School of Engineering & Technology

Syllabi and Course Structure

M. Tech. in Information Security

(Computer Science)

Academic Programmes

July, 2013
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Information Security)

*Course Structure*

**First Semester**

<table>
<thead>
<tr>
<th>yr</th>
<th>Sub Code</th>
<th>Sub Name</th>
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<tbody>
<tr>
<td>I</td>
<td>M11001</td>
<td>Advanced Topics in Algorithm Design</td>
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<td>Distributed &amp; Cloud Computing</td>
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<td>G11007</td>
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**Third Semester**

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**Fourth Semester**

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**Faculty of Engineering & Technology**

*M.Tech. in Computer Science & Engineering (Information Security)*

**Proposed ELECTIVE Theory Subjects:**

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<td>M111 01</td>
<td>Advance Data Communication network</td>
<td>M111 05</td>
<td>Mobile Computing</td>
<td>M1210 1</td>
<td>Secure Ecommerce</td>
<td>M121 05</td>
<td>Natural Language Processing</td>
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<td>M111 02</td>
<td>Client server programming</td>
<td>M111 06</td>
<td>Digital Image Processing</td>
<td>M1210 2</td>
<td>Data Mining and warehousing</td>
<td>M121 06</td>
<td>Biometric Security</td>
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<td>M111 03</td>
<td>Optical network</td>
<td>M111 07</td>
<td>Secure communication and VPN</td>
<td>M1210 3</td>
<td>Pattern Recognition</td>
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<td>Storage System</td>
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<td>Information system security</td>
<td>M111 08</td>
<td>Grid computing</td>
<td>M1210 4</td>
<td>Network Simulation</td>
<td>M121 08</td>
<td>PKI and Trust Management</td>
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M.Tech. in Computer Science & Engineering (Information Security) Semester I

Contact Hours (L-T-P): 4-0-0

M11001- Advanced Topics in Algorithm Design: Course Outlines

Advanced Data Structure: Graph, B-tree, binomial heaps and, Fibonacci heap.


Linear Programming: The simplex algorithm and duality.

Number Theoretic Algorithm: GCD, modular arithmetic, solving modular linear equation and Chinese remainder theorem.


Parallel Algorithms: Model for parallel computation, basic techniques, work and efficiency, parallel evaluation of expressions, parallel sorting networks and parallel sorting.

Suggested Books
3. Basse S., Computer Algorithms - Introduction to Design and Analysis, Addison Wesley
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M.Tech. in Computer Science & Engineering (Information Security) Semester I

Contact Hours (L-T-P): 4-0-0

M11002 - Advanced Software Engineering: Course Outlines


Suggested Books:


CPU Scheduling: Basic Concepts, Scheduling Criteria, Algorithms, Multiple-processor Scheduling, Real Time Scheduling, Algorithm Evaluation.


Protection and Security: Threats, Intruders, Accidental Data Loss, Cryptography, User authentication, Attacks from inside the system, Attacks from outside the system, Protection Mechanism, Trusted Systems, Domain of Protection, Access Matrix, Programs Threats, System Threats.

Distributed systems, topology network types, design strategies. Network operating structure, distributed operating system, remote services, and design issues. Distributed file system: naming and transparency, remote file access, Stateful v/s Stateless Service, File Replication.

Distributed co-ordinations: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, and Reaching Agreement. Case studies of Unix and MS-DOS operating system.

Suggested Books
List of Experiments

1. Write a Program to implement Efficient Matrix Multiplication
2. Write a Program to define the graphs and list all nodes and Links
3. Write a Program to implement the concept of BFS
4. Write a Program to implement the concept of DFS
5. Write a Program to implement the concept of B-tree
6. Write a Program to implement Dijkstra Algorithm
7. Write a Program to implement the concept of Binomial Heap
8. Write a program to find Greatest Common Divisor
9. Write a program using Chinese remainder theorem
10 Write program to solve linear equations
11 Write a program to solve Travelling Salesman problem
12 Write a program to implement Vertex cover problem
13 Write a program to implement all pair shortest path Algorithm
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M.Tech. in Computer Science & Engineering (Information Security) Semester I

Contact Hours (L-T-P): 0-0-4

M11005- Advanced Software Engineering Lab: Course Outlines

List of Experiments
Students will Identify Projects they will be working on in this Lab. Once Projects are Identified then they will work on objectives given for the projects below

1. To perform the user’s view analysis: Use case diagram for
2. To perform the system analysis: Requirement analysis, SRS
3. To perform the function oriented diagram: DFD and Structured chart
4. To perform the user’s view analysis: Use case diagram
5. To draw the structural view diagram: Class diagram, object diagram
6. To draw the behavioral view diagram: Sequence diagram, Collaboration diagram
7. To draw the behavioral view diagram: State-chart diagram, Activity diagram
8. To draw the implementation view diagram: Component diagram.
9. To draw the implementation view diagram: deployment diagram
10. To perform various techniques for testing using manual Testing
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M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 4-0-0

M12001- Distributed & Cloud Computing: Course Outlines


Understanding cloud computing: Introduction to Cloud Computing - Benefits and Drawbacks - Types of Cloud Service Development - Deployment models


Text books:

M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 4-0-0

M12002 - Advanced Computer Network and Security: Course Outlines

HIGH SPEED NETWORKS

CONGESTION AND TRAFFIC MANAGEMENT

TCP AND ATM CONGESTION CONTROL

INTEGRATED AND DIFFERENTIAL SERVICES
Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection, Differentiated Services

PROTOCOLS FOR QOS SUPPORT

TEXT BOOKS:

REFERENCES:
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 4-0-0

M12003-IPR and Cyber Laws: Course Outlines

Intellectual Property rights:

Cyber laws:
Introduction to the Cyber World and Cyber Law, Information Technology Act, 2000 – Digital Signature; E-Governance; Regulation of Certifying Authorities; Duties of subscribers; Penalties and Adjudications; Offences under the Act; Making of Rules and Regulations etc.

Cyber Crimes
Introduction – computer crime and cyber crimes; Classification of cyber criems. Cyber forensic, Cyber criminals and their objectives Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; computer vandalism etc.

Books:
1. Peter Weil, Jeanne Ross "IT Governance: How Top Performers Manage IT Decision Rights for Superior Results"
2. www.wipo.org
3. IT Act 2000 with amendments in 2008
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M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 3-0-0

G11007 - Research Methodology & Technical Communication: Course Outlines

Research: Meaning & Purpose, Review of literature, Problem definition/Formulation of research problem, Research proposal, Variables, Hypothesis, types, construction of hypothesis

Classification of research: Quantitative research: Descriptive Research, Experimental Research

Qualitative research: Observational studies, Historical research, Focus group discussion, Case study method,

Sources of data collection: Primary and Secondary Data Collection, Sample and Sampling technology, Non-probability and Probability Sampling


Data Analysis, Report Writing, Results and References,

Thesis Writing and Journal Publications: Writing thesis, Writing journal and conference papers, IEEE and Harvard style of referencing, Effective presentation, Copyrights, and Avoid plagiarism
M.Tech. in Computer Science & Engineering (Information Security) Semester I

Contact Hours (L-T-P): 3-0-0

M11101-Advanced Data Communication Network: Course Outlines

Module 1: Introduction

Module 2: Data Link Layer
Introduction to Data Link Layer, Framing, Error Detection and Correcting Codes, Hamming Code, Block Codes and Convolution Codes, ARQ Techniques, Transmission Codes, Baudot, EBCDIC and ASCII Codes, Barcodes, Terminal Handling. ARQ Protocols: Stop & Wait Protocols, Sliding Window Protocols, Performance and Efficiency, Multi Access Protocols: ALOHA and CSMA.

Module 3: Network Layer

Module 4: Transport Layer

References:


4. Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.


TEXT BOOK:
M11103 - Optical Network: Course Outlines

1. **Introduction**: Three generations of Digital Transport Networks; A brief introduction to WDM and TDM; The Optical Marketplace; Wireless Optical Systems; Key Optical Nodes; Other Key Terms; Evolution of Optical Systems; Key attributes of Optical Fiber.

2. **Telecommunications Infrastructure**: The Local Connections; The Backbone Connections; The Digital Multiplexing Hierarchy; The Digital Signaling Hierarchies; T1 / DS1 and T3 / DS3; The Layered Protocol Model in the Transport Network; considerations for Interworking Layer1, Layer 2, and Layer 3 Networks.

3. **Characteristics of Optical Fiber**: The Basics; The Wavelength; The Basic Components; Structure of the Fiber; Fiber Types; Key Performance Properties of Fiber; Attenuation; Amplifier Spontaneous Emission; Chromatic Dispersion; Lasers.

4. **Timing and Synchronization**: Timing and Synchronization in Digital Networks; Effect of a Timing error; The Clocking Signal; Types of Timing in Networks; Timing Variations; Methods of Clock Exchange; Distribution of Timing Using SONET and DS1; Timing Downstream Devices; Building Integrated Timing Supply; Synchronization Status Messages and Timing Loops.

5. **SONET and SDH**: Introduction; The SONET Multiplexing Hierarchy; SONET and SDH Multiplexing Structure; The SONET / SDH Frame Structure; SONET and SDH Functional Components; SONET and SDH Problem Detection; Locating and Adjusting Payload with Pointers; Virtual Tributaries in more detail; Virtual Tributaries in Virtual Containers; The Overhead Bytes; SONET and SDH Concatenation.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Information Security) Semester I

Contact Hours (L-T-P): 3-0-0

M11104 - Information System Security: Course Outlines

Introduction to Securities: Introduction to security attacks, services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon’s theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES

Modular Arithmetic: Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryption Fermat’s and Euler’s theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA

Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA)

Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm

Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure.

Authentication Applications: Kerberos

Electronic mail security: pretty good privacy (PGP), S/MIME.


Suggested Books:
2. Behrouz A. Frouzan: Cryptography and Network Security, TMH
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M.Tech. in Computer Science & Engineering (Information Security) Semester I

Contact Hours (L-T-P): 3-0-0

M11105-Mobile Computing: Course Outlines

Overview of Mobile Computing: Its applications, Radio Communication, Mobile Computing Architecture, Mobile System Networks, Data Dissemination, Mobility Management,

Introduction to Cellular network: components, Architecture, Call set-up, Frequency Reuse and Co-channel cell, Cell Design, Interference, Channel assignment, Hand Off;

Cellular Network Standards: Digital cellular communication, Multiple Access Techniques: FDMA, TDMA, CDMA. GSM: System Architecture, Mobile services & features, Protocols, Radio interface, Handover, GSM Channels, Localization and calling, User validation; General Packet Radio Service; Introduction to CDMA based systems; Spread spectrum in CDMA systems; coding methods in CDMA; IS-95


Mobile Ad-hoc and Sensor Networks: Introduction, MANET, Routing in MANET”s Wireless Sensor Networks, Applications; Mobile Devices: Mobile Agent, Application Server, Gateways, Portals, Service Discovery, Device Management,

Support for Mobility: Mobile IP: Architecture, Packet delivery and Hand over Management, Location Management, Registration, Tunneling and Encapsulation, Route optimization, DHCP.

Mobile Transport Layer: Conventional TCP/IP transport protocols, Indirect TCP, Snoop TCP, Mobile TCP

Suggested Books
Fundamentals Of Image Processing

Image Enhancement and Restoration

Image Segmentation and Feature Analysis
Detection of Discontinuities, Edge Operators, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation, Motion Segmentation, Feature Analysis and Extraction.

Multi Resolution Analysis and Compressions

Applications of Image Processing
Representation and Description, Image Recognition, Image Understanding, Image Classification, Video Motion Analysis, Image Fusion, Steganography, Colour Image Processing.

Suggested Books:
1. Digital Image Processing - Dr. S.Sridhar Oxford University Press
M11108-Grid Computing: Course Outlines

Grid Computing: values and risks – History of Grid computing, Grid computing model and protocols, Overview and types of Grids.

Desktop Grids: Background, Definition, Challenges, Technology, Suitability, Grid server and practical uses, Clusters and Cluster Grids, HPC Grids, Scientific in sight, Application and Architecture, HPC application, Development Environment and HPC Grids, Data Grids, Alternatives to Data Grid, Data Grid architecture.

The open Grid services Architecture, Analogy, Evolution, Overview, Building on the OGSA platform, Implementing OGSA based Grids, Creating and Managing services, Services and the Grid, Service Discovery, Tools and Toolkits, Universal Description Discovery and Integration


Suggested Books:
Faculty of Engineering & Technology

**M.Tech. in Computer Science & Engineering (Information Security) Semester II**

**Contact Hours (L-T-P): 3-0-0**

**M12101-Secure E-Commerce: Course Outlines**

The importance of e-commerce security to the business enterprise. Current threats facing organizations that conduct business online and how to mitigate these challenges. Cryptography review public key certificates and infrastructures, authentication and authorization certificates secure credential services and role-based authorization, mobile code security, security of agent-based systems, secure electronic transactions, electronic payment systems, intellectual property protection, Law and Regulation

**Books:**
6. National Institutes of Standards and Technology (NIST) Special Publications
Overview: Concept of data mining and warehousing, data warehouse roles and structures, cost of warehousing data, roots of data mining, approaches to data exploration and data mining, foundations of data mining, web warehousing, web warehousing for business applications and consumers, introduction to knowledge management, data warehouses and knowledge bases.

Data Warehouse: Theory of data warehousing, barriers to successful data warehousing, bad data warehousing approaches, stores, warehouse and marts, data warehouse architecture, metadata, metadata extraction, implementing the data warehouse and data warehouse technologies.

Data Mining and Data Visualisation: Data mining, OLAP, techniques used to mine the data, market basket analysis, current limitations and challenges to DM, data visualization.

Designing and Building the Data Warehouse: The enterprise model approach of data mining design, data warehouse project plan, analysis and design tools, data warehouse architecture, specification and development.

Web-Based Query and Reporting: Delivering information over the web, query and reporting tools and business value, architectural approaches to delivering query capabilities over the web.

Web Based Statistical Analysis and Data Mining: Analytical tools, business value from analytical tools, humble spreadsheet, determining the business value that analytical tools will deliver, statistical products overview – statistical analysis applications, correlation analysis, regression analysis, data discovery tools overview, data discovery applications, comparison of the products, architectural approaches for statistical and data discovery tools.

Search Engines and Facilities: Search engines and the web, search engine architecture, variations in the way the search facilities work and variations in indexing schemes.

Future of Data Mining and Data Warehousing: Future of data warehousing, trends in data warehousing, future of data mining, using data mining to protect privacy, trends affecting the future of data mining and future of data visualization.

Suggested Books
M12103 - Pattern Recognition: Course Outlines

Introduction and mathematical preliminaries - What is pattern recognition?, Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques.

Classification: Bayes decision rule, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries.

Fisher’s LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.

Clustering: Different distance functions and similarity measures, Minimum within cluster distance criterion, K-means clustering, single linkage and complete linkage clustering, MST, medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.

Feature selection: Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm.

Feature Extraction: PCA, Kernel PCA.

Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy.

Books & References:

PREREQUISITES
Vector spaces and Linear Algebra; Algorithms.
Probability theory; Statistics.

REFERENCES
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M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 3-0-0

M12103-Network Simulation: Course Outlines
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M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 3-0-0

M12105-Natural Language Processing: Course Outlines

Sound: Biology of Speech Processing; Place and Manner of Articulation; Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

Meaning: Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

Web 2.0 Applications: Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

Books & References:

PREREQUISITES
1. A previous course on Artificial Intelligence will help.
2. Courses of Data Structures and Algorithms should have been done.
3. Exposure to Linguistics is useful, though not mandatory.

REFERENCES

ADDITIONAL READINGS
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 3-0-0

M12106-Biometric Security: Course Outlines


Texts/References:


2. Davide Maltoni (Editor), et al, Handbook of Fingerprint Recognition

3. L.C. Jain (Editor) et al, Intelligent Biometric Techniques in Fingerprint and Face Recognition

4. John Chirillo, Scott Blaul, Implementing Biometric Security
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M.Tech. in Computer Science & Engineering (Information Security) Semester II

Contact Hours (L-T-P): 3-0-0

M12107 - Storage System: Course Outlines

Introduction: History: computing, networking, storage, Need for storage networking, SAN, NAS, SAN/NAS Convergence, Distributed Storage Systems, Mainframe/proprietary vs. open storage, Storage Industry Organizations and Major Vendors Market, Storage networking strategy (SAN/NAS)

Technology: Storage components, Data organization: File vs. Block, Object; Data store; Searchable models; Storage Devices (including fixed content storage devices), File Systems, Volume Managers, RAID systems, Caches, Prefetching.

Network Components: Connectivity: switches, directors, highly available systems, Fibre Channel, 1GE/10GE, Metro-ethernet, Aggregation, Infiniband

Error management: Disk Error Mgmt, RAID Error Mgmt, Distributed Systems Error Mgmt

Highly available and Disaster-tolerant designs: Ordered writes, Soft updates and Transactions, 2 phase, 3 phase, Paxos commit protocols, Impossibility Results from Distributed Systems, Choose 2 of 3: Availability, Consistency and Partition Tolerance Layering and Interfaces in Storage Protocols (eg. SCSI 1/2/3SNIA model)

SAN Components: Fibre Channel, IP-based Storage (iSCSI, FCIP, etc.), Examples NAS: NFS, CIFS, DAFS

Large Storage Systems: Google FS/BigTable, Cloud/Web-based systems (Amazon S3), FS+DB convergence, Programming models: Hadoop


Suggested Books:
