database Security*, Addison Wesley and ACM, 1995.
2. Merkov, *Information Security: Principles and Practices*, 1st Edition, Pearson, 2007.

CS6371 **DISTRIBUTED OPERATING SYSTEMS** (3-0-0) 3

Introduction to distributed systems - Communication models in distributed systems - Synchronization - Processor allocation - Scheduling algorithms - Distributed file systems - Distributed shared memory - Case Studies of Distributed systems.

Reading:

1. Andrew S. Tanenbaum, *Distributed Operating Systems*, 2nd Edition, Pearson Education Asia Publishers, 2002.
2. Ajay D. Kshemakalyani, Mukesh Singhal, *Distributed Computing*, Cambridge University Press, 2008

CS6372 **IMAGE PROCESSING** (3-0-0) 3

Introduction to Image Processing, Image Processing Applications, Image Representation and Modeling, Image Acquisition, Image Enhancement, Image Filtering, Edge Detection, Segmentation, Image Compression, different Image Transformations, Object recognition, Color Image Processing, Wavelets, Texture, Feature Extraction.

Reading:

1. Gonzalez and Woods, *Digital Image Processing*, 3rd Edition, Prentice Hall, 2007.
2. M Sonka et. al., *Image Processing: Analysis and Machine Vision*, 3rd Edition, Cole Pub. Co., 2008

CS6373 **PARALLEL COMPUTING** (3-0-0) 3

Parallel Programming plat forms - Parallel Algorithm - Basic Communication Operations - Analytical Modeling of Parallel Programs - Programming using MPI - Matrix, graph and sorting algorithms.

Reading:

1. Ananth Grama, Anshul Gupta and Vipin Kumar, *Introduction to Parallel Computing*, 2nd Edition, Pearson Edition 2009.
2. Michael J Quinn, *Parallel Computing Theory and Practice*, 2nd Edition, TMH, 2002.

CS6374 **PROTOCOL ENGINEERING** (3-0-0) 3

Principles of communication protocols - services - protocols - layers -layered architectures - protocol functions - case study - the internet protocol stack - description of communication protocols - formal description techniques - development of communication protocols - protocol development process - verification - performance evaluation-implementation - testing.

Reading:

1. Konig, Hartmut, *Protocol Engineering*, Springer Publishers, 2012.
2. Pallapa Venkataram and Sunil Kumar S, *Communication Protocol Engineering*, 1st Edition, PHI, 2004.

CS7311 **MIDDLEWARE TECHNOLOGIES** (3-0-0) 3

Introduction to client/server computing - Introducing DCOM, CORBA, .NET Technologies - Developing Applications using C# and JAVA - JAVA Bean Component Model and EJB.

Reading:

1. Robert Orfali and Dan Harkey, *Client/Server Programming with Java and CORBA*, 2nd Edition, John Wiley , SPD, 1998
2. Robert J Oberg, *Introduction to C# Using.NET*, Pearson Education PH 2002.

CS7312 **CLOUD COMPUTING** (3-0-0) 3

Introduction to cloud computing-cloud provider-Cloud computing platforms-different cloud technologies-web services, AJAX- Databases in cloud-MAP reduce extensions-Cloud computing and security architecture-Implementing real time issues on cloud platform.

Reading:

1. Anothony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, MGH, 2010.
2. Gautam Shroff, *Enterprise Cloud Computing*, Cambridge, 2010.
3. Ronald Krutz and Russell Dean Vines, *Cloud Security*, 1st Edition, Wiley, 2010.

CS7313 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS (3-0-0) 3

An overview of performance evaluation, Types of workloads and workload election, Work load characterization, Monitors and program execution, Benchmarking and data presentation, Ratio Games, Probability theory and statistics, Bounds on Performance, Analysis of a single queue, Queuing networks, Mean-value analysis, Convolution algorithm, Hierarchical decomposition, Factorial design, Factorial designs with replication, One-factor experiments, Two-factor factorial design, Two-factor factorial design with replications, General full factorial designs, Simulation and analysis of results, Random number generation, Random variate generation.

Reading:

1. Raj Jain, *The Art of Computer Systems Performance Analysis*, John Wiley & Sons, 1991.
2. E.D. Lazowska, J. Zahorjan, G.S. Graham and K.C Sevcik, *Quantitative System Performance*, Prentice Hall, 1984.

CS7314 SERVICE ORIENTED ARCHITECTURE (3-0-0) 3

SOA Fundamentals - SOA Planning and Analysis - SOA Design and implementation - Managing SOA Environment - SOA Security.

Reading:

1. Thomas Erl, *Service-Oriented Architecture: Concepts, Technology, and Design*, Prentice Hall, 2005.
2. Michael Rosen, Boris Lublinsky, *Applied SOA Service Oriented Architecture and Design Strategies*, Wiley India Ed., 2008.

CS7321 DESIGN PATTERNS AND SOFTWARE ARCHITECTURE (3-0-0) 3

Introduction to Patterns and UML, Software Design Patterns From GoF, Creational Patterns, Structural Patterns, Behavioral Patterns, Software Architectural Patterns, Layer, Pipe and Filters and Black Board, Broker, Reflection and Microkernel.

Reading:

1. Erich Gamma, *Design Patterns*, Addison-Wesley, 1994.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, *Pattern-Oriented Software Architecture: A System of Pattern*, John Wiley & Sons, 1996.

CS7322 ADVANCED DATABASE SYSTEMS (3-0-0) 3

Distributed Databases: Query processing - query optimization - Concurrency control, Heterogeneity issues. Advanced Transaction Models: Save-points, Sagas, Nested Transactions, Multi Level Transactions. Recovery: Multi-level recovery, Shared disk systems, Distributed systems 2PC, 3PC, replication and hot spares. Recursive query processing: Top-down and bottom-up evaluation, Magic optimization. Parallel Databases: Parallel Architectures, performance measures, Data partitioning, Intra-operator parallelism, Pipelining, Scheduling, Load balancing, query optimization.

Readings:

1. M. Stonebraker, *Readings in Database Systems*, 2/e, Morgan Kauffman, 1993.
2. M T Ozsu, Patrick Valduriez, *Principles of Distributed Database Systems*, Prentice Hall, 1999.
3. S. Ceri and G. Pelagatti, *Distributed Database System Principles and Systems*, MGH, 1985.

CS7323 SENSOR NETWORKS (3-0-0) 3

Introduction - Types of sensor networks - Components of a sensor node - Basic design and deployment of WSN - Network Protocol Stack - Classification MAC protocols - Routing Protocols and Transport protocols

in WSN - Operating System in Sensors - client -server Vs mobile agent based data collections - sensor data management - Localization techniques - Security and privacy - Application specific design - energy models - Sensor network simulators.

Reading:

1. Fie Hu and Xiaojun Cao, *Wireless Sensor Networks: Principles and Practice*, Taylor and Francis Group, CRC Press, 2010.
2. Feng Zhao, Leonidas Guibas, *Wireless Sensor Networks: An Information Processing Approach*, 1st Edition, Morgan Kaufmann, 2004.

CS7324

ERP AND SUPPLY CHAIN MANAGEMENT

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Strategizing ERP- Customer Relationship Management- ERP implementation- Product life cycle management- Introduction to Supply Chain Management-Supply chain process management- policy management-quality and deployment-modeling the strategic supply chain- Decision science models for supply chain excellence.

Reading:

1. Christian N Madu, *ERP and Supply Chain Management*, Chi Publishers, 2005.
2. Marianne Bradford, *Modern ERP: Select, Implement and Use Today's Advanced Business Systems*, Lulu.com, 2nd Edition, 2010.