Information Technology Department
Goa College of Engineering

Master of Engineering, Information Technology and Engineering

Scheme of Instruction and Syllabus

The credit distribution in this proposed MITE is not as per existing ME courses under Goa University. However the proposed scheme is inline with ordinance OC 11.A.5 of Goa University.

Scheme of Teaching and Examination for
Master of Information Technology and Engineering
Two years Full time Course

Semester-I										
Subject Code	Subject	Hours per week			Scheme of Examination					
						Credits				Total Credits
		L	T	P	Theory (Hrs)	Theory	IA	Practical	Oral	
MITE 1.1	Mathematical Foundations of Computer Science	4	-	-	4	3	1	-	-	4
MITE 1.2	Advanced Data Structures	4	-	-	4	3	1	-	-	4
MITE 1.3	Intelligent and Learning Systems	4	-	-	4	3	1	-	-	4
MITE 1.4	Constrained Networks	4	-	-	4	3	1	-	-	4
MITE 1.5	Elective –I	4	-	-	4	3	1	-	-	4
MITE 1.6	Advanced Data Structures & Intelligent Systems Lab	-	-	4	-	-	-	2	-	2
	Total	**20**	**0**	**4**	**20**	**15**	**5**	**2**	**-**	**22**

Semester-II										
Subject Code	Subject	Hours per week			Scheme of Examination					
						Credits				Total Credits
		L	T	P	Theory (Hrs)	Theory	IA	Practical	Oral	
MITE 2.1	Research Methodology	4	-	-	4	3	1	-	-	4
MITE 2.2	Security in Constrained Networks	4	-	-	4	3	1	-	-	4
MITE 2.3	Computational Theory and Algorithms	4	-	-	4	3	1	-	-	4
MITE 2.4	Techniques in Optimization	4	-	-	4	3	1	-	-	4
MITE 2.5	Elective –II	4	-	-	4	3	1	-	-	4
MITE 2.6	Algorithms & Cryptography Lab	-	-	4	-	-	-	2	-	2
	Total	**20**	**0**	**4**	**20**	**15**	**5**	**2**	**-**	**22**

Semester-III										
Subject Code	Subject	Hours per week			Scheme of Examination					
		L	T	P	Theory (Hrs)	Credits				Total Credits
						Theory	IA	Practical	Oral	
MITE 3.1	Pattern Recognition	4	-	-	4	3	1	-	-	4
MITE 3.2	Elective – III	4	-	-	4	3	1	-	-	4
MITE 3.3	Project	-	-	16	-	-	2	-	6	8
MITE 3.4	Research Seminar	-	-	6	-	-	3	-	-	3
	Total	**8**	**0**	**22**	**8**	**6**	**7**	**-**	**6**	**19**

Semester-IV										
Subject Code	Subject	Hours per week			Scheme of Examination					
		L	T	P	Theory (Hrs)	Credits				Total Credits
						Theory	IA	Practical	Oral	
MITE 4.1	Dissertation	-	-	24	-	-	4	-	8	12
	Total	**0**	**0**	**24**	**0**	**-**	**4**	**-**	**8**	**12**

MITE 1.5 Elective – I	**MITE 2.5 Elective –II**	**MITE 3.2 Elective –III**
MITE 1.5.E-I.1 Real -Time and Embedded Systems	**MITE 2.5.E-II.1** Virtualization Techniques	**MITE 3.2.E-III.1** Bioinformatics
MITE 1.5.E-I.2. Information Storage and Retrieval	**MITE 2.5.E-II.2** User Interface Design	**MITE 3.2.E-III.2** Digital Signal Compression
MITE 1.5.E-I.3. Ontology and Semantic Web	**MITE 2.5.E-II.3** Business Intelligence	**MITE 3.2.E-III.3** Virtual Reality
MITE 1.5.E-I.4 Internet and Web Technologies	**MITE 2.5.E-II.4** Cloud Computing	**MITE 3.2.E-III.4**Big Data Technology
MITE 1.5.E-I.5 Mobile and Pervasive Computing	**MITE 2.5.E-II.5** Mobile Robotics	**MITE 3.2.E-III.5** Cyber Crime and Computer Forensics
MITE 1.5.E-I.6 Natural Language Processing	**MITE 2.5.E-II.6**. Wireless Sensor Networks	**MITE 3.2.E-III.6** Game Theory
MITE 1.5.E-I.7. Soft Computing	**MITE 2.5.E-II.7** Artificial Intelligence for Robotics	**MITE 3.2.E-III.7** Sensor and Data Fusion
		MITE 3.2.E-III.8 Entrepreneurship skill development

Techniques for theorem proving: Direct Proof, Proof by Contra position, Proof by exhausting cases and proof by contradiction, Linear-time temporal logic and Branching-time logic-Syntax, Semantics, Practical patterns of specifications, Important equivalences, Adequate sets of connectives. Principle of mathematical induction, principle of complete induction. Recursive definitions, Generating functions, function of sequences calculating coefficient of generating function, solving recurrence relation by substitution and generating functions Solution methods for linear, first-order recurrence relations with constant coefficient, characteristic roots. [16 hours]

Divisibility, gcd, prime numbers, fundamental theorem of arithmetic, Congruences, Fermat's theorem, Euler function, primality testing, solution of congruences, Chinese remainder theorem.

[6 hours]

Fundamental principles of counting, pigeonhole principle, countable and uncountable sets, principle of inclusion and exclusion – applications, derangements, permutation and combination, Pascal's triangles, binomial theorem.

[10 hours]

Graphs, Terminology, Euler tours, planar graphs, Hamiltonian graphs, Euler's formula (proof), four colour problem (without proof) and the chromatic number of a graph, five colour theorem, chromatic polynomials, Warshall's algorithm, Decision Trees, weighted trees

Groups and subgroups, homomorphism theorems, cosets and normal subgroups, Lagrange's theorem, rings , finite fields, polynomial arithmetic, quadratic residues, reciprocity, discrete logarithms, elliptic curve arithmetic.

[16 hours]

Propositional calculus – propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility – natural deduction system and axiom system; Soundness and completeness.

[16 hours]

Recommended Readings:

1. Richard Johnson, Probablity and Statistics for Engineers, 7/e, Prentice-Hall India Private Limited, 2005.
2. Robert V. Hogg, Elliot A. Tanis, Meda J. M. Rao, Probability and Statistical Inference,7/e,, Pearson Education India, 2006.
3. Michael Huth, Mark Ryan, Logic in Computer Science, 2/e, Cambridge University Press,2004.
4. J. Truss, Discrete Mathematics for Computer Scientists, 2/e, Addison Wesley, 1999.
5. Bernard Kolman, Robert C Busby, SharonKutler Ross, Discrete Mathematical Structures, 2/e, Prentice-Hall India Private Limited, 1996.
6. E. Mendelsohn, Introduction to Mathematical Logic, 2nd ed. Van-Nostrand, London, 1979.
7. L. Zhongwan: Mathematical Logic for Computer Science, World Scientific, Singapore, 1989
8. J. P. Tremblay, R. Manohar, Discrete Mathematical Structures with Application to Computer Science, Tata McGrawHill, 2000, 1st Edition.
9. Kenneth H. Rosen, Discrete Mathematics and its Applications, 7/e, McGraw Hill Inc,2011

Review of basic data structures ,searching and sorting techniques..Recursion: Solution, refinement and analysis, application to various search problems like game trees, tail recursion and when not to use recursion.

[12 hours]

Priority queues and heaps : Binomial heaps, Leftist heaps, Skewed heaps, Fibonacci heaps and its amortized analysis, Applications to minimum spanning tree algorithms ,dictionaries, hash tables, bloom filters. Hashing: Hash function, collision resolution using methods, analysis of hashing, symbol tables . [16 hours]

Tree: Definition and terminologies, BST: AVL tree, balance multi way search tree, Splay trees, Amortized analysis, 2-3 trees, 2-3-4 trees, red and black tree, B tree, B+ tree, Suffice trees ,Tries, Fusion tree. [18 hours]

Graph: Traversals, MST, Shortest path algorithm, graph colouring-chromatic number, algorithm for transitive closure, topological sort, critical path and network algorithms. [18 hours]

Recommended Readings:

1. S.Sahni ,Data structures, Algorithms and Applications in Java, Universities Press, 2/e, 2005.
2. Adam Drozdek , Data structures and Algorithms in Java, ,3rd edition, Cengage Learning.
3. M.A.Weiss ,Data structures and Algorithm Analysis in Java, 2nd edition, Addison-Wesley (Pearson Education).
4. Horowitz &Sahani , Fundamental of Data Structures, [Galgotia], 2/e 2002.
5. Deitel and Deitel , Java for Programmers, ,Pearson education ,2/e, 2012.
6. R.Lafore, Data structures and Algorithms in Java, Pearson education, 2/e, 2002.
7. Herbert Schildt , Java: The Complete Reference, 8th editon, , TMH.
8. M.T.Goodrich, R.Tomassia ,Data structures and Algorithms in Java, 3rd edition
9. Peter Brass, Advanced Data Structures, Cambridge University Press 2008.

Structures and strategies for state space search: Graph theory, strategies for state space search

Control and implementation of state space search: Recursion-based search, Pattern-based search.

Knowledge Representation: Issues in knowledge representation, Brief history of AI representation systems, Conceptual graphs, alternatives to explicit representation. [14 hours]

Strong method problem solving: overview of expert system technology, Rule based expert system, Model based, case based and hybrid systems, planning.

Planning and Acting in the Real World Time: Hierarchical Task Network Planning, Planning and Acting in Nondeterministic Domains, Conditional Planning, Execution Monitoring, Continuous Planning, Multi-Agent Planning. [16 hours]

Machine learning ,symbol based: A framework for symbol based learning, version space search, Inductive bias and learn ability, unsupervised learning, Reinforcement learning.

Machine Learning ,Connectionist: Foundation of connectionist network, Perceptron learning, Backpropogation learning, competitive learning, Hebbian coincidence Learning. [18 hours]

Fuzzy systems : fundamentals of fuzzy sets, fuzzy set relations ,fuzzy set operations and their properties, fuzzy logic fundamentals, fuzzy control basics, fuzzy control expert systems. [16 hours]

Recommended Readings:

1. George F. Lugar , Artificial Intelligence structure and strategies for complex problem solving, 3/e
2. Stuart Russell, Peter Norvig, Artificial Intelligence – A Modern Approach, 2nd Edition Pearson Publication.
3. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Pearson Publication.
4. Satish Kumar, Neural Network,a classroom approach.
5. Rajasekharan and Rai , Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by– PHI Publication. 2/e

Internet/Web and Networking : OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Web Servers, Introduction to Cloud Computing. [8 hours]

IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. [8 hours]

Network Fundamentals: Overview and working principle of Wired Networking equipment's , Overview and working principle of Wireless Networking equipment's . Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions. [8 hours]

The IoT Networking Core : Technologies involved in IoT Development. [2 hours]

IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols, The Layering concepts ,IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN. [10 hours]

IoT Application Protocols : MQTT, REST/HTTP, CoAP, MySQL. [4 hours]

IoT Back-end Application Designing : Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB, Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools. [12 hours]

Case Study &IoT Applications:

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino) [12 hours]

Recommended Readings:

1. Zach Shelby, Carsten Bormann, 6LoWPAN: The Wireless Embedded Internet, Wiley, 2009.
2. Dr. OvidiuVermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers,1/e, 2013.
3. Jean-Philippe Vasseur, Adam Dunkels , Morgan Kuffmann ,Interconnecting Smart Objects with IP: The Next Internet, , 1/e, 2010.
4. Vijay Madisetti , Arshdeep Bahga ,Internet of Things (A Hands-on-Approach) , 2014.
5. Adrian McEwen , Hakim Cassimally, Designing the Internet of Things , 1/e, 2013.
6. Stallings William ,Data and Computer Communications ; Pearson Education , 6th Edition.
7. F. Adelstein and S.K.S. Gupta, Fundamentals of Mobile and Pervasive Computing, McGraw Hill, 2009.
8. Barrie Sosinsky , Cloud Computing Bible, Wiley-India, 2010.
9. RonaldL. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010.

MITE 1.5 ELECTIVE –I

Embedded Computing: Embedded Architecture **,** Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process-Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design-Structural Description, Behavioral Description, Design Example: Model Train Controller. [12 hours]

Computing Platform And Design Analysis: Embedded Processor And Computing Platform , ARM processor-processor and memory organization, Data operations, Flow of Control, SHARC processor-Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.
[16 hours]

Hardware Accelerates & Networks: Distributed Embedded Architecture-Hardware and Software Architectures, Networks for embedded systems-I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design,Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.
[12 hours]

Real-Time Characteristics : Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus Online scheduling. [12 hours]

Case Study: System Design Techniques**,**Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example: Telephone PBX-System Architecture, Ink jet printer-Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes. [12 hours]

Recommended Readings:

1. Wayne Wolf,,Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
2. C. M. Krishna and K. G. Shin , Real-Time Systems, McGraw-Hill, 1997
3. Frank Vahid and Tony Givargi, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, 2000.
4. David E-Simon, An Embedded Software Primer, Pearson Education, 2007.
5. K.V.K.K.Prasad, Embedded Real-Time Systems: Concepts, Design &Programming, Dreamtech press, 2005.
6. Tim Wilmshurst, An Introduction to the Design of Small Scale Embedded Systems, Pal grave Publisher, 2004

Introduction: Motivation: Information versus Data Retrieval, Information retrieval at the center of the stage; Basic Concepts: The user task, Logical view of the documents; Past, Present and Future: Early developments, Information Retrieval in the library, The web and digital libraries; The Retrieval Process. [4 hours]

Boolean retrieval: An example information retrieval problem; A first take at building an inverted index; Processing Boolean queries; The extended Boolean model versus ranked retrieval.
The term vocabulary and postings lists: Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries. [10 hours]

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction.
Index construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes . [10 hours]

Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.
Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, Variant tf-idf functions.
Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.
Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance, A broader perspective: System quality and user utility, Results snippets. [14 hours]

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.
Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear versus nonlinear classifiers, Classification with more than two classes, The bias-variance tradeoff
Support vector machines and machine learning on documents: Support vector machines: The linearly separable case, Extensions to the SVM model, Issues in the classification of text documents, Machine learning methods in ad hoc information retrieval [14 hours]

Matrix decompositions and latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing
Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.
Web crawling and indexes: Overview, Crawling, Distributing indexes, Connectivity servers, Link analysis, The Web as a graph, PageRank, Hubs and Authorities. [12 hours]

Recommended Readings:

1. Manning, C.D., Raghavan, P. and Schütze, H.;Introduction to Information Retrieval 2008, Cambridge University Press, ISBN-13: 978-1-107-66639-9.
2. R. R. Korfhage Information Storage and Retrieval published by John Wiley & Sons in 1997.ISBN 0-471-14338.
3. R. Baeza-Yates, B. Ribeiro-Neto , Modern Information Retrieval,. Addison-Wesley, 1999, Pearson Publishers, ISBN 978-81-317-0977-1.

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. [14 hours]

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. [16 hours]

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 . [16 hours]

Ontology management, tools and applications: Overview , need for management development process, target ontology, ontology mapping , skills management system , ontological class constraints issues, Volution , Development of Tools and Tool Suites Ontology Merge Tools, Ontology based Annotation Tools, Web Services, Semantic Web Services, Case Study for specific domain Security issues , current trends. [18 hours]

Recommended Readings:

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, Rudi Studer , Paul Warren , Semantic Web Technologies: Trends and Research in Ontology-based Systems, Wiley Publications, July 2006.
6. Dieter Fensel , Wolfgang Wahlster, Henry Lieberman, James Hendler, Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential, The MIT Press, 2002.
7. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management, Wiley, 2003.
8. Steffen Staab , Rudi Studer, Handbook on Ontologies (International Handbooks on Information Systems), Springer 1st edition, 2004.
9. Dean Allemang , James Hendler , Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann, 2008.

Name Services and Configuration :
DNS, DHCP, X500 Directory Services, LDAP, Internet Security, Authentication and Encryption, Watermarks, Firewall, SSL, Digital Signatures, Kerberos. [10 hours]

Network Management :
Infrastructure for Network Management, Intranet Standard Management framework, SMI, MIB, SNMP,CGI Scripts, Scripting Language, Perl, Java Script and VB Script, Internet Servers, Proxy Server, Search Engine. [18 hours]

Content Delivery and Preparation :
Overview of TCP/IP, HTTP, FTP, UDP, N-Tier, ,XHTML, XML; JavaScript, CSS, Ajax, Blogs, Wikis, RSS feeds Platform for Web Services Development MVC Design Pattern, .NET, J2EE Architecture, J2EE Components & Containers, Specification, Application servers, Struts. [18 hours]

Dynamic Web Programming :
Java Applets, JSP, ASP, PHP, Servlets, Servlet Life cycle, C#, Component Technologies, Java beans, CORBA, Introduction to EJBs, JDBC, Ruby on rails ,Secure Electronics Transactions over Web.
[18 hours]

Recommended Readings:

1. Ravi Kalakota and Andrew B Whinston, Frontiers of Electronic commerce, Addison Wesley Publishing, 1996.
2. Eric Ladd, Jim O' Donnel; Using HTML 4, XML and Java, Prentice Hall of India – QUE,
3. Jeffy Dwight, Michael Erwin and Robert Niles, Using CGI, prentice Hall of India – QUE,
4. Scot Johnson, Keith Ballinger, Davis Chapman, Using Active Server Pages, Prentice Hall of India,
5. Margaret Levine Young; Internet and WWW , 2nd Edition, Tata McGraw Hill,
6. Herbert Schildt,, The Complete Reference – Java 2 , 4th Edition, Tata McGraw Hill,
7. Deitel & Deitel, Java,How to Program, Prentice Hall , 3rd edition.

Introduction To Pervasive Computing : Local Area Networks Wireless LANs Relationship of Wireless, Internet and Ubiquitous computing Pervasive Computing and Ubiquitous Computing Ambient Computing Pervasive Web application. [14 hours]

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Architecture: Requirements of computational infrastructure failure management security performance dependability Pervasive Computing devices and Interfaces Device technology trends, Connecting issues and protocols. [14 hours]

WAP & WML: Pervasive Computing and web based Applications XML and its role in Pervasive Computing ,Wireless Application Protocol (WAP) Architecture and Security Introduction to Wireless Mark-Up language (WML). [14 hours]

Pervasive Computing And Security : Voice Enabling Pervasive Computing Voice Standard Speech Applicationsin Pervasive Computing and security. [6 hours]

PDA in pervasive computing– Introduction ,PDA software Components, Standards, emerging trends ,PDA Device characteristics ,PDA Based Access Architecture. [16 hours]

Recommended Readings:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec & Klaus Rindtorff, Pervasive Computing Technology and Architecture of Mobile Internet Applications, Addision Wesley, Reading, 2002.
2. Uwe Hansman, LothatMerk, Martin S Nicklous & Thomas Stober, Principles of Mobile Computing, Second Edition, Springer,Verlag, New Delhi, 2003.
3. Rahul Banerjee, Internetworking Technologies: An Engineering Perspective, Prentice-Hall of India, New Delhi, 2003.
4. Burkhardt, Henn, Hepper, Rintdorff, Schaeck. ,Pervasive Computing, Addison Wesley, 2002.

Introduction: Knowledge in speech and language processing, Ambiguity, Models and Algorithms, Brief History

Regular Expressions and Automata: Regular Expressions, Finite-State Automata, Regular Languages and FSA [6 hours]

Morphology and Transducers: Inflectional and derivational morphology, finite state morphological parsing, Combining FST Lexicon and rules. Lexicon free FST: Porter Stemmer

N-grams: Counting Words in Corpora, Simple (Unsmoothed) N-Grams, Smoothing, Entropy

HMM and Speech Recognition: Speech Recognition Architecture, Overview of HMM, A* decoding

[8 hours]

Word Classes and Part-of-Speech Tagging: English word classes, Targets for English, Part of speech Tagging, Rule Based part of speech Tagging, Transformation Based Tagging

Context Free Grammars for English: Constituency, Context Free rules and Trees, Sentence level construction, The Noun Phrase, Coordination, Agreement, The verb phrase and sub-categorization. Spoken Language Syntax, Grammar Equivalence and Normal form, Finite state context free grammars, Grammar and human processing. [10 hours]

Parsing with context free grammars: Parsing as Search, Basic Top down Parser, Problems with basic top-down-parsers, the early Algorithm, Finite state parsing method

Features and Unifications: Feature structures, Unification of Features Structures, Features Structures in the grammar, Implementing Unification.

Lexicalized and probabilistic parsing: Probabilistic context free grammars, problems with probabilistic context free grammars, probabilistic lexicalized GFG. [16 hours]

Representing Meaning: Computational Desiderata for representation, Meaning structure of language, First order predicate calculus, linguistically relevant concept, Related Re-presentational approaches, Alternative approaches to meaning.

Semantic Analysis: Syntax driven semantic analysis, Attachment of Fragment of English, Integrating semantic analysis with early parser. Robust Semantic Analysis.

Lexical Semantics: Relation among lexemes and their senses, Internal Structure of words. [14 hours]

Discourse: Reference resolution, Text Coherence, Discourse Structure, Psycholinguistics Studies of reference and coherence.

Natural Language generation: Introduction to language generation, Architecture for generation, Surface realization, Discourse planning, Macro planning, Lexical selection, evaluating generation systems, generating speech. [10 hours]

Recommended Readings:

1. Daniel Jurafsky and James H. Martin; Speech and Language processing An Introduction to Natural Language, Second Edition, 2009
2. Steven Bird , Ewan Klein , Edward Lopper Processing, Computational Linguistics and Speech Recognition-Natural Language Processing with Python ,First Edition, June 2009
3. Nitin Indurkhya, Fred J. Damerau , Fred J. Damerau , Handbook of Natural Language Processing, Second Edition.

Soft Computing : soft computing concepts, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. [10 hours]

Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP. [16 hours]

Neural Network : Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow &Hebb;s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA, [16 hours]

Counter propagation network : architecture, functioning & characteristics of counter Propagation network, Hopfield/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine.
Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory. [12 hours]

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system : fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic. [10 hours]

Recommended Readings:

1. S. Rajsekaran & G.A. VijayalakshmiPai, Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications, Prentice Hall of India, Second Edition.
2. N.P.Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press 2005, First Edition.
3. Siman Haykin , Neural Networks ,Prentice Hall of India Third Edition, 2008.
4. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India ,4th Edition.
5. Kumar Satish, Neural Networks, Tata Mc Graw Hill ,Third Edition,2007.

Advanced Data Structures Lab

1. Implement an application using basic data structures.
2. Represent a polynomial as a linked list and write functions for polynomial operations.
3. Implement binary search tree.
4. Implement operations on AVL trees.
5. Implement operations on Red and black trees.
6. With suitable application implement TRIES
7. Implement priority queue using heaps
8. Implement Dijkstra's algorithm using priority queues
9. Implement hashing techniques with suitable application.
10. Implement a backtracking algorithm for Knapsack problem
11. To perform various operations on graphs (i) Vertex insertion. ii) Vertex deletion. iii) Edge insertion. (iv)Edge deletion. (v) BFS. (vi) DFS.
12. Implement different network algorithms.
13. Implement graph and show graph coloring techniques

Intelligent System Lab

1. Implement Best First Search Algorithm
2. Implement A* Algorithm
3. Implement Hill Climbing Algorithm
4. Implement Min max algorithm with alpha beta cutoff in competitive games
5. Implement pattern matching algorithm
6. Knowledge representation
7. Implement unification and Resolution
8. Create a Medical diagnosis expert system
9. Case study of JESS and RVD expert system
10. Implement Linearly separable Problem using perceptron
11. Implement Multi layer neural network to solve non linearly separable problems

Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method , Understanding the language of research ,Concept, Construct, Definition, Variable. Research Process. . [04 hours]

Research Design: Concept and Importance in Research ,Features of a good research design ,Exploratory Research Design ,concept, types and uses, Descriptive Research Designs ,concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.
Qualitative and Quantitative Research: Qualitative research ,Quantitative research ,Concept of measurement, causality, generalization, replication, Merging the two approaches. . [10 hours]

Statistics: Distributions,Discrete, Uniform Binomial, Geometric, Pascal , Hyper geometric, Poisson, Continuous Distributions: Uniform, Exponential, Normal, Weibull.
Descriptive statistics: Population and sample, Graphical Representation of the data, Numerical description of the data, measures of central tendency , dispersion and grouped data. [10 hours]

Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample ,Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample ,Practical considerations in sampling and sample size. . [10 hours]

Problem Identification & Formulation : Research Question ,Investigation Question ,Measurement Issues , Hypothesis ,Qualities of a good Hypothesis ,Null Hypothesis & Alternative Hypothesis. Hypothesis Testing , Logic & Importance . [10 hours]

Interpretation of Data and Paper Writing : Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. . [10 hours]

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Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism . [10 hours]
(Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline).

Recommended Readings:

1. Donald Cooper & Pamela Schindler ,Business Research Methods, TMGH, 9th edition.
2. Alan Bryman & Emma Bell; Business Research Methods, Oxford University Press, Third Edition.
3. C.R.Kothari ,Research Methodology, 2/e.
4. Douglas Montgonury, George Runger; Applied Statistics and probability for engineering , 6th Edition.

MITE 2.2 Security in Constrained Networks

Data Security : Cryptographic algorithms,Secret & Public key, Identity based encryption, Security Attacks, Security Mechanisms, Elliptic curve cryptography, Quantum cryptography, Hashing Algorithms, Digital Signature, Public Key Infrastructure & authentication, Authentication protocols.

[12 hours]

System security: Access Control, Intrusion Detection and Prevention. Firewalls: Design Principles , Characteristics & Configurations, Trusted Systems, Malicious Soft wares, Cyber Laws and Forensics , IT ACT 2000.

[14 hours]

Network security: Network Concepts, OSI Layers and Protocols, Network Devices, Network layer Security (IPSec) , IP Security, IPSec Architecture, Key management, Transport Layer Security , SSL/TLS, SET. Application Layer Security, Authentication Applications, Kerberos, X. 509 Authentication Services, E,mail Security ,PGP, S/MIME, Denial of service,attacks and solutions, VPN technology.

. [16 hours]

Embedded security : Security Features ,Physical, Cryptographic, Platform. Kinds of Devices ,CDC, CLDC Embedded Security Design, Keep It Simple and Stupid Principle, Modularity Is Key, Important Rules in Protocol Design, Miniaturization of security, Wireless Security, Security in WSN.

[10 hours]

Multimedia Security : Digital rights management, Digital watermarking, Steganography and Steganalysis, Data sanitization. [12 hours]

Recommended Readings:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 3/e.
2. Timothy Stapko, , Practical Embedded Security: Building Secure Resource Constrained Systems, Publisher Newnes , 1/e, 2009.
3. SD Stinson Cryptography: Theory and Practice , CRC Press, 3rd /e.
4. Holden Greg, Guide to firewalls & network security: with intrusion detection & VPNs , Course Technology, 2004.
5. Ingemer Cox, Mathew Miller, Jeffrey Bloom, Digital watermarking: Principles & Practices, Morgan Kaufmann Series, 2/e.

MITE 2.3 Computational Theory and Algorithms

Basics of computational theory:
Introduction to Finite automata , regular languages ,context free languages, Definition and Construction of Turing Machines, Languages of TM, Types of TM. Big O notation and classes. [10 hours]

Review of Basic Algorithmic Design Techniques:
Divide and Conquer Technique, Greedy technique, Dynamic programming, Backtracking , Branch and Bound. [10hours]

Computational Geometry: Robust geometric primitives, Convex hull, Triangulation, Voronoi diagrams, Nearest neighbor search , Range search, Point location, Intersection detection. [10hours]

NP, Completeness and the P & NP Classes:
Introduction, Polynomial Time & Verification ,NP,NP Hard, NP Completeness and Reducibility , Traveling Salesman Problem, Knapsack, Set Cover. [10 hours]

Randomized Algorithms: Introduction, Type of Randomized Algorithms, Quick Sort, Min-cut , 2-SAT, Game Theoretic techniques, Random Walks. [12 hours]

Approximation Algorithms:
Introduction, Greedy Algorithms, Travelling Salesman Problem, Dynamic Programming, Knapsack Problem. [12 hours]

Recommended Readings:

1. Cormen, Leiserson, Rivest, Stein, Introduction to Algorithm, PHI, 2000.
2. Parag Dave & Himanshu Dave, Design and Analysis of Algorithms, Pearson Education,2009
3. Michel Goodrich, Roberto Tamassia, Algorithm design,foundation, analysis & internet examples, Wiley, First edition,2008.
4. A V Aho, J E Hopcroft, J D Ullman, Design and Analysis of Algorithms, Addison,Wesley Publishing ,2011 , 3/e.
5. Berman Kenneth, Paul Jerome, Fundamentals of Sequential and Parallel Algorithms, Cengage Learning, 1996
6. Anany V. Levitin , Introduction to the Design and Analysis of Algorithms, Pearson Education publication. 3rd Edition,2012
7. Knuth D.E., The Art of Computer Programming, Vol. 1,2 and 3, Addison, Wesley Publishing,Third edition ,2008.
8. John C, Martin ,Theory of computation, Fourth Edition,2003.

MITE 2.4 Techniques in Optimization

Linear Programming: Management's role in decision making and quantitative techniques. Historical development of Operations Research. Linear programming. Formulation of linear programming models. Assumptions in modeling. Solution to two variable linear programming problems – graphical method. Special cases: Degeneracy, Unbounded solution. Alternate optima and Infeasible solution.

[16 hours]

Methods to solve linear programming problems: Simplex Method, Big-M method, Two-phase method and modified simplex method and Dual Simplex method. Duality in linear programming and post optimal analysis.

Specially structured linear programming problems: Transportation problem and transportation algorithm. Assignment model and Hungarian method. [16 hours]

Nonlinear Programming: Introduction. Classification of models and methods. Formulation of nonlinear models. Single variable unconstrained optimization. Classical method. Unimodal function and its properties. Bracketing methods- unrestricted search with constant and accelerated step size. Locating methods: Dichotomous search, Interval halving method, Fibonacci search and Golden section method. Gradient based methods: Bisection method, Secant method and Newton Raphson method.

[16 hours]

Multi variable unconstrained optimization: Classical method, Univariate method, Conjujate direction method and steepest ascent/descent method

Multi variable constrained optimization: Lagrangian method, Karush Kuhn Tucker optimality conditions.

[16 hours]

Recommended Readings:

1. David G Luenberger, .Linear and Non Linear Programming., 2nd Ed, AddisonWesley, 1984
2. S.S.Rao, .Engineering Optimization.; Theory and Practice; Revised 3rd Edition, New Age International Publishers, New Delhi
3. R. Panneerselvam , Operations Research,Prentice Hall,2ndedition,2006.
4. J.K. Sharma, Operations Research: theory and application,4th edition, Macmillan Publishers,2006.
5. D. S. Hira and Prem Kumar Gupta, Problems in Operation Research , S.Chand Publication, 2nd Edition.
6. Kalyanmoy Deb, Optimization for Engineering: Design-Algorithms and Examples, Prentice Hall (India), 1998.
7. Ravindran , Don T. Phillips, James J. Solberg, Operations Research: Principles and Practice, 2nd Edition,Wiley Publication, India

MITE 2.5 Elective –II

MITE 2.5.E-II.1 Virtualization Techniques

Overview of virtualization

Basics of Virtualization , Virtualization Types ,Desktop Virtualization ,Network Virtualization ,Server and Machine Virtualization ,Storage Virtualization ,System, level or Operating Virtualization ,Application Virtualization, Virtualization Advantages ,Virtual Machine Basics ,Taxonomy of Virtual machines , Process Virtual Machines ,System Virtual Machines ,Hypervisor , Key Concepts [10 hours]

Server consolidation

Hardware Virtualization ,Virtual Hardware Overview , Sever Virtualization ,Physical and Logical Partitioning , Types of Server Virtualization ,Business cases for Sever Virtualization ,Uses of Virtual server Consolidation ,Planning for Development ,Selecting server Virtualization Platform [10 hours]

Network virtualization

Design of Scalable Enterprise Networks , Virtualizing the Campus WAN Design ,WAN Architecture , WAN Virtualization , Virtual Enterprise Transport Virtualization,VLANs and Scalability ,
Theory Network Device Virtualization Layer 2 , VLANs Layer 3 VRF Instances Layer 2 , VFIs Virtual Firewall Contexts. [10 hours]

Network Device Virtualization , Data, Path Virtualization Layer 2: 802.1q , Trunking Generic Routing Encapsulation ,Ipsec L2TPv3 Label Switched Paths , Control,Plane Virtualization–Routing Protocols, VRF , Aware Routing Multi,Topology Routing. [10 hours]

Virtualizing storage

SCSI, Speaking SCSI, Using SCSI buses ,Fiber Channel ,Fiber Channel Cables ,Fiber Channel Hardware Devices ,iSCSI Architecture ,Securing iSCSI ,SAN backup and recovery techniques ,RAID ,SNIA Shared Storage Model ,Classical Storage Model ,SNIA Shared Storage Model ,Host based Architecture ,Storage based architecture ,Network based Architecture ,Fault tolerance to SAN ,Performing Backups ,Virtual tape libraries. [16 hours]

Virtual machines products

Xen Virtual machine monitors, Xen API ,VMware ,VMware products ,Vmware Features ,Microsoft Virtual Server ,Features of Microsoft Virtual Server [8 hours]

Recommended Readings:

1. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.
2. Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, APress 2005.Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.
3. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.

Human Computer Interaction as an emerging field : Disciplines contributing to HCI, Human Information Processing Psychology of everyday things, Importance of human factors in design ,cultural, emotional , technological, business, Need Satisfaction curve of technology, Levels of human computer interaction [10 hours]

Foundations of User Interface Design (U.I.D): Goals of UID, Goal directed Design, User Interface Models, Understanding and Conceptualizing Interface, Psychology of users designing for collaboration and communication, Process of Interaction Design, Standards & Guidelines, Usability Testing, GIU. [10 hours]

UCD Models , UCD methodology : User centered design life cycle ,cooperative , participative , contextual Understanding users , user experience levels , human information processing ,i/o channels ISO 13407,Human memory , user study techniques , user models, User research ,Personas, , scenarios , story boarding Focus Groups , Card Sorting , Questionnaires , Interviews , Onsite observation, Role Playing, Walkthroughs, [10hours]

User Research: Interviews, questionnaires, social interaction & emotional design, [2 hours]

Interaction Design: Goals of interaction design , Interaction design strategies Task analysis & design , GOMS model , navigation design , screen design Defining interactivity , types of interactions , interaction models Interaction models , styles, Advancements in interaction devices Ergonomics principles in interaction design [6 hours]

Design ,Types participatory: Scenario/task based , usage centered , user centered, User interface models, Interface metaphors and conceptual models User support systems ,online help, documentation Accessibility of User Interfaces Heuristics, Principles , patterns in interaction design HCI frameworks, Architectural patterns for user interface Designing for effectiveness , comprehension , satisfaction Evaluation criteria for UI Testing: Usability Testing, Suitability Testing, Accessibility Testing methods ,Think Aloud, Videotaping, Customer Satisfaction questionnaires Advantages & disadvantages of user centered design Case studies in UCD [16 hours]

Usable Web ,Web Site Usability: Web User Interfaces , Rich web experience design Navigations, Links, Searching , Comparisons , Readability , Collaborative systems, groupware & coordination technology [5 hours]

Object Oriented User Interfaces (OOUI): Identifying needs and establishing requirement, Object Oriented User Interface, Migrating GUI to Object Oriented User Interfaces. [3 hours]

Advanced UI ,Techniques and Technology: User Interface design, Toolkit, Help Advise, Wizard Testing and Modeling Testing, PC Internet user Interface. [2 hours]

Recommended Readings:

1. Theo Mandel, Elements of User Interface Design, John Wiley & Sons
2. Preece , Roger, Sharp Interaction Design, John Wiley & Sons, Fourth Edition.
3. Wilbert O. Galitz , The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, 3rd Edition, Wiley Publication.
4. Alan Dix , Human Computer Interaction ,Third Edition, 2004

Basics of OLTP, Dimensional Modeling and DW design: Design and implementation aspect of OLTP, Design and implementation aspect of Warehouse, Comparison of Analytical queries with Transactional Queries, Components of Warehouse Architectures. [10 hours]

Dimensional Modeling and DW design : Start schema and snow flake schema, Grain of dimensional model, transactions, Recurring Snapshots, Accumulating Snapshots, Dimensions (SCD types, conformed dimensions), Facts (additive, semi,additive, non,additive), Hierarchy in dimensions, parent child relationships, Many,Many Dimensional relationship, Multi Valued Dimensions and Dimension Attributes. [14 hours]

ETL: Data Quality, Data profiling, Data enrichment, data duplication, ETL Architecture and what is ETL, Extraction concept and Change data capture Transformation concept, lookups, time lag, formats, consistency, Loading concept, Initial and Incremental loading, late arriving facts, What is Staging, Data marts, Cubes, Scheduling and dependency matrix. [10hours]

Reporting : Metadata Layer, Presentation Layer, Data Layer, Use of different layers and overall Reporting architecture, Basic Report authoring, Various report elements such as Charts, Tables, prompts Data aggregation: Table based, Materialized views, Query rewrite, OLAP, MOLAP, Dashboards, Ad,hoc reports, interactivity in analysis (drill down, drill up), Security: report level, data level (row, column) ,Scheduling. [10 hours]

Data Analytics and Recent Trends : Analytics concepts and use in Business Intelligence, Exploratory and statistical techniques:, Cluster analysis, Data visualization, Predictive analysis :, Regression, Time series, Data Mining :, Hierarchical clustering, Decision tree Text analytics :, Text mining. [10hours]

Recent trends : Big data like HIVE, PIG and DW appliances like Netezza, Teradata, Smart Change data capture using log based techniques, Real time BI, Operational BI, Embedded BI, Agile BI, BI on cloud. [10hours]

Recommended Readings:

1. Ralph Kimball, Margy Ross, The Complete Guide to Dimensional Modeling ,2nd ed,Wiley publication.
2. Ralph Kimball, Joe Caserta, The data warehouse ETL toolkit: practical techniques for extracting, cleaning, conforming, and delivering data, Wiley Publication
3. Jiawei Han, Micheline Kamber,Jian Pei ,Data Mining: concepts and techniques, 2nd edition, Elsevier/Morgan Kaufmann
4. Efrem G. Mallach, Decision Support And Data Warehouse Systems, 1st Edition,Tata McGraw, Hill Education.
5. Efraim Turban, Ramesh Sharda, DursunDelen, David King ,Business Intelligence,2/E,Prentice Hall.

Introduction to Cloud Computing

Overview, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks [16 hours]

Cloud Architecture, Services and Applications

Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frameworks, Software as a Service Cloud Deployment Models, Public vs Private Cloud, Cloud Solutions, Cloud ecosystem, Service management, Computing on demand, Identity as a Service, Compliance as a Service . [16 hours]

Cloud Infrastructure and Cloud Resource Management

Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards Risks . [16hours]

Cloud Security

Security Overview, Cloud Security Challenges and Risks, Software,as,a,Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security, Virtual Machine Security Risks. [16hours]

Recommended Readings:

1. 1.Rajkumar Buyyaet. el., Cloud Computing: Principles and Paradigms, Wiley India Edition
2. Sosinsky B., Cloud Computing Bible, Wiley India
3. Rajkumar Buyya, C.Vecchiola, S.Thamarai Selv,Mastering Cloud Computing,,iMcGrawHill,1/e,2013
4. Miller Michael, Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online, Pearson Education India, Aug 2008.
5. Velte T., Velte A., Elsenpeter R., Cloud Computing ,A practical Approach, Tata McGrawHill, 2014.

Introduction to mobile robots

Introduction to Mobile robots , Locomotion, Classification , Legged, Wheeled, Aerial. Key issues in locomotion. Mobile Robot Kinematics , Kinematic model, Forward Kinematic model, Representing position, Wheel kinematic constraints. Motion control. [14 hours]

Control of mobile robots

Control theory , Control design basics, Cruise,Controllers, Performance Objectives. Simple robot ,State space model, Linearization, LTI system, stability. PID control, basic control algorithms [12 hours]

Perception

Sensors for mobile robots ,Classification, performance, uncertainty in sensors, wheel sensor, heading sensor, accelerometers, inertial measurement, motion sensor, range sensors. Vision sensor, Basics of computer vision, image processing techniques, feature extraction ,image, range data location recognition. [14 hours]

Localization

Major challenges, localization based navigation. Belief representation, map representation, probabilistic Map.Examples of localization systems. Autonomous map building [12 hours]

Planning and navigation

Planning and Reaction, Path Planning , graph search, D* algorithm, Potential field. Obstacle avoidance, bug algorithm, histogram, curvature velocity techniques.Navigation architecture. Case studies. [12 hours]

Recommended Readings:

1. Siciliano. et al, Robotics: Modelling, Planning and Control, 3rd Edition, Springer, 2009
2. Choset. et al, Principles of Robot Motion: Theory, Algorithm & Implementations, MIT Press,2005
3. Thrun, Burgard, Fox, Probabilistic Robotics, MIT Press, 2005
4. Siegwart, Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2004
5. Siciliano, Khatib, Eds., Handbook of Robotics, Springer, 2008

Overview of Wireless Sensor Networks :

Brief Historical Survey of Sensor Networks, and Background of Sensor Network Technology, Ad Hoc Networks, Applications of Wireless Sensor Networks: Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Another Taxonomy of WSN Technology, Basic Sensor Network Architectural Elements, Home Control, Medical Applications, Basic Wireless Sensor Technology : Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Network Standards: IEEE 802.15.4, ZigBee, IEE 1451 [16 hours]

Medium Access Control Protocols for Wireless Sensor Networks

Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs: Schedule,Based Protocols, Random Access,Based Protocols, Coordination, Schedule Synchronization, Adaptive Listening, Access Control and Data Exchange (B,MAC,Box,MAC, Bit,MAC, H,MAC, I,MAC, O,MAC, S,MAC. Ri,MAC, T,MAC, Q,MAC (Querry MAC), Q,MAC (QoS MAC), X,MAC) [16 hours]

Routing Protocols for Wireless Sensor Networks

Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks Network Scale and Time,Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks: WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low,Energy Adaptive Clustering Hierarchy, Power,Efficient Gathering in Sensor Information Systems, Directed Diffusion,Geographical Routing [16hours]

Transport Control Protocols and Middle wares for Wireless Sensor Networks

Traditional Transport Control Protocols: TCP (RFC 793), UDP (RFC 768), MobileIP, Introduction, WSN Middleware Principles, Middleware Architecture: Existing Middleware: MiLAN (Middleware Linking Applications and Networks), IrisNet (Internet,Scale Resource, Intensive Sensor Networks Services). Introduction, Examples of Operating Systems: Tiny OS,Mate, Magnet OS [16hours]

Recommended Readings:

1. KazemSohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Ltd, 2005.

Robotic Paradigms : From Teleportation To Autonomy ,, How Can a Machine Be Intelligent, social implication of robotics, Industrial manipulator ,Space robotics and the AI approach , Teleoperation, Telepresence. [10 hours]

The Hierarchical Paradigm: Attributes of the Hierarchical Paradigm, Closed World Assumption and the Frame Problem, Representative Architectures, Nested Hierarchical Controller [10 hours]

Reactive Paradigm : Perception in Behaviors, Schema Theory, Attributes of Reactive Paradigm, Subsumption Architecture. [10 hours]

Designing a Reactive Implementation : Behaviors as Objects in OOP, Steps in Designing a Reactive Behavioral System [10 hours]

Common Sensing Techniques for Reactive Robots: Behavioral Sensor Fusion, Designing a Sensor Suite, Proprioceptive Sensors, Proximity Sensors. [10 hours]

Hybrid Paradigm : Attributes of the Hybrid Paradigm, components and styles of hybrid architectures , Managerial Architectures, Autonomous Robot Architecture (AuRA), Sensor Fusion Effects (SFX), State Hierarchy Architectures,, 3 Tiered (3T), Model Oriented Architectures—Saphira and TCA

[14 hours]

Recommended Readings:

1. Robin R. Murphy ,Introduction to AI robotics ,2000
2. Russell Stuart, Norvig Peter, Artificial Intelligence Modern Approach, Pearson Education series in AI, 3rd Edition, 2010.
3. Dan.W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI Learning, 2009.
4. Donald.A.Waterman, A guide to Expert Systems, Pearson, 2002.

Algorithms Lab

1. Implement insertion sort and calculate time required using different data sets
2. Analyse algorithm for NP completeness and NP classes.
3. Taking suitable application , implement different methods for solving recurrence
4. Implement approximation algorithm.
5. Implement Radix Sort and analyse its time complexity.
6. Implement and analyse time complexity for Red black trees
7. Implement and analyse Bellman Ford algorithm
8. Implement randomized algorithm technique

Cryptography Lab

1. Study and Implement Triple DES
2. Study and Implement Kerberos authentication service
3. Study and implement Digital Signatures
4. Configure E mail Server and enforce email security protocol
5. Configure IPsec virtual private network and verify packets are encrypted
6. Simulate Intrusion detection system
7. Study and Implementation of NMap
8. Experiment On Active And Passive Finger Printing Using Xprobe2 and Nmap.
9. Generating Password Hashes With Openssl
10. Study and implement a steganographic technique.

Basics of Pattern recognition: Bayesian Decision Theory, Minimum error rate classification Classifiers, discriminant functions, decision surfaces ,The normal density and discriminant functions for the Normal density, Continuous and discrete valued features, Bayesian Belief Networks [12 hours]

Methods for parameter estimation: Maximum Likelihood (ML) estimation, Maximum a posteriori (MAP) estimation, Bayesian estimation, Gaussian mixture model (Both unimodal and multimodal distribution), Expectation, maximization method [12 hours]

Sequential pattern classification: Discrete hidden Markov model, Continuous density hidden Markov models, Non, parametric techniques for density estimation, Parzen, window method , K Nearest Neighbour method [12 hours]

Dimension reduction methods, Principal component analysis, Fisher discriminant analysis, Linear discriminant function based classifiers, Perceptron, Minimum Mean Squared Error (MME) method ,The Ho Kashyap method, Non metric methods for pattern classification, Decision trees, Classification and Regression Tree (CART) . [13 hours]

Regression: Linear models for regression, Polynomial regression, Bayesian regression, Unsupervised learning and clustering, Criterion functions for clustering, Algorithms for clustering:, K-means, Hierarchical clustering ,Cluster validation [9 hours]

Syntactic Pattern Recognition: Error correcting methods ,Bayesian networks ,Hidden Markov models,Applications.

[6 hours]

Recommended Readings:

1. R.O.Duda, P.E.Hart and D.G.Stork ;Pattern Classification, , John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
4. Robert J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, 2 e/d, John Wiley & Sons, 1992

MITE 3.2 Elective –III

MITE 3.2.E-III.1 Bioinformatics

History of Bioinformatics : History of Bioinformatics, role of Bioinformatics in biological sciences, scope of bioinformatics, network basics, LAN & WAN standards, network topologies and protocols, ftp, http , division of Bioinformatics, Bioinformatics and internet-challenges in Bioinformatics.

[12 hours]

Databases In Bioinformatic : Databases in Bioinformatics, Genbank, NCBI, EMBL, DDBJ, UniGene, SGD, EMI Genomes, ,protein databases-PIR, SWISSPROT, TrEMBL, Prosite, PRINTS ,structural databases-PDB, SCOP, CATH, PDB_SELECT, PDBSUM, DSSP, FSSP, DALI, PRODOM, protein families & pattern databases, Pfam, KEGG ,sequence storage sequence accuracy,EST,STS, sequence retrieval systems, Entrez, SRS,sequence query refinement using Boolean operators, limits, preview, history and index.

[18 hours]

Sequence Submission : Sequence submission tools-BANKIT,SEQUIN, WEBIN, SAKURA, literature databases-PubMed and medline. Data mining and its techniques, data warehousing, Sequence annotation: principles of genome annotation, annotation tools & resources.

[18 hours]

Applications Of Bioinformatics : Applications of Bioinformatics, phylogenetic analysis, steps in phylogenetic analysis, icroarrays, DNA and protein microarrays , Bioinformatics in pharmaceutical industry, informatics & drug discovery , pharma informatics, resources drug discovery and designing-SNP.

[16 hours]

Recommended Readings:

1. Attwood T.K and Parry-Smith, Introduction to Bioinformatics, Addison Wesley Longman, 1999.
2. David W Mount, Bioinformatics: Sequence and Genome Analysis, 2nd edition, CBS publishers, 2004.
3. Arun Jagota, Data Analysis and Classification for Bioinformatics, Pine Press, 2001.
4. Des Higgins and Willie Taylor, Bioinformatics Sequence, Structures and Databanks, Oxford University Press, USA, 2000.

Compression: Techniques, Modeling & coding, Distortion criteria, Differential Entropy, Rate Distortion Theory, Vector Spaces, Information theory, Models for sources, Coding uniquely ELDodable codes, Prefix codes, Kraft McMillan Inequality. [6 hours]

Quantization: Quantization problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization; Entropy coded Quantization, Vector Quantization, LBG algorithm, Tree structured VQ, Structured VQ, Variations of VQ – Gain shape VQ, Mean removed VQ, Classified VQ, Multistage VQ, Adaptive VQ, Trellis coded quantization. [11 hours]

Differential Encoding: Basic algorithm, Prediction in DPCM, Adaptive DPCM, Delta Modulation, Speech coding – G.726, Image coding. Transform Coding: Transforms – KLT, DCT, DST, DWHT; Quantization and coding of transform coefficients, Application to Image compression – JPEG, Application to audio compression. [10 hours]

Sub-band Coding: Filters, Sub-band coding algorithm, Design of filter banks, Perfect reconstruction using two channel filter banks, M-band QMF filter banks, Poly-phase EL Decomposition, Bit allocation, Speech coding – G.722, Audio coding – MPEG audio, Image compression. [10 hours]

Wavelet Based Compression: Wavelets, Multiresolution analysis & scaling function, Implementation using filters, Image compression – EZW, SPIHT, JPEG 2000. [6 hours]

Analysis/Synthesis Schemes: Speech compression – LPC-10, CELP, MELP, Image Compression – Fractal compression. [5 hours]

Video Compression: Motion compensation, Video signal representation, Algorithms for video conferencing & videophones – H.261, H. 263, Asymmetric applications – MPEG 1, MPEG 2, MPEG 4, MPEG 7, Packet video. [5 hours]

Lossless Coding: Huffman coding, Adaptive Huffman coding, Golomb codes, Rice codes, Tunstall codes, Applications of Huffman coding, Arithmetic coding, Algorithm implementation, Applications of Arithmetic coding, Dictionary techniques – LZ77, LZ78, Applications of LZ78 – JBIG, JBIG2, Predictive coding – Prediction with partial match, Burrows Wheeler Transform, Applications – CALIC, JPEG-LS, Facsimile coding – T.4, T.6. [11 hours]

Recommended Readings:

1. K. Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers, 1/e, 1996.
2. N. Jayant and P. Noll, Digital Coding of Waveforms: Principles and Applications to Speech and Video, Prentice Hall, USA, 1984.
3. D. Salomon, Data Compression: The Complete Reference, Springer, 2000.
4. Z. Li and M.S. Drew, Fundamentals of Multimedia, Pearson Education (Asia) Pte. Ltd., 2004.

Virtual Reality Concepts: Three I's of Virtual Reality , 3D Computer Graphics , Benefits of Virtual Reality, Components of VR System , Input Devices, 3D Position Trackers ,Performance Parameters, Types of Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Types of Gesture Input Devices. Output Devices , Graphics Display , Human Visual System , Personal Graphic Displays , Large Volume Displays , Sound Displays , Human Auditory System.

[12 hours]

Haptic rendering: Haptic sense, Haptic devices, Algorithm for Haptic rendering.
Geometric Modeling : Virtual Object Shape , Object Visual Appearance
Kinematics Modeling: Transformation Matrices , Object Position , Transformation Invariants ,Object Hierarchies , Viewing the 3D World

[16 hours]

Physical Modeling: Collision Detection , Surface Deformation , Force Computation , Force Smoothing and Mapping , Behavior Modeling , Model Management.
VR Programming : Toolkits and Scene Graphs , World ToolKit , Java 3D , Comparison of World ToolKit and Java 3D , GHOST , People Shop. Human Factors in VR: Methodology and Terminology , VR Health and Safety Issues , VR and Society.

[18 hours]

Applications of VR: Medical Applications of VR , Education, Arts and Entertainment , Military VR Applications , Emerging Applications of VR , VR Applications in Manufacturing , Applications of VR in Robotics , Information Visualization.

[18 hours]

Recommended Readings:

1. Grigore C. Burdea, Philip Coiffet, Virtual Reality Technology, 2nd Edition, Wiley India, 2006.
2. John Vince, Introduction to Virtual Reality, Springer-Verlag Ltd., 2004.
3. William R.Sherman, Alan B.Craig , Understanding Virtual Reality Interface, Application, Design, The Morgan Kaufmann Series, 2003.

Introduction To Big Data : Distributed file system , Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

[10 hours]

Introduction Hadoop: Big Data , Apache Hadoop & Hadoop EcoSystem , Moving Data in and out of Hadoop ,Understanding inputs and outputs of MapReduce , Data Serialization.

[14 hours]

Hadoop Architecture : Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers , Cluster Setup , SSH & Hadoop Configuration , HDFS Administering ,Monitoring & Maintenance.

[15 hours]

Hadoop Ecosystem And Yarn : Hadoop ecosystem components , Schedulers , Hadoop 2.0 New Features, NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

[10 hours]

Hive And Hiveql, Hbase : Hive Architecture and Installation, Comparison with Traditional Database, HiveQL ,Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing ,PIG, Zookeeper , monitoring a cluster, Build Applications with Zookeeper.

[15 hours]

Recommended Readings:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Professional Hadoop Solutions, Wiley, 2015.
2. Chris Eaton , Understanding Big data , McGraw Hill, 2012.
3. Tom White, HADOOP: The definitive Guide , O Reilly 2012.
4. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packet Publishing, 2013.
5. Tom Plunkett, Brian Mac donald , Oracle Big Data Handbook, Oracle Press, 2014.
6. JyLiebowitz, Big Data and Business analytics, CRC press, 2013.

Ethical Hacking : Foundation for Ethical Hacking, Ethical Hacking in Motion, Hacking Network Hosts,Hacking Operating Systems, Hacking Applications. Hacking windows , Network hacking , Web hacking, Password hacking. A study on various attacks– Input validation attacks, SQL injection attacks, Buffer overflow attacks , Privacy attacks.

[16 hours]

Computer Forensics : TCP / IP , IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS Models. Batch File Programming. Computer Forensics Fundamentals , Types of Computer Forensics Technology , Types of Vendor and Computer Forensics Services.

[16 hours]

Data Recovery : Data Recovery , Evidence Collection and Data Seizure , Duplication and Preservation of Digital Evidence Computer Image Verification and Authentication. Computer Fraud , Threat concepts, Framework for understanding and predicting inside attacks, Managing the threat – Threat Strategic Planning Process. Architecture strategies for computer fraud prevention , Protection of Web sites,– Intrusion detection system , Web Services security for Reducing transaction risks.

[16 hours]

Electronic Evidence & Threats : Discovery of Electronic Evidence, Identification of Data Reconstructing Past Events Networks, Fighting against Macro Threats , Information Warfare Arsenal , Tactics of the Military , Tactics of Terrorist and Rogues, Tactics of Private Companies. Key Fraud Indicator selection process, customized taxonomies , Key fraud signature selection process, Accounting Forensics , Computer Forensics, Journaling and it requirements, Standardized logging criteria ,Journal risk and control matrix , Neural networks , Misuse detection and Novelty detection.

[16 hours]

Recommended Readings:

1. John R. Vacca, Computer Forensics, Firewall Media, 2004.
2. Kevin Beaver, Hacking For Dummies, John Wiley & Sons, 2012.
3. Chad Steel, Windows Forensics, Wiley India, 2006.
4. Majid Yar, Cybercrime and Society, Sage Publications, 2006.
5. Robert M Slade, Software Forensics, Tata McGrawHill, 2004.
6. Ankit Fadia , Ethical Hacking, 2nd Edition ,Macmillan India Ltd, 2006.
7. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005.

Introduction To Game Theory :
Introduction to game theory, Theory of rational choice, Interacting decision makers

[6 hours]

Strategic Games And Nash Equilibrium
Strategic games: examples, Nash equilibrium: concept and examples, Best response functions Dominated Actions, Symmetric games and symmetric equilibria

[13 hours]

Illustrations Of Nash Equilibrium
Cournot's model of duopoly market, Bertrand's model of duopoly market, Electoral Competition, War of Attrition, Auctions, Accident Laws

[13 hours]

Mixed Strategy Nash Equilibrium
Introduction, Strategic games with randomization, Mixed strategy Nash equilibrium: concept and examples, Dominated Actions, Formation of Players' beliefs

[13 hours]

Extensive Games And Nash Equilibrium
Introduction to extensive games, Strategies and outcomes, Nash equilibrium, Subgame perfect Nash equilibrium, Backward induction

[13 hours]

Illustrations Of Extensive Games And Nash Equilibrium
Stackelberg model of duopoly markets, Ultimatum game

[6 hours]

Recommended Readings:

1. Osborne, M.J. An Introduction to Game Theory, Oxford University Press, 2004.
2. Mas-Colell, A., M.D. Whinston and J.R. Green Microeconomic Theory, Oxford University Press, 1995 .
3. Gibbons, R. A Primer in Game Theory, Pearson Education, 1992 .

Introduction: Definition, synergy, multi-sensor data fusion strategies, formal framework, catastrophic fusion, organization. [4 hours]

Sensors: Smart sensors, logical sensors, interface file system, sensor observations, sensor characteristics, sensor model. [6 hours]

Architecture: Fusion Node, simple fusion networks, network topology, software. [4 hours]

Common Representational Format: Spatial-temporal transformation, geographical information system, common representational format, subspace methods, multiple training sets. [4 hours]

Spatial Alignment: Image registration, resample/interpolation, pairwise transformation, image fusion, mosaic image. [6 hours]

Temporal Alignment: Dynamic time warping, dynamic programming, video compression. [3 hours]

Sensor Value Normalization: Introduction, binarization, parametric and fuzzy normalization functions, ranking, conversion to probabilities. [8 hours]

Bayesian Inference: Bayesian analysis, probability model, a posteriori distribution, model selection, computation. [5 hours]

Parameter Estimation: Parameter estimation, Bayesian curve fitting, maximum likelihood, least squares, linear Gaussian model, generalized Millman formula. [5 hours]

Robust Statistics: Introduction, outliers, robust parameter estimation, classical robust estimators, robust subspace techniques, robust statistics in computer vision. [4 hours]

Sequential Bayesian Inference: Recursive filter, Kalman filter, extensions of the Kalman filter, particle filter, multi-sensor multi-temporal data fusion. [4 hours]

Bayesian Decision Theory: Pattern recognition, naïve Bayes' classifier, modification, error estimation, pairwise classifiers. [4 hours]

Ensemble Learning: Bayesian and empirical frameworks, diversity techniques and measures, classifier types, combination strategies, boosting. [4 hours]

Sensor Management: Hierarchical classification, sensor management techniques. [3 hours]

Recommended Readings:

1. Lawrence A. Klein, Sensor and Data Fusion: A Tool for Information Assessment and Decision Making, SPIE Publications, 1/e, 2004.
2. David L. Hall and James Llinas, Handbook of Multisensor Data Fusion, CRC Press, 2001.
3. David L. Hall and Sonya A.H. McMullen, Mathematical Techniques in Multisensor Data Fusion, 2nd edition, Artech House, 2004.

MITE 3.2.E-III.8 Entrepreneurship Skill Development

Concept of Entrepreneurship : Entrepreneurship Meaning , Types ,Qualities of an Entrepreneur , Classification of Entrepreneurs , Factors influencing Entrepreneurship, Functions of Entrepreneur

(12 hours)

Entrepreneurial Development , Agencies Commercial Banks , District Industries Centre ,National small Industries Corporation, Small Industries Development organization , Small Industries Service Institute. All India Financial Institutions – IDBI , IFCI, ICICI ,IRDBI.

(12 hours)

Project Management Business idea generation techniques : Identification of Business opportunities, Feasibility study , Marketing, Finance, Technology & Legal Formalities –Preparation of Project Report , Tools of appraisal. (18 hours)

Entrepreneurial Development Programmes (EDP): Role, relevance, and achievements , Role of Government in organizing EDPs , Critical Evaluation.

(10 hours)

Economic development and entrepreneurial growth: Role of entrepreneur in economic growth , Strategic approaches in the changing Economic scenario for small scale Entrepreneurs , Networking, Niche play, Geographic Concentration, Franchising/Dealership , Development of Women Entrepreneurship.

(12 hours)

Recommended Readings:

1. Dr. Gupta C.B, Dr. Srinivasan N.P., Entrepreneurial Development, Sultan Chand & Sons, 1/e, 2009.
2. Saravanavel P., Entrepreneurial Development, Ess Pee kay Publishing House, 1997.
3. Vasant Desai, Project Management, Himalaya Publishing House, 1999.
4. Jayshree Suresh, Entrepreneurial Development, Margham Publications, 1/e, 2010.

MITE 3.3 Project

Synthesize information that is collected through literature survey.

Critical evaluation of the trends in the selected research topic.

Giving views and research directions on the selected research topic.

Expectations:

1. Collaboration with R&D Lab from the industry of repute and public sector.
2. At least 01 Technical Paper publication in at least a peer reviewed SCI rated conference (National/International).
3. Individual work.
4. Project approval and related activities based on the advice from SAC (Student Advisory Committee).

MITE 3.4 Research Seminar

Expectations:

1. Identify and select topics from peer reviewed journals/thesis/SCI rated conference papers.
2. Implement selected research paper.

MITE 4.1 Dissertation

Design and implementation of selected research topic.

Expectations:

1. Collaboration with R&D Lab from the industry of repute and public sector.
2. At least 01 Technical Paper publication in at least a peer reviewed SCI rated conference (National/International).
3. Individual work.
4. Project approval and related activities based on the advice from SAC (Student Advisory Committee).

SUMMARY FOR ALL FOUR SEMESTERS										
	Semester	Total Hours per Week			Scheme of Examination					
		L	T	P	Theory hrs	Total Credits for Semester				
						Theory	IA	Practical	Orals	Total
	Semester 1	20	-	4	-	15	5	2	-	22
	Semester 2	20	-	4	-	15	5	2	-	22
	Semester 3	8	-	22	-	6	7	-	6	19
	Semester 4	-	-	24	-	-	4	-	8	12
	Total	48		52	-	36	21	4	14	75