

MCA 501 Computer Security

Module I

Introduction: OSI Security Architecture, Security attacks, Security Services, Security Mechanisms, Model for Network Security, Fundamentals of Abstract Algebra : Groups, Rings, Fields, Modular Arithmetic, Euclidean Algorithm, Finite Fields of the form $GF(p)$, Polynomial Arithmetic, Finite Fields of the form $GF(2^n)$, Classical Encryption techniques, Block Ciphers and Data Encryption Standard.

Module II

Advanced Encryption Standard, Multiple Encryption and Triple DES, Block Cipher Modes of operation, Stream Ciphers and RC4, Confidentiality using Symmetric Encryption, Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms, Public-Key Cryptography and RSA

Module III

Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography, Message Authentication and Hash Functions, Hash and MAC Algorithms
Digital Signatures and Authentication Protocols

Module IV

Network Security: Authentication Applications, Electronic Mail Security, IP Security, Web Security, System Security: Intruders, Malicious Software, Firewalls

Module V

Hardware Solutions: Cryptographic Accelerator, Authentication Tokens, Smart Cards, Biometrics, Digital cash, Secret sharing schemes, Zero-knowledge techniques, Folklore, Secret Sharing, Interactive proof.

References

- Stallings, W., Cryptography and Network Security. Principles and Practice, 4th edition, Prentice Hall.
- Steve Burnett & Stephen Paine RSA Security's Official Guide to Cryptography, Tata Mc GrawHill
- Behrouz A. Forouzan, Cryptography & Network Security, Tata McGraw Hill.
- Kaufman, C., Perlman, R., Speciner, M., Network security. Private communication in a public world, Prentice Hall, 2002.
- Trappe, W., Washington, L.C., Introduction to Cryptography with coding theory, Pearson-Prentice Hall, 2006.
- Tanenbaum, A.S., Computer Networks, 4th edition, Prentice Hall,
- Stinson, D., Cryptography. Theory and Practice, 2nd edition, CRC Press.

Online resources

1. Online resources of Stallings's [Cryptography and Network Security. Principles and Practice](http://williamstallings.com/Crypto3e.html) <http://williamstallings.com/Crypto3e.html>
2. Online resources of Menez, van Oorschot, Vanstone's [Handbook of Applied Cryptography](http://www.cacr.math.uwaterloo.ca/hac/) available at <http://www.cacr.math.uwaterloo.ca/hac/>

MCA 502 INTERNET TECHNOLOGY AND DISTRIBUTED APPLICATIONS

Module I

Internetworking(Host to Host delivery):- Principles, TCP/IP reference model, Connectionless Internetworking, Internet Protocol(IP). IP addressing: Classful addressing, Classless addressing, Subnetting, VLSM, Supernetting. Other Network layer Protocols: ARP, RARP, ICMP, IGMP. IPv6 and ICMPv6- Comparison of IPv4 and IPv6. Point to Point Protocol(PPP), PPPoE.

Module II

Autonomous Systems. Unicasting, Unicast Routing Protocols : Interior Gateway Routing Protocol- RIP, OSPF. Exterior Gateway Routing Protocols - BGP. Multicasting, Multicast applications, Multicast Routing Protocols: MOSPF, DVMRP. Host Configuration Protocols: BOOTP, DHCP. Private Networks, Virtual Private Network and Network Address Translation(NAT).

Module III

UDP: Process to Process Communication, User Datagram and Header format, UDP operation, Use of UDP.

TCP:- TCP Services, TCP features, TCP Segment Header, TCP Connection management, TCP State Transition Diagram, Flow Control, Error Control, Silly Window Syndrome, TCP Congestion control, TCP timer management.

Module IV

Domain Name System(DNS) :- Name space, Domain name space, Distribution of name space, DNS in the Internet, Resolution, DNS messages, Types of Records, Compression, DDNS.

TELNET:- Concept, Network Virtual Terminal, Embedding.

File Transfer Protocol(FTP):- Connections, communication, File Transfer, Anonymous FTP.

Trivial File Transfer Protocol (TFTP): Messages, Connection, Data Transfer.

Electronic Mail: Architecture, User agent - Sending Mail, Receiving Mail. Multipurpose Internet Mail Extensions (MIME). Mail transfer agent: SMTP. Mail access protocols: POP and IMAP. Web-based Mail.

World Wide Web- Hypertext and Hypermedia- Browser Architecture- Static documents- HTML- Dynamic Documents- Common Gateway Interface(CGI)- Active Documents.

HTTP:- Transactions, Request messages, Response message, Headers, Some other features.

WAP – Architecture, protocol stack and features.

Module V

Multimedia:- Digitizing Audio and Video, Audio and Video compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real –Time interactive Audio/Video- Real Time Transport Protocol (RTP), Real Time Transport Control Protocol (RTCP), Video On Demand, Voice Over IP.

References

- Behrouz A. Forouzan - TCP/IP Protocol Suite- Third Edition- Tata McGraw Hill
- Andrew S Tanenbaum- Computer Networks- PHI- Fourth Edition.
- Behrouz A. Forouzan – Data Communications and Networking- Fourth Edition- Tata McGraw Hill
- William Stallings- Data and computer communications- PHI- Seventh Edition.

- Douglas E. Comer- Internetworking with TCP/IP- Volume I- PHI- Third Edition.
- Comer, Douglas. The Internet Book: Everything you need to know about computer networking and how the Internet works, 4th Ed., 2007

MCA 503 COMPUTER GRAPHICS

(All the Graphics techniques specified should be implemented using OpenGL)

Module I

Introduction: Applications of Computer graphics-Image processing and Graphics-Interactive Graphics- Input devices-Display Methods-Hardware and software –Standard Graphics pipeline-drawing primitives. Basic raster graphics algorithms-filling- line clipping – polygon clipping.

Module II

Transformations: Basic 2D transformations - Reflection, Shear, Composite Transformations. Window to viewport transformation-changing coordinate systems- Surface normal-Plane equation. Modeling a 3D object – Data structure for object representation

Module III

Projection: 3D Geometric transformations- Translation, Scaling, Rotation. Perspective parallel Matrix representation – 3D viewing – 3D clipping

Module IV

Representations of 3D Objects :Representation of curves and surfaces –Parametric, Quadric-Bezier, B-Splines, NURBS. Representing surfaces using polygon meshes- Sweep representations, Boundary representations, Spatial-partitioning representations, Constructive solid geometry.

Module V

Visible surface detection methods- Shading-diffused, specular - Illumination -Gouraud, Phong. Comparison of different shading methods-Ray tracing.

References

- Hearn D.,Baker M.P., *Computer Graphics(using OpenGL)*, Prentice- Hall of India 2006.
- Foley J.D. , Andries van Dam, *Computer Graphics(latest) - Principles and Practice* , Addison-Wesley.
- Angel, Edward. *Interactive Computer Graphics- A Top-down Approach with OpenGL*, Addison-Wesley,1996.
- Computer Graphics using OpenGL F S Hill – Prentice Hall
- Geometric tools for Computer Graphics – Philip J. Schneider and David H. Eberly – The Morgan Kaufman series in Computer Graphics & Modeling

MCA 504 DATA MINING

Module I - Introduction to Data mining & Data Warehouse

What is Data mining, Data mining -On What kinds of Data, Data mining Functionalities, Classification of Data mining Systems, Data Mining Task Primitives, Integration of Data mining systems, Major issues of Data mining, What is Data Warehouse, Multidimensional Data Model, A three-tier Data Warehousing Architecture.

Module II–Data Preprocessing and Mining Frequent Patterns

Data Preprocessing

Data Cleaning, Data Integration and Transformation, Data Reduction, Data discretization and concept hierarchy generation.

Association Rules

Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods : Apriori Algorithm, Generating association Rules from Frequent Item sets, Improving the Efficiency of Apriori. Mining Frequent item-sets without Candidate Generation.

Module III-Classification and Prediction

Introduction to Classification and Prediction, Issues Regarding Classification and Prediction

Classification by Decision Tree Induction: Decision Tree induction, Attribute Selection Measures, Tree Pruning, **Bayesian Classification:** Bayes' theorem, Naïve Bayesian Classification, **Rule Based Algorithms:** Using If - Then rules of Classification, Rule Extraction from a Decision Tree, Rule Induction Using a Sequential Covering algorithm, **K- Nearest Neighbour Classifiers.**

Prediction : Linear Regression, Nonlinear Regression, Other Regression-Based Methods

Module IV - Clustering

What is Cluster Analysis, Requirements of Cluster Analysis' Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, **Partitioning Methods :**k-Means and k-Medoids, From K-Medoids to CLARANS , **Hierarchical Method :** Agglomerative and Divisive Hierarchical Clustering, BIRCH, ROCK, Chameleon, **Density–Based Method:** DBSCAN, **Grid Based Methods:** STING: S**T**atistical **I**nformation **G**rid, Wave Cluster, **Model based Methods-** Expectation-Maximization, Conceptual Clustering, Neural Network Approach.

Module V-Applications and Trends in Data Mining

Data Mining Applications : Data Mining for Financial Data Analysis, Data Mining for the Retail Industry, Data Mining for the Telecommunication Industry, Data Mining for Biological Data Analysis, Data Mining in Other Scientific Applications, Data Mining for Intrusion Detection, Social Impacts of Data Mining, Trends in Data Mining.

References

- Data Mining Concepts and Techniques – Jiawei Han and Micheline Kamber, Second Edition, Elsevier, 2006
- Data Mining – BPB Editorial Board, BPB Publications, First Edition, 2004
- Data Warehousing , Data Mining, & OLAP – Alex Berson, Stephen J Smith, Tata McGraw Hill, 2004
- Data Warehousing, Sinha, Thomson Learning , First Edn.

MCA 506 COMPUTER GRAPHICS Lab (using OpenGL)

Lab directives

OpenGL libraries-installation in your computer-getting familiar with openGL commands-
Running simple programs downloaded from the site specified in the reference books or *Official guide*

Display drawing primitives – Draw Polygon surfaces, filling with colors–shading, scale, rotate and translate a triangle with 3 colors at 3 vertices. Animate the triangle. Draw a circle and an ellipse. Draw a cuboid with different colors on its sides. Implement projections using the cuboid.

Draw a sphere model with constant color. Draw a cone scale rotate and translate it. Animate two objects on same screen.

Simulate solar system. Display Bazier and B-Spline surfaces. Implement Constructive solid geometry techniques. Display a scene with and without back face culling.

MCA 505 (1) USER INTERFACE DESIGN

Module I

Introduction

Introduction-Importance-Human-Computer interface-characteristics of graphics interface-Direct manipulation graphical system - web user interface-popularity-characteristic & principles

Module II

Human Computer Interaction

User interface design process- obstacles-usability-human characteristics in design - Human interaction speed-business functions-requirement analysis-Direct-Indirect methods-basic business functions-Design standards-system timings - Human consideration in screen design - structures of menus - functions of menus-contents of menu-formatting -phrasing the menu - selecting menu choice-navigating menus-graphical menus.

Module III

Windows

Windows: Characteristics-components-presentation styles-types-managements-organizations-operations-web systems-device-based controls: characteristics-Screen -based controls: operate control - text boxes-selection control-combination control-custom control-presentation control.

Module IV

Multimedia

Text for web pages - effective feedback-guidance & assistance- Internationalization-accessibility-Icons-Image-Multimedia -coloring.

Module V

Windows Layout - Test

Windows layout-test :prototypes - kinds of tests - retest - Information search - visualization - Hypermedia - www - Software tools.

References

- Wilbent. O. Galitz ,“The Essential Guide to User Interface Design”, John Wiley& Sons, 2001.
- Ben Sheiderman, “Design the User Interface”, Pearson Education, 1998.
- Alan Cooper, “The Essential of User Interface Design”, Wiley – Dream Tech Ltd., 2002.

MCA 505(2) BIOINFORMATICS

Module I

Fundamental of Biological Systems: Cell- cell organelles- Eukaryotic, Prokaryotic cell- Cell division- Mitosis- Meiosis- Macromolecules: Carbohydrates- Protein- Lipids- Nucleic acid- Structure of DNA and RNA, Genomic Organization in Prokaryotes and Eukaryotes, Chromosome and Chromatin Structure of Human

Module II

Fundamentals of Bioinformatics: Definition- Bioinformatics in industrial applications- Importance of Bioinformatics- Advantages and breakthroughs of HGP, Ethical Issues related to Human Genome Project, Genomics, Gene prediction in Prokaryotes and Eukaryotes, ORF prediction Proteomics levels of protein structure: primary, secondary, Tertiary and quaternary structures, Structure Prediction Tools , Molecular Visualization-Rasmol & SPDBV

Module III

Biological Databases: Biological Databases: Nature and diversity of data, classification and importance of Biological Databases, Nucleic Acid databases-Primary Sequence Databases and secondary sequence Databases, NCBI, Protein databases-sequence databases and structural databases

Module IV

Biological sequence Analysis: Concept of sequence Alignment, Scoring matrices: PAM & Blosum, Alignment of Pairs of sequences: Dot Plot; Alignment Algorithms-Needleman and Wunsch Algorithm, Smith Waterman Algorithm, Search for Homologous sequences using BLAST & FASTA programs

Multiple Sequence Alignment: Dynamic Programming and progressive alignment.

Tools: ClustalW, Concept of Molecular Phylogeny, Phylip

Module V

Advances in Bioinformatics: Microarray based technique – Analysis of gene expression, DNA Fingerprinting & DNA Foot printing, SNP Maps in population studies. Chemoinformatics, Pharmacogenomics, Personalized Medicine and ethical issues in Pharmacogenomics

References

- The Cell – A Molecular Approach, Geoffrey M. Cooper, Robert E. Hausman
Cell & Molecular Biology Gerald Karp
- Bioinformatics : Sequence & Genome Analysis, David W Mount
- Fundamental Concepts of Bioinformatics, Dan E Krane, Michael L Raymer
- Introduction to Bioinformatics – Sunderarajan & Balaji
- Microarray Bioinformatics- Dav Stakel
- Bioinformatics Concepts Skills & Applications, Rastogi Sc, Namita Mendiratta, Parag Rastogi
- Pharmacogenomics in Drug Discovery and Development, Yan and Qing

MCA 505(3) Digital Image Processing

Module I (DIGITAL IMAGE FUNDAMENTALS)

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals -RGB, HSI models, Image acquisition and sampling, Quantization, Image file formats, Two-dimensional convolution, correlation, and frequency responses.

Module II (IMAGE TRANSFORMS)

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Radon, and Wavelet Transform.

Module III (IMAGE ENHANCEMENT AND RESTORATION)

Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic filters, Homomorphic filtering, Color image enhancement. Image Restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation.

Module IV (IMAGE SEGMENTATION AND RECOGNITION)

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking, Morphological operators: dilation, erosion, opening, and closing. Image

Recognition – Patterns and pattern classes, matching by minimum distance classifier, Statistical Classifier. Matching by correlation, Neural network application for image recognition.

Module V (IMAGE COMPRESSION)

Need for image compression, Huffman, Run Length Encoding, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. Image compression standards.

References

- Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing’, Pearson Education, Inc., Second Edition, 2004.
- Anil K. Jain, ‘Fundamentals of Digital Image Processing’, Prentice Hall of India, 2002.
- David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
- Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, ‘ Digital Image Processing using MATLAB’, Pearson Education, Inc., 2004.
- William K. Pratt, ‘ Digital Image Processing’, John Wiley, New York, 2002.
- Milman Sonka, Vaclav Hlavac, Roger Boyle, ‘Image Processing, Analysis, and Machine Vision’, Brooks/Cole, Vikas Publishing House, II ed., 1999.
- Sid Ahmed, M.A., ‘Image Processing Theory, Algorithms and Architectures’, McGrawHill, 1995.
- Lim, J.S., ‘Two Dimensional Signal and Image Processing’, Prentice-Hall.

MCA 505(4) ADVANCED COMPUTING PARADIGMS

Module I Grid Computing

Overview, Definition of Grid , Basic Building Blocks , Issues in Management of Grid Models: Evolution of Grid Models,. Architecture- Requirements concerning abstractions, behaviors, resources, connectivity and protocols,

Module II Overview of Grid Computing Environment

Programming models, Middleware for building grid computing environments, Language support (MPI- G, MPI-G2, etc) for grid computing, Meta models for grid programming, Security. Monitoring and evaluation. Monitoring, Scheduling, Performance tuning, Debugging and performance diagnostic issues:

Module III Cloud Computing

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS

Module IV Cloud Computing Security Architecture

Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures, Identity Management and Access control- Identity management, Access control, Autonomic Security

Module V Issues in Cloud Computing

Issues in cloud computing, Implementing real time application over cloud platform
Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration,
streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.
in Cloud

References

- The Grid: Blueprint for a New Computing Infrastructure (2nd edition) by Ian Foster (Editor), Carl Kesselman (Editor) Publisher : Morgan Kaufmann, 2nd edition
- Enterprise Cloud Computing by Gautam Shroff, Cambridge
- Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
- Grid Computing: Making the Global Infrastructure a Reality by Fran Berman (Editor), Geoffrey Fox (Editor), Tony Hey (Editor) Publisher: John Wiley & Sons, (April 8, 2003) ISBN: 0-470-85319-0.
- Grid Resource Management : State of the Art and Future Trends by Jarek Nabrzyski (Editor), Jennifer M. Schopf (Editor) , Jon Weglarz (Editor) Publisher: Kluwer Academic Publishers: (September 2003) ISBN: 1-402-07575-8
- Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)
- Grid Computing: A research: monograph: D .Janakiram, Tata McGrawhill Publication.

MCA 505(5) XML and Web Services

Module I XML Technology Family

XML – Benefits – Advantages of XML over HTML – EDI – Databases – XML Based standards – Structuring with schemas – DTD – XML schemas – XML processing – DOM – SAX – Presentation technologies – XSL – XFORMS – XHTML – transformation – XSLT – XLINK – XPATH – Xquery

Module II Architecting Web Services

Business motivations for web services – B2B – B2C – Technical motivations – Limitations CORBA and DCOM – Service Oriented Architecture (SOA) – Architecting web services – Implementation view – Web services technology stack – Logical view – Composition of web services – Deployment view – From application server to peer to peer – Process view – Life in the runtime.

Module III Web Services Building Blocks

Transport protocols for web services – Messaging with web services – Protocols – SOAP – Describing web services – WSDL – Anatomy of WSDL – Manipulating WSDL – Web service policy – Discovering web services – UDDI – Anatomy of UDDI – Web service inspection – Ad hoc discovery – Securing web services.

Module IV Implementing XML in E-Business

B2B – B2C applications – Different types of B2B interaction – Components of E-Business XML systems – EBXML – RosettaNet – Applied XML in vertical industry – Web services for mobile devices.

Module V XML Content Management and Security

Semantic web – Role of meta data in web content – Resource description framework – RDF schema – Architecture of semantic web – Content management workflow – XLANG – WSFL – Securing web services

References

- Ron Schmelzer and Travis Vandersypen, “XML and Web Services unleashed”, Pearson Education
- Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education
- David Chappell, “Understanding .NET A Tutorial and Analysis”, Addison Wesley
- Kennard Scibner and Mark C. Stiver, “Understanding SOAP”, SAMS Publishing
- Alexander Nakhimovsky and Tom Myers, “XML Programming: Web Applications and Web Services with JSP and ASP”, Apress

MCA 505(6) Distributed Computing

Module I

Introduction to distributed systems – definition, goals, types. Architectures- System architectures, architectures versus middle ware, self management. Processes – Threads, Virtualisation, Clients, Servers, Code Migration

Module II

Communication – RPC, Message oriented, Stream oriented. Naming – flat naming, structured naming, attribute based naming. Synchronization – Clock synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion

Module III

Consistency and replication – Data centric consistency, client centric consistency, consistency protocols. Fault Tolerance – introduction, process resilience, reliable client-server communication, reliable group communication, distributed commit.

Module IV

Security – Threats, cryptography, Secure Channels, access control mechanisms, security management

Module V

Distributed File Systems – Network File System, CODA, XFS, Secure File System.
Distributed Coordination based Systems – TIB/Rendezvous, JINI

References

- Distributed Systems – Principles and Paradigm, Tanenbaum & Van Steen, 2nd Edition, PHI Publications
- Elements of Distributed Computing, Garg, Wiley Publications
- Distributed Operating System, Pradeep K Sinha, PHI Publications

MCA 505(7) EMBEDDED SYSTEMS

Module I Introduction

Examples of Embedded systems, Major Application areas, Hardware fundamentals.

Module II Hardware and Software

Advanced hardware details, Interrupts, Software Architectures, Embedded Development Environment.

Module III Operating System

Introduction to Real Time Operating Systems, Operating System services, Basic design using a Real Time Operating System.

Module IV Tools

Embedded Software Development Tools, Debugging Tools and Techniques.

Module V Embedded Microcontrollers

Introduction, Programming Microcontrollers, Microcontroller Hardware and I/O.

References

- David E. Simon, *An Embedded Software Primer*, Addison Wesley, 2001.
- Todd D. Morton, *Embedded Microcontrollers*, Pearson 2011.
- Mazidi M. Ali, *The 8051 Microcontroller and Embedded Systems*, Pearson Education Asia, 2002.