School of Engineering & Technology

Syllabi and Course Structure

M. Tech. in Software Engineering

(Computer Science and Engineering)

Academic Programmes

July, 2013
## Course Structure

### First Semester

<table>
<thead>
<tr>
<th>yr</th>
<th>Sub Code</th>
<th>Sub Name</th>
<th>L</th>
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<tr>
<td>1</td>
<td>M11007</td>
<td>Software Engineering Design Methodology</td>
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<td></td>
<td>M11001</td>
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### Third Semester

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Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Software Engineering)

Proposed ELECTIVE Theory Subjects:

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<td>M110 03</td>
<td>Advanced Operating System</td>
<td>M111 06</td>
<td>Digital Image Processing</td>
<td>M1211 0</td>
<td>Artificial Intelligence and Expert system</td>
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<td>Distributed Algorithms</td>
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<td>M111 02</td>
<td>Client server programming</td>
<td>M111 05</td>
<td>Mobile computing</td>
<td>M1211 3</td>
<td>Performance Evaluation and Reliability of Information System</td>
<td>M121 17</td>
<td>High Performance Scientific Computing</td>
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<td>M111 03</td>
<td>Optical network</td>
<td>M121 12</td>
<td>Grid computing</td>
<td>M1211 1</td>
<td>Distributed and Cloud Computing</td>
<td>M121 18</td>
<td>Database Engineering</td>
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<td>M111 04</td>
<td>Information system security</td>
<td>M111 10</td>
<td>Geographic Information system</td>
<td>M1211 5</td>
<td>Software Construction (Design Pattern)</td>
<td>M121 19</td>
<td>Information Retrieval</td>
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Faculty of Engineering & Technology

**M.Tech. in Computer Science & Engineering (Software Engineering) Semester I**

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

**M11007- Software Design Methodology: Course Outlines**

**Principles and Motivations**
Definitions and need for engineered approach to software development; Software development process models from the points of view of technical development and project management: waterfall, rapid prototyping, incremental development, spiral models, emphasis on computer-assisted environments.

**Introduction to Modeling Tools**
Basics of object-oriented approach, object-oriented programming and languages, OMT, visual modeling, UML, Rational Rose Tool

**Object Modeling and Design**
Classes, objects, relationships, key abstractions, common mechanisms, diagrams, class diagrams, advanced classes, advanced relationships, interfaces, types, roles, packages, instances, object diagrams, interactions, use cases, use case diagrams, interaction diagrams, activity diagrams, events and signals, state machines, processes, threads, state chart diagrams, components, deployment, collaborations, patterns and frameworks, component diagrams, systems and models, code generation and reverse engineering.

**Software Development Methods**
Formal, semi-formal and informal methods; Requirements elicitation, requirements specification; Data, function, and event-based modeling; Some of the popular methodologies such as Yourdon’s SAD, SSADM etc; CASE tools-classification, features, strengths and weaknesses; ICASE; CASE standards.

**Software Project Management**
Principles of software projects management; Organizational and team structure; Project planning; Project initiation and Project termination; Technical, quality, and management plans; Project control; Cost estimation methods - Function points and COCOMO.

**References:**
2. Ian Sommerville; Software Engineering, Addison-Wesley Publishing Company, England
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Software Engineering) 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
Faculty of Engineering & Technology

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

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

M11008 - Software Project Management: Course Outlines

Introduction to Project Management: Definition of the Project, Project Specification and parameters, Principles of Project Management, Project Management Life Cycle


Project Scheduling and Tracking Techniques: Why projects are delayed? Effort Estimation Techniques, Task Network and Scheduling Methods, Monitoring and Control Progress, Graphical Reporting Tools

Project Economics: Project Costing, Empirical Project Estimation Techniques, Decomposition Techniques, BEP, Automated Estimation Tools

Risk Analysis and Management: Risk Mitigation and Management, Software Metrics and Project Management

Project Control and Closure, Project Management Issues with regard to New Technologies

Suggested Readings:
1. Clements and Gido, Effective Project Management, Thomson India Edition
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Software Engineering) 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
M12013 - Software Architecture: Course Outlines


References:
2. Documenting Software Architectures: Views and Beyond Paul Clements, Felix Bachmann, Len Bass, David Garlen, James Ivers, Reed Little, Robert Nord, Judith Stafford
Faculty of Engineering & Technology

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

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

M12014- Software Testing: Course Outlines

1. Fundamentals of Testing

2. Role of Testing in SDLC
   Review of software development models (Waterfall Models, Spiral Model, W Model, V Model) Agile Methodology and Its Impact on testing, Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic)

3. Approaches to Testing
   Static Testing : Structured Group Examinations, Static Analysis: Control flow & Data flow, Determining Metrics
   Dynamic Testing
   Black Box Testing : Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques
   White Box Testing
   Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced White Box Techniques, Instrumentation and Tool Support Gray Box Testing, Intuitive and Experience Based Testing

5. Test Management

6. Testing Tools

7. Testing Object Oriented Software
   Introduction to OO testing concepts, Differences in OO testing Term

References:
M12015-Service Oriented Architecture: Course Outlines

1. SOA Fundamental:
    Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment

2. SOA Planning and Analysis:
    Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, non-runtime qualities), business centric SOA and its benefits, Service modelling, Basic modelling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA)

3. SOA Design and Implementation:
    Service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security mplementation, implementation of integration patterns, services enablement, quality assurance

4. Managing SOA Environment:
    Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and matrices), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle

Reference Books:
Faculty of Engineering & Technology

M.Tech. in Computer Science & Engineering (Software Engineering) 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


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: namingvand 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, Reaching Agreement. Case studies of Unix and MS-DOS operating system.

Suggested Books
M11102- Client Server Programming: Course Outlines


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

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

M11106-Digital Image Processing: Course Outlines

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
Faculty of Engineering & Technology

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, Snooping TCP, Mobile TCP

Suggested Books
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:
M11110-Geographic Information System: Course Outlines

Introducing GIS and spatial data: Definition - maps and spatial information, computer assisted mapping and map analysis, components of GIS, people and GIS, maps and spatial data, thematic characteristics of spatial data, other sources of spatial data: census, survey data, air photos, satellite images, field data. Spatial and attributes data modeling and Management: Data quality and data standards: Concepts, Definition, Components and assessment of data quality: Spatial entities, generalization, Raster and Vector spatial data structures, comparison of Vector and Raster Methods, Acquisition of spatial data for terrain modeling, Raster and Vector approach to digital terrain modeling, modeling network, layered approach and object-oriented approach, modeling third and fourth dimension, problem of data management, database management system - relational database model - linking spatial and attribute data - GIS database application and development.


GIS Modeling for decision support: Models of spatial processes: natural and scale analogue models, conceptual models, mathematical model, models of physical and environmental processes, modeling human process, gravity model, problems related to using GIS to model spatial processes. Maps as output, alternative cartographic outputs, non-cartographic outputs, spatial multimedia, delivery mechanism, GIS and spatial decision supports, maps as decision tools.

Suggested Books
Faculty of Engineering & Technology

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

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

M12110- *Artificial Intelligence and Expert System: Course Outlines*

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**Overview of Artificial Intelligence**: Definition & Importance of AI.

**Knowledge: General Concepts**: Introduction, Definition and Importance of Knowledge, Knowledge-Based Systems, And Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, And Acquisition of Knowledge.

**LISP and Other AI Programming Languages**: Introduction to LISP : Syntax and Numeric Function, Basic List Manipulation Functions in LISP, Functions, Predicates and Conditionals, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, PROLOG and Other AI Programming Languages.


**Knowledge Organization and Management**: Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.


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**Text Book:**


**Reference Books:**


M12113 - Performance Evaluation and Reliability of Information System: Course Outlines


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

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

M12111-Distributed and Cloud Computing: Course Outlines

Introduction to Parallel and Distributed Systems, goals, hardware concepts, software concepts, client server model; communication, layered protocols, remote procedure call, objective invocation, message & stream oriented communication; processes, threads, clients, servers; naming entities, mobile and unreferenced entities. Clock synchronization, algorithms, transaction; consistency and replication, data-centric & client-centric models, protocols; fault tolerance, process resilience, reliable client-server & group Communication, commit, recovery; security, channels, access, security control; distributed object-based systems explanation and comparison; distributed file systems (SUN, CODA) and comparison; distributed document-based system and coordination-based systems, multimedia systems, Parallel Programming Languages and Algorithms.

Suggested reference materials:
3. Joel M. Crichlow “An Introduction to Distributed & Parallel Computing” 2nd ed. PHI.
4. M. Sasikumar, Dinesh Shikhare P Ravi Prakash "Introduction to parallel Processing" PHI
5. Andrew S. Tanenbaum "Distributed Operating System" TMH
M12115-Software Construction (Design Pattern): Course Outlines

Introduction
Patterns in software engineering, definition and evolution, identifying patterns, representation, reflection, usage, refactoring and anti pattern.

J2EE & Design Pattern
Sum Java center J2EE patterns catalog, presentation Tier design considerations and Practices, Business Tier design considerations and Practices.

J2EE Refactoring
Presentation Tier Refactoring, Business and Integration Tier Refactoring, General refactoring.

Server side.com patterns
catalog, patterns applied to the web tier, patterns applied to a persistence framework, patterns to improve performance, scalability and security, pattern for enterprise integration, patterns applied to enable reusability, maintainability & extensibility.

VB .NET & Design Pattern
Patterns in the Data Tier, Middle Tier, Presentation Tier, .NET remoting.

References:
1. E. Gamma et. al., “Design Pattern, Elements of reusable object oriented software”, AWL
2. C. A. Berry et. al., “J2EE design patterns applied”, Wror/Spd, 2000
3. Deepak Alur, John Crupi, Dan Malks, “Core J2EE Patterns “, Pearson Educations
Models of synchronous and asynchronous distributed computing systems: synchronous networks, asynchronous shared memory, asynchronous networks; basic algorithms for synchronous and asynchronous networks: leader election, breadth first search, shortest path, minimum spanning tree; advanced synchronous algorithms: distributed consensus with failures, commit protocols; asynchronous shared memory algorithms: mutual exclusion and consensus; relationship between shared memory and network models; asynchronous networks with failures.

Suggested reference materials:

1. Nancy Lynch, "Distributed Algorithms" Morgan Kaufmann.
2. Gerlad Tel, “Introduction to Distributed Algorithms” Cambridge University Press
M.Tech. in Computer Science & Engineering (Information Security) Semester II

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

M12117-High Performance Scientific Computing: Course Outlines


Suggested texts and reference materials:

2. Lloyd D. Fosdick, Elizabeth R. Jessup, Carolyn "an introduction to High Performance Scientific computing" PHI
Faculty of Engineering & Technology

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

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

M12118-Database Engineering: Course Outlines


Deductive Databases: Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases.

Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.


Active Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery.


Image and Multimedia Databases: Modelling and Storage of Image and Multimedia Data, Data Structures - R-tree, k-d tree, Quadtrees, Content Based Retrieval: Color Histograms, Textures etc, Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio and Handwritten Data, Geographic Information Systems (GIS).

References

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

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

M12119-Information Retrieval: Course Outlines

Introduction to Information Retrieval: The nature of unstructured and semi-structured text. Inverted index and Boolean queries.


Advanced Topics: Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval.

Web Information Retrieval: Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS, XML and Semantic web.

References

3. Soumen Charabarti, Mining the Web, Morgan-Kaufmann.
4. Survey by Ed Greengrass available in the Internet.