

MAHATMA GANDHI UNIVERSITY



SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

INFORMATION TECHNOLOGY

WITH SPECIALIZATION

IN

NETWORK ENGINEERING

**SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME
IN INFORMATION TECHNOLOGY
WITH SPECIALIZATION IN
NETWORK ENGINEERING**

Semester II

Sl No.	Course No.	Subject	Hrs/Week			Evaluation Scheme (Marks)					Credits
						Sessional Exam (internal)			ESE	Total	
			L	T	P	TA	CT	Sub. Total			
1	MITNE 201	Web Security	3	1	0	25	25	50	100	150	4
2	MITNE 202	Advanced Distributed Systems	3	1	0	25	25	50	100	150	4
3	MITNE 203	Wireless & Mobile Networks	3	1	0	25	25	50	100	150	4
4	MITNE 204	Network Flow Algorithms	3	1	0	25	25	50	100	150	4
5	MITNE 205	Elective III	3	0	0	25	25	50	100	150	3
6	MITNE 206	Elective IV	3	0	0	25	25	50	100	150	3
7	MITNE 208	Network Simulation Lab	0	0	3	25	25	50	100	150	2
8	MITNE 207	Seminar II	0	0	2	50	-	50	0	50	1
Total			18	4	5	225	175	400	700	1100	25

MITNE 205	Elective – III	MITNE 206	Elective – IV General Paper
MITNE 205 – 1	Internet Routing Design	MITNE 206 - 1	Information Retrieval, Data Mining & Data Warehousing
MITNE 205 – 2	Ontology & Semantic Web	MITNE 206 - 2	Agent Based Intelligent Systems
MITNE 205 – 3	Complex Networks	MITNE 206 - 3	Bio Computing
MITNE 205 – 4	Distributed Algorithms	MITNE 206 - 4	Computer Vision

L – Lecture, **T** – Tutorial, **P** – Practical

TA – Teacher’s Assessment (Quizzes, attendance, group discussion, tutorials, seminars, field visit etc.)

CT – Class Test (Minimum of two tests to be conducted by the Institute)

ESE – University End Semester Examination will be conducted by the institute through concerned affiliating University.

Electives: New Electives may be added by the department according to the needs of emerging fields of technology. The name of the elective and its syllabus should be submitted to the University before the course is offered

L	T	P	C
3	1	0	4

Module I

Web application security- Key Problem factors – Core defence mechanisms- Handling user access-handling user input- Handling attackers – web spidering – Discovering hidden content
Transmitting data via the client – Hidden form fields – HTTP cookies – URL parameters – Handling client-side data securely – Attacking authentication – design flaws in authentication mechanisms – securing authentication

Attacking access controls – Common vulnerabilities – Securing access controls

Module II

SQL Injection - How it happens - Dynamic string building - Insecure Database Configuration - finding SQL injection – Exploiting SQL injection – Common techniques – identifying the database – UNION statements – Preventing SQL injection

Platform level defenses - Using run time protection - web application Firewalls - Using ModSecurity - Intercepting filters- Web server filters - application filters – securing the database – Locking down the application data – Locking down the Database server

Module III

Mod Security - Blocking common attacks – HTTP finger printing – Blocking proxied requests – Cross-site scripting – Cross-site request forgeries – Shell command execution attempts – Null byte attacks – Source code revelation – Directory traversal attacks – Blog spam – Website defacement – Brute force attack – Directory indexing – Detecting the real IP address of an attacker

Module IV

Web server Hacking - Source code disclosure – Canonicalization attacks – Denial of service – Web application hacking – Web crawling

Database Hacking – Database discovery – Database vulnerabilities

References

1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook, 2nd Edition, Wiley Publishing, Inc.
2. Justin Clarke, SQL Injection Attacks and Defense, 2009, Syngress Publication Inc.
3. Magnus Mischel , ModSecurity 2.5, Packt Publishing

Stuart McClure Joel, ScambRay, George Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Seventh Edition, 2012, The McGraw-Hill Companies

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Module I

Overlay Networks : Introduction - Routing Overlays - Structured Overlays - Unstructured Overlays.
Peer to Peer Systems : P2P Network Architectures - Structured P2P Systems - Unstructured (Mesh) P2P Systems - Hybrid P2P Systems - Video Streaming Network Architecture. Topology Control - Structured Topology Control - Unstructured Topology Control. Trust - EigenTrust - PeerTrust – FuzzyTrust. Case Study : Gnutella

Module II

Cluster Computing : Architecture – Classifications. High Speed Networks - Fast Ethernet - High Performance Parallel Interface - Asynchronous Transfer Mode– Infiny Band– Myrinet. Network RAM – Distributed Shared Memory. Case Study : Beowulf Cluster
Grid Computing : Services-Grid Standards – OGSA, WSRF, Grid Monitoring Architecture (GMA), Grid Security- PKI-X509 Certificates, Grid Scheduling and Resource Management, Grid Data Management, Grid Portals, Grid Middleware Case Study : Globus Toolkit

Module III

Cloud Computing Fundamentals : Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models - Cloud Security - Cloud Infrastructure Mechanisms - Specialized Cloud Mechanisms - Cloud Management Mechanisms - Cloud Security Mechanisms. Cloud Computing Architectures - Fundamental Cloud Architectures - Advanced Cloud Architectures - Specialized Cloud Architectures.

Module IV

Cloud Computing Technologies : Data in the cloud: Relational databases – Amazon RDS- Google Cloud SQL, No SQL databases - Amazon DynamoDB-Mongo DB. Cloud file systems: GFS and HDFS, BigTable, HBase.

Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce, Features and comparisons among GFS,HDFS etc, Map-Reduce model case study: Google.

TEXT BOOKS

1. Overlay Networks: Toward Information Networking, Sasu Tarkoma, CRC Press
2. Peer-to-Peer Computing: Applications, Architecture, Protocols, and Challenges, Yu-Kwong Ricky Kwok, CRC Press
3. High Performance Cluster Computing: Architectures and Systems, Volume 1, Rajkumar Buyya, Prentice Hall
4. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl; Zaigham Mahmood; Ricardo Puttini, Prentice Hall

References

- 1.George Coulouris, Jean Dellimore Tim Kindberg ,”Distributed Systems – Concepts and designing” Fifth Edition, Pearson Education Asia
- 2.Kai Hwang ,Jack Dongarra, Geoffrey Fox , Distributed and Cloud Computing, 1st Edition, Morgan Kaufmann
- 3.Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Elsevier Series, 2004.
- 4.Vladimir Silva, Grid Computing for Developers, Charles River Media, January 2006.
5. Rajkumar Buyya, High Performance Cluster Computing: Architectures and Systems, Pearson
6. Andrei Gurtov, Dmitry Korzun , Structured Peer-to-peer Systems, Springer
7. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
- 8.Enterprise Cloud Computing by Gautam Shroff,Cambridge
- 9.Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
- 10.Google Apps by Scott Granneman,Pearson

11. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
12. Cloud Computing Bible by Barrie Sosinsky, Wiley India
13. Stefano Ferretti et.al. "QoS aware Clouds", QoS , 2010 IEEE 3rd International Conference on Cloud Computing
14. Andrew S. Tenenbaum, "Distributed Operating Systems", Pearson Education Asia
15. Pradeep. K.Sinha , "Distributed Operating Systems- Concepts and designing" , PHI
16. MapReduce Design Patterns, O'Reilly
17. Computer Networks – A Systems Approach, Larry L. Peterson and Bruce S. Davie, The Morgan Kaufmann Series in Networking

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3	1	0	4

Module I: Overview of Wireless Networks

Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer- MAC Management Sublayer- Wireless ATM - HIPERLAN- HIPERLAN-2, WiMax, Wireless Local Loop (WLL). Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, CDMA2000 overview- Radio and Network components, Network structure. 4G features and challenges, Technology path, IMS Architecture, Convergent Devices, 4G technologies, Advanced Broadband Wireless Access and Services.

Module II: Mobile and Adhoc Networks

Introduction to Mobile Networks, Heterogeneity in Mobile Devices, Types of Mobile Communications, Types of Mobile Host Movements, Challenges Facing Mobile Networks, Introduction to Ad-hoc Wireless Networks, Overview, MAC Protocols. Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, DSDV, WRP, AODV, DSR, TORA.

Module III: Wireless Sensor Networks

Introduction to Wireless Sensor Networks, Overview, Characteristics, Network Applications, Design Objectives, Technological Background, Wireless Sensor Networks Architecture, Classification, Protocol stack, MAC Protocols. Routing Protocols – Flat – Architectural Protocols – Hierarchical Protocols – Geographic Routing Protocols – QoS Based Protocols. Time Synchronization – Localization and Positioning – Topology Management.

Module IV: Special Wireless Sensor Networks

Wireless Sensor and Actor Networks – Network Architecture – Sensor Actor Coordination – Actor Actor Coordination. Wireless Multimedia Sensor Networks – Network Architecture. Wireless Underwater Sensor Networks – Network components – Communication Architecture – Basics of Acoustic Propagation. Wireless Underground Sensor Networks – Applications – Network Architecture – Communication.

TEXT BOOKS

1. Ian F. Akyildiz and Mehmet Can Vuran, Wireless Sensor Networks, Wiley
2. Siva Ram Murthy C. and Manoj B. S., "Ad Hoc Wireless Networks: Architectures and Protocols", 2nd Edn. Pearson Education 2005

References:

1. Imielinski T. and Korth H.F., "Mobile Computing", Kluwer Academic Publishers, 1996.
2. William Stallings, "Wireless Communications and Networks", Prentice Hall, 2004.
3. Clint Smith. P.E., and Daniel Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.
4. Carlos de Moraes Cordeiro and Dharma Prakash Agrawal, "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific, 2007.
5. Toh C. K., "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.
6. Yi-Bing and Imrich Chlamtac, "Wireless and Mobile Networks Architectures", John Wiley & Sons, 2001.
7. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers,
8. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006
9. Fie Hu, Xiaojun Cao, Wireless Sensor Networks – Principles and Practice, CRC Press

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Module I

Network flow problems, Network representations, network transformations, Complexity Analysis, Developing Polynomial time algorithms, Search Algorithms, Flow Decomposition algorithms

Module II

Shortest Paths: Label Setting Algorithms – Dijkstra’s Algorithm, Dial’s implementation, Heap Implementation, Radix Heap Implementation

Shortest Paths : Label Correcting Algorithms – Generic Label Correcting algorithms, Special implementations of the modified label correcting algorithm, detecting negative cycles, All pairs shortest path problem

Module III

Maximum Flows : Generic Augmenting path algorithm, Labeling algorithm and Max- Flow Min – cut theorem, Capacity Scaling Algorithm, Distance labels and layered networks, Generic pre flow push algorithm, FIFO pre flow push algorithm,

Minimum Cost flows : Optimality conditions, Cycle canceling algorithm and the integrity property, Successive shortest path algorithm, Primal – dual algorithm, Out – of Kilter Algorithm, Capacity scaling algorithm, Cost scaling algorithm

Module IV

Minimum Spanning Trees – Kruskal’s algorithm, Prim’s Algorithm, Sollin’s Algorithm, Convex Cost Flows – Pseudo Polynomial time algorithm, polynomial time algorithm

Generalized Flows – Augmented forest structures, determining potentials and flows for an augmented forest structure, generalized network simplex algorithm

References

1. Ravindra K. Ahuja, Thomas L. Magnanti, James B. Orlin, Network Flows – “Theory, Algorithms and Applications”, Prentice Hall
2. Mokhtar S. Bazaraa, John J. Jarvis, Hanif D. Sherali, “Linear Programming And Network Flows”, John Wiley & Sons, 4th Edition,
3. Gunther Ruhe, Kluwer, “Algorithmic Aspects Of Flows In Networks”, Academic Publishers Group
4. Michael W. Lucas, “Network Flow Analysis”, , No Starch Press
5. Alexander Engau, Vdm Verlag Dr. Muller, “Semi-Simultaneous Flows In Multiple Networks”, Aktiengesellschaft & Co. Kg
6. Wai-kai Che, John Wiley, “Theory Of Nets: Flows In Network”s,
7. Ulrich Derigs, “Programming In Networks And Graphs: On The Combinatorial Background And Near-Equivalence Of Network Flow And Matching Algorithms”,
8. Ford L. R. Jr. , Robert G. Bland, Fulkerson D. R, “Flows In Networks”, Princeton University Press.
9. Alexander Hall, Vdm Verlag Dr. Mueller E. K, “Scheduling And Flow-Related Problems In Networks”
10. Pioro M, Routing, “Flow And Capacity Design In Communication And Computer Networks”, Elsevier India Private Limited

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Module I

ROUTING PROTOCOLS: FRAMEWORK AND PRINCIPLES : Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing, Protocol, Link Cost.

Module II

INTERNET ROUTING AND ROUTER ARCHITECTURES : Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy- Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability. Router Architectures: Functions, Types, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures

Module III

ANALYSIS OF NETWORK ALGORITHMS : Network Bottleneck, Network Algorithmics, Strawman solutions, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms. IP Address Lookup Algorithms : Impact, Address Aggregation, Longest Prefix Matching, Naïve Algorithms, Binary , Multibit and Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches IP Packet Filtering and Classification : Classification, Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for d Dimensions,

Module IV

QUALITY OF SERVICE ROUTING : QoS Attributes, Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching , Routing Protocols for QoS Routing.

ROUTING AND TRAFFIC ENGINEERING : Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Problem Illustration: Layer 3 VPN, LSP Path Determination: Constrained Shortest Path Approach, LSP Path Determination: Network Flow Modeling Approach, Layer 2 VPN Traffic Engineering, Observations and General Modeling Framework, Routing/Traffic Engineering for Voice Over MPLS.

References

1. Network Routing: Algorithms, Protocols, and Architectures Deepankar Medhi and Karthikeyan Ramasamy (Morgan Kaufmann Series in Networking)
2. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)
3. TCP/IP Protocol Suite, (B.A. Forouzum) Tata McGraw Hill Edition, Third Edition
4. TCP/IP Volume 1,2,3 (N. Richard Steveus Addison Wesley)
5. Computer Networks (A.S. Taueubaum) Pearson Edition, 4th Edition

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Module I

INTRODUCTION : Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background -Sample - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need –Foundation – Layers – Architecture

Module II

LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES : Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM- OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL - DAML + OIL- OWL

Module III

ONTOLOGY LEARNING FOR SEMANTIC WEB : Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms -Evaluation

Module IV

ONTOLOGY MANAGEMENT AND TOOLS : Overview – need for management – development process – target ontology – ontology mapping – skills management system – ontological class – constraints – issues. Evolution– Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

References

1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez “Ontological Engineering: with examples from the areas of Knowledge Management, e- Commerce and the Semantic Web” Springer, 2004
2. Grigoris Antoniou, Frank van Harmelen, “A Semantic Web Primer (Cooperative Information Systems)”, The MIT Press, 2004
3. Alexander Maedche, “Ontology Learning for the Semantic Web”, Springer; 1 edition, 2002
4. John Davies, Dieter Fensel, Frank Van Harmelen, “Towards the Semantic Web: Ontology – Driven Knowledge Management”, John Wiley & Sons Ltd., 2003.
5. John Davies (Editor), Rudi Studer (Co-Editor), Paul Warren (Co-Editor) “Semantic Web Technologies: Trends and Research in Ontology-based Systems”Wiley Publications, Jul 2006
6. Dieter Fensel (Editor), Wolfgang Wahlster, Henry Lieberman, James Hendler, “Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential”, The MIT Press, 2002
7. Mining the Web, Discovering Knowledge from Hypertext Data, Elsevier, Soumen Chakrabarti, Morgan Kaufmann publishers

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Module I

Introduction to model of synchronous distributed computing system, Leader election in a General Network - Simple Flooding Algorithm, Basic Breadth-First Search Algorithm., Bellman-Ford algorithm.

Module II

Algorithms in Synchronous Networks, Minimum Spanning Tree, Leader Election in a Synchronous Ring , LCR algorithm, HS algorithm, Time Slice Algorithm, Variable Speeds Algorithm, Lower Bound for Comparison-Based Algorithms

Maximal Independent Set, LubyMIS algorithm. Distributed Consensus with Link Failures and Process Failures – Basics

Module III

Introduction to model of asynchronous distributed computing system, Send/Receive systems, Broadcast systems, Multicast systems, Basic algorithms, Peterson Leader-Election Algorithm, Local Synchronizer, Safe Synchronizer.

Module IV

Asynchronous System Model. Shared Memory Systems, Environment Model, Shared Variable Types, Mutual Exclusion - Asynchronous Shared Memory Model, Dijkstra's Mutual Exclusion Algorithm. Resource Allocation - Nonexistence of Symmetric Dining Philosophers Algorithms, Right-Left Dining Philosophers Algorithm, mutual exclusion and consensus, relationship between shared memory and network models, asynchronous networks with failures

References

1. Nancy A. Lynch, Morgan," Distributed Algorithms", Kaufmann Publishers, Inc
2. Wolfgang Reisig, W. Reisig, "Elements Of Distributed Algorithms: Modeling And Analysis With Petri Nets", Springer-verlag
3. Tel Gerard , "Introduction To Distributed Algorithms", 2nd Edition, Cambridge University Press
4. Sukumar Ghosh, "Distributed Systems: An Algorithmic Approach (Hardcover)", Chapman & Hall/crc
5. Valmir C. Barbosa,"An Introduction To Distributed Algorithms", Mit Press
6. Randy Chow, Theodore Johnson, "Distributed Operating Systems and Algorithm Analysis, , Pearson Education
7. Santoro N., Nicola Santoro, "Design And Analysis Of Distributed Algorithms", Wiley-interscience
8. Fionnuala O'donnell, Vdm Verlag Dr. Muller, "A Simulated Framework For The Teaching Of Distributed Algorithms", Aktiengesellschaft & Co. Kg
9. Ajay D. Kshemkalyani, Mukesh Singhal, "Distributed Computing - Principles, Algorithms, And Systems", Cambridge University Press

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Module I

Types of network: Social networks, Information networks, Technological networks, Biological networks.

Properties of network: Small world effect, transitivity and clustering, degree distribution, scale free networks, maximum degree; network resilience; mixing patterns; degree correlations; community structures; network navigation.

Module II

Random Graphs: Poisson random graphs, generalized random graphs, the configuration model, power-law degree distribution, directed graph, bipartite graph, degree correlations.

Module III

Models of network growth: Price's model, Barabasi and Albert's model, other growth models, vertex copying models.

Processes taking place on networks: Percolation theory and network resilience, Epidemiological processes.

Module IV

Applications: Search on networks, exhaustive network search, guided network search, network navigation; network visualization.

References

1. S. N. Dorogovtsev and J. F. F. Mendes, Evolution of Networks, Oxford University Press.
2. Narsingh Deo, Graph Theory, Prentice Hall of India.

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Module I

Study some basic concepts of information retrieval and data mining, such as the concept of relevance, association rules, and knowledge discovery. Basic IR Models: Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity. Various indexing techniques for textual information items, such as inverted indices, tokenization, stemming and stop words. Query Operations and Languages: Relevance feedback, pseudo relevance feedback and Query expansion; Evaluation of Retrieval Performance : Measurements: Average precision, NDCG, etc. Cranfield paradigm and TREC conferences. Text Representation: Word statistics; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Metadata and markup languages (SGML, HTML, XML). Web Search: Search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, Google PageRank);

Module II

Text Categorization: Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Language-Model Based Retrieval: Using naive Bayes text classification for ad hoc retrieval. Improved smoothing for document retrieval. Text Clustering: Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Evolution of Decision Support Systems- Data warehousing Components –Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP ,OLTP, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations. Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Data Warehousing and Business Intelligence Trends

Module III

Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating - Mining frequent patterns- association rule mining. Frequent item set mining methods – Apriori, FP growth, Correlation Analysis

Module V

Decision Tree Induction - Bayesian Classification – Rule Based Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – , Partitioning methods- k-means- Hierarchical Methods - distance-based agglomerative and divisible clustering, Density-Based Methods – expectation maximization - Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis: Statistical approaches-Proximity based approaches-Clustering and Classification based approaches, Practical retrieval and data mining applications. Currently available tools. Advanced Techniques : Web Mining, Spatial Mining, Text Mining

TEXT BOOKS

1. Ricardo Baexa-Yates & Berthier Ribeiro-Neto Modern Information Retrieval,Addison Wesley Longman,1999
2. Introduction to Information Retrieval by Christopher D. Manning, Prabhakar Raghavan and Hinrich Schtze Cambridge University Press in 2008 <http://nlp.stanford.edu/IR-book/>
3. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, third edition 2011, ISBN: 1558604898.

4. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", TataMc Graw Hill Edition, Tenth Reprint 2007.
5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
6. MargaretH. Dunham, S.Sridhar, "Data Mining : Introductory and Advanced Topics", Pearson Education.
7. Mining the Web, Discovering Knowledge from Hypertext Data, Elsevier, Soumen Chakrabarti, Morgan Kaufmann publishers.

REFERENCES

1. Mehmed kantardzic, "Data mining concepts,models,methods, and algorithms", Wiley Interscience, 2003.
2. Ian Witten, Eibe Frank, "Data Mining; Practical Machine Learning Tools and Techniques", third edition, Morgan Kaufmann, 2011.
3. George M Marakas, "Modern Data Warehousing, Mining and Visualization", Prentice Hall, 2003
4. Sergey Brin and Lawrence page, The anatomy of large scale hyper textual(Web) search engine, Computer Networks and ISDN systems, Vol 30,No 1-7
5. J Kleinberg, et. Al, The Web as a graph: Measurements, models and methods,

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Module I

Artificial Intelligence – intelligent agents – Environment – Structure of agents – Agent types – Problem solving agents – Uninformed Search strategies – Informed Search and Exploration – Adversarial Search.

Module II

Knowledge and reasoning – Knowledge Based Agents – First order logic – Reasoning – Backward chaining – Resolution – Knowledge representation – Handling uncertain knowledge – Reasoning under uncertainty – Statistical reasoning.

Module III

Planning – Components of planning systems – Planning with state space search – Partial order planning – Planning Graphs – Hierarchical planning – Multi agent planning.

Module IV

Learning – forms of learning – Inductive learning – Learning decision trees – Explanation based learning – Statistical learning – Instance based learning – Neural networks – Reinforcement learning.

Agent oriented programming language – KQML as an agent communication language – Java implementation of intelligent agents JADE – Languages supporting mobility – Telescript.

References

1. Software Agents: Jeffrey M. Broadshaw, AAAI Press (1997)
2. Multi agent System – A modern approach to distributed artificial intelligence: Gerhard Weiss, MIT Press (2000)
3. Artificial intelligence. A modern approach by Stuart Russell & Peter Norvig.
4. Artificial Intelligence by Elaine Rich & Kevin Knight.

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MODULE I

Molecular Biology and Biological Chemistry - The Genetic Material, Gene Structure and Information Content, Protein Structure and Function, The Nature of Chemical Bonds, Molecular Biology Tools, Genomic Information Content, Major Databases in Bioinformatics

Information Search and Data Retrieval- Tools for Web Search, Data Retrieval Tools, Data Mining of Biological Databases

Gene Analysis and Gene Mapping- Genome Analysis, Genome Mapping, Physical Maps, Cloning The Entire Genome, Genome Sequencing, The Human Genome Project (HGP)

MODULE II

Alignment of Pairs of Sequences - Methods of Sequence Alignments, Using Scoring Matrices, Measuring Sequence Detection Efficiency, Methods of Multiple Sequence Alignment, Evaluating Multiple Alignments, Phylogenetic Analysis, Tree Evaluation

Tools for Similarity Search and Sequence Alignment – Working with FASTA, BLAST, FASTA and BLAST Algorithms Comparison

Module III

Profiles and Hidden Markov Models - Using Profiles, Hidden Markov Models

Gene Identification and Prediction – Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods

Gene Expression and Microarrays – Working with DNA Microarrays, Clustering Gene Expression Profiles, Data Sources and Tools for Microarray Analysis, Applications of Microarray Technology

Module IV

Protein Classification and Structure Visualization - Protein Structure Visualization, Protein Structure Databases, Protein Structure Alignment, Domain Architecture Databases, Protein Classification Approaches, Protein Identification and Characterization, Primary and Secondary Structure Analysis and Prediction, Patterns and Fingerprints Search, Methods of 2D Structure Prediction, Protein Prediction from a DNA Sequence

Proteomics – Tools and Techniques in Proteomics, Protein-Protein Interactions, Methods of Gene Family Identification

Computational Methods for Pathways and Systems Biology – Analysis of Pathways, Metabolic Control Analysis, Simulation of Cellular Activities, Biological Markup Languages

References

1. S C Rastogi, N Mendiratta, P Rastogi, Bioinformatics Methods and Applications Genomics, Proteomics and Drug Discovery, Third Edition, PHI Learning Private Limited, 2011
2. Vittal R Srinivas, Bioinformatics A modern Approach, PHI Learning Private Limited, 2009
3. Bryan Bergeron, Bioinformatics Computing PHI Learning Private Limited, 2010
4. Dan E Krane, Michael L Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003
5. T K Attwood, D J Parry Smith, Introduction to Bioinformatics, Pearson Education, 2003.

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Module I

Digital Image Fundamentals: - Digital image Representation – Functional Units of an Image processing system. Visual perception – Image Model _ Image sampling and Quantization – grayscale resolution – pixel relationship – image geometry Image Transforms – Unitary Transform, Discrete Fourier Transform, Cosine Transform, Sine Transform, Hadamard Transform, Slant and KL Transform.

Module II

Image Enhancement – Histogram processing – Spatial operations – Image smoothing – Image Sharpening – Color Image Processing methods- Color Image Models.

Image restoration and compression Degradation Model – Discrete Formulation – Circulant matrices – Constrained and Unconstrained restoration geometric transformations fundamentals – Compression Models – Error Free Compression – Lossy Compression – International Image Compression Standards.

Module III

Image Analysis and Computer Vision: Spatial feature Extraction – Transform feature – Edge detection-Boundary Representation-Region Representation-Moment Representation- Structure-Shape Features-Texture-Scene Matching and Detection-Image Segmentation- Classification techniques-Morphology-Interpolation.

Module IV

Sensing 3D shape: how the 3rd dimension changes the problem. Stereo 3D description, 3D model, matching, TINA, Direct 3D sensing-structured light, range finders, range image segmentation Emerging IT applications: Recognition of characters, Fingerprints and faces-Image databases.

Text Books

1. Fundamentals of Digital Image Processing-A. K. Jain
2. Image Processing and machine vision-Milan Sonka,Vaclav Hlavac

Reference Books

1. Pattern Recognition Principles-J.T. Tou and R. C. Gonzalez
2. Syntactic Pattern Recognition and applications. King Sun Fun
3. Computer vision-Fairhurst (PHI).

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Lab Experiments based on the courses MITNE 203 and implementation of basic protocols of computer network.

Experiment list:

- Familiarizing Network Simulator – 2 (NS2) with suitable examples
- Simulate a wired network consisting of TCP and UDP Traffic using NS2 and then calculate their respective throughput using AWK script.
- Performance evaluation of different routing protocols in wired network environment using NS2
- Performance evaluation of different queues and effect of queues and buffers in wired network environment using NS2
- Compare the behavior of different variants of TCP (Tahoe, Reno, Vegas....) in wired network using NS2. Comparison can be done on the congestion window behavior by plotting graph.
- Simulation of wireless Ad hoc networks using NS2
- Simulate a wireless network consisting of TCP and UDP Traffic using NS2 and then calculate their respective throughput using AWK script.
- Performance evaluation of different ad-hoc wireless routing protocols (DSDV, DSR, AODV ...) using NS2
- Create different Wired-cum-Wireless networks and MobileIP Simulations using NS2.

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Each student shall present a seminar on any topic of interest related to the core / elective courses offered in the first semester of the M. Tech. Programme. He / she shall select the topic based on the References: from reputed International Journals, preferably IEEE journals. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted.