

# GOA UNIVERSITY

## Master of Engineering in Information Technology (Internet Technology) Revised Scheme of Instructions and Examinations

### Sem I

<b>Subject</b>	<b>Instruction</b>		<b>Scheme of Examination</b>		<b>Total Credits</b>
	<b>Lectures Hrs/ week</b>	<b>Practical Hrs/ week</b>	<b>IA * (credits)</b>	<b>Theory Terminal Examination (credits)</b>	
MIT 101 Computer Mathematics	4	-	2	2	4
MIT 102 Internet Security	4	3	2	4	6
MIT 103 Information Retrieval	4	3	2	4	6
MIT 104 Distributed Applications	4	3	2	4	6
<b>Total</b>	<b>16</b>	<b>9</b>	<b>8</b>	<b>14</b>	<b>22</b>

\*IA - Internal Assessment shall be based on internal tests, assignments, seminars, performance in practical classes (if applicable)

### Sem II

<b>Subject</b>	<b>Instruction</b>		<b>Scheme of Examination</b>		<b>Total Credits</b>
	<b>Lectures Hrs/ week</b>	<b>Practical Hrs/ week</b>	<b>IA * (credits)</b>	<b>Theory Terminal Examination (credits)</b>	
MIT 201 Advanced Communication Network	4	-	2	2	4
MIT 202 Data Mining and Warehousing	4	3	2	4	6
MIT 203 Software Quality Assurance and Project Management	4	3	2	4	6
MIT 204 <u>Elective I</u> -E Commerce -Embedded Systems -Multimedia Systems and Applications - Design of Web Services Applications	4	3	2	4	6
<b>Total</b>	<b>16</b>	<b>9</b>	<b>8</b>	<b>14</b>	<b>22</b>

\*IA - Internal Assessment shall be based on internal tests, assignments, seminars, performance in practical classes (if applicable)

### Sem III

Subject	Instruction		Scheme of Examination		Total Credits
	Lectures Hrs/week	Practical Hrs/week	IA * (credits)	Theory Terminal Examination (credits)	
MIT 301 Internet Protocol and Design	4	3	2	4	6
MIT 302 <u>Elective II</u> -Mobile Computing -Real time Systems -Network Economics -Technology Management	4	3	2	4	6
MIT 303 Seminar		2	2	-	2
MIT 304 Project		9	4	4**	8
Total	8	17	-	-	22

\*IA - Internal Assessment shall be based on internal tests, assignments, seminars, performance in practical classes (if applicable)

### Sem IV

Subject	Instruction		Scheme of Examination			Total Credits
	Lectures Hrs/week	Practical Hrs/week	IA* (credits)	External Examiners Report (Credits)	Project Examination (Credits)	
MIT 401 Project	-	25	8	8	8	24**
Total	-	25	-	-	-	24**

\*\* Project examination shall be conducted as per the norms.

# **MIT 101 Computer Mathematics**

## **MODULE 1**

### **Algebra:**

Integers and Division, primes, Fundamental theorem of Arithmetic, Division algorithm, Modular Arithmetic, Linear Congruences, Chinese Remainder theorem, Algebraic Numbers and Algebraic Integers, Groups of Units, Quadratic fields.

### **Linear Algebra:**

Vector spaces, solution of  $m$  equations in  $n$  unknowns, Linear Independence, Basis and Dimension, Linear transformations, Eigen values and Eigen vectors, Diagonalization.

## **MODULE 2**

### **Elementary Probability Theory**

Probability Axioms, Combinational Problems, Conditional Probability, Independence of Events, Total Probability Theorem, Baye's Theorem, Bernoulli Trials.

### **Discrete and Continuous Random Variables:**

Random Variables and their Event Spaces, Probability Mass Function, Probability Density Function, Cumulative Distribution Function, Expectation, Variance, Moment Generating Function, Characteristic Function, Special Discrete and Continuous Distributions, Functions of Random Variables.

## **MODULE 3**

### **Higher dimensional random variables:**

Two dimensional random variables, marginal distributions, conditional distributions, conditional expectation, independence of random variables, covariance and correlation, cumulative distribution function for two-dim random variables, functions of two-dim random variables, Linear combinations of random variables and moment generating functions, Law of large numbers.

### **Stochastic Processes**

Classification of Stochastic processes, Methods of Description of Stochastic processes, Special Classes of Stochastic processes, Stationarity, Ergodicity.

## **MODULE 4**

### **Special Stochastic Processes**

Bernoulli processes, Poisson processes, Renewal processes, Discrete Time Markov Chains, Computation of  $n$ -step transition probabilities, Chapman-Kolmogorov Equations, Classification of States and Limiting Probabilities, Applications.

### **Queuing Theory:**

Continuous time Markov chains, The birth-death processes in Queueing, Considerations in Queueing models, M/M/1, M/M/C and M/G/1 Queueing Models.

## MODULE 5

### **First Order Logic**

Syntax and semantics, extensions and notational variations, using first order logic, deducing hidden properties, inference in first order logic, quantifiers, modus ponens, forward and backward chaining.

### **Optimization**

Linear Programming, Simplex method, Revised Simplex method, M-method, Theory of Duality, Assignment Problems.

### **Recommended Reference Books:**

1. Sheldon Ross, A First Course in Probability, Sixth Edition, Pearson Education.
2. Sheldon M. Ross, Introduction to Probability Models, Seventh Edition, Academic Press.
3. K.S. Trivedi, Probability Statistics with Reliability, Queueing and Computer Science Applications, Prentice Hall, 2000.
4. Sheldon Axler, Linear Algebra Done Right, Second Edition, Springer Verlag, 1997.
5. Niven I and Zuckerman H.S., An Introduction to the theory of numbers, Wiley Eastern Ltd. 1989.
6. Topics in Algebra by I. N. Herstein.
7. Hamdy A. Taha, Operations Research-An Introduction, Seventh Edition, Pearson Education.
8. E Mendelson, Introduction to Mathematical Logic, Van Nostrand Reinhold, New York, 1964
9. D Gries and F.B. Schneider, A Logical Approach to Discrete Math, Springer Verlag, New York, 1993.
10. P Supper, Introduction to Logic, D.Van Nostrand, Princeton, NJ, 1987.

**Note : The semester theory exam shall consist of five questions with one question from each module.**



# **MIT 102 Internet Security**

**Objective:** To impart the concepts related to the network security so that the student directly implements the security related algorithms. Secret and Public Key Cryptography, Firewalls, authentication, and secured communication techniques are to be studied as part of this course.

## **MODULE 1**

### **1. Introduction:**

- Why Security? Picking a security policy strategies for a secure network,
- Gateways and Firewalls, protecting passwords, the Ethics of computer security.
- An overview of TCP/IP, different layers, Routers and routing protocols, the domain name system standard services
- The network time protocol, File transfer protocols, Information Services.
- The X.25 system.

## **MODULE 2**

### **2. Crptography:**

- Block Ciphers and the Data Encryption Standard, Block Cipher Modes of Operation
- Contemporary Symmetric Ciphers: Tripple DES, Blowfish, RC4, RC5
- Public Key Cryptography, RSA
- Hash Algorithms, MD5, SHA, HMAC

## **MODULE 3**

### **3. Firewall Gateways:**

- Packet filtering gateways, Filtering FTP sessions, Filtering X windows sessions.
- Filter placement. Filtering other protocols, Routing filters, Implementing packet filters.
- Application level Gateways, circuit level gateways, what firewalls cant do,
- Building an application level gateway, Hardware configuration options,
- Internet installation, Gateway tools, Installing services, Proxy Services,
- WWW, Protecting the protectors, Gateway administration, (Evaluation Firewalls) Gateway tools.

## **MODULE 4**

### **4. Authentication:**

- User authentication, Host to host authentication, Gateway tools, Internet hacking, Hacker's workbench, discovering a hacker,
- Ping list , mapping tools, Fremont, Probing hosts, connection tools, Network monitors, Attacks on internet.
- Classes of attacks, stealing password, social engineering, Bugs and backdoors,
- Authentication failure, protocol failure, information leakage, Denial of services.
- Legal Consideration: Computer crime statutes, Log files as evidence, Legality of network monitoring.

## **MODULE 5**

### **5. Secure Communication & Network Security:**

- The Kerbens Authentication System
- Link level encryption, Application level encryption.

**Recommended Reference Books:-**

1. Fire walls and Internet Security, 2<sup>nd</sup> edition – William RCheswik and Steven M. Bellovin AT & T
2. Practical Unix & Internet Security, 2<sup>nd</sup> edition – O'Reilly Publication
3. Building Internet Firewalls – O'Reilly Publication
4. Cryptography and Network Security, William Stallings, Third Edition, Prentice Hall ISBN 0-13-03221-0

**Note :** The semester theory exam shall consist of five questions with one question from each module.

# MIT 103 Information Retrieval

## MODULE 1

1. **Overview of Information Retrieval:**
  - Function of an IR system
  - Kinds of IR systems
  - Components of an IR system
  - Problems in designing an IR system.
  - The nature of unstructured and semi-structured text
  
2. **Text Analysis and Indexing**
  - Preliminary stages of text analysis and document processing, tokenization, stemming, lemmatization, stop words, phrases,
  - Indexing: Boolean IR models, inverted files, indexing, signature files, PAT trees, Positional indices
  - Vector-based IR models: TF/IDF term weighing, similarity measures, test collections and issues
  
3. **Index construction and Compression:**
  - Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes
  - Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law. Blocking. Extreme compression

## MODULE 2

4. **Query Processing:**
  - Query expansion: spelling correction and synonyms. Wild-card queries, permuterm indices, n-gram indices. Edit distance, soundex, language detection
  
5. **Matching techniques:**
  - Similarity between documents and queries
  - Parametric or fielded search. Document zones.
  - The vector space retrieval model.
  - tf.idf weighting.
  - Scoring documents, vector space scoring, the cosine measure, efficiency considerations, reduced dimensionality approximations, Latent Semantic Indexing (LSI), random projection, Page Ranking and HITS

## MODULE 3

6. **Information Extraction:**
  - Information extraction
  - Named entity extraction
  - Question Answering
  - Summarization - Qualities of good summary, summary types, extract summary



## 7. **Evaluation of IR systems**

- Assessment of the performance of IR systems - Precision, Recall, F-Measure
- Criteria for evaluation, measuring 'goodness', tests of IR systems
- Presentation of search results, display of search results, manipulation of search results.

## 8. **Relevance feedback:**

- User modeling and information need: user profiling
- Relevance judgments
- Additional term selections to the system
- Dynamic respond ally to judgments and selections.
- Personalization of search

## **MODULE 4**

## 9. **Taxonomy and Ontology:**

- Creating domain specific ontology
- Ontology life cycle

## 10. **Distributed and Parallel IR:**

- Relationships between documents
- Identify appropriate networked collections
- Multiple distributed collections simultaneously.

## **MODULE 5**

## 11. **Web Search Engines:**

- Web crawlers, robot exclusion
- Web data mining
- Metacrawler, Collaborative filtering, Web agents (web shopping, bargain finder,..)
- Economic, ethical, legal and political issues.

## 12. **Multimedia IR:**

- Techniques to represent audio and visual document
- Query databases of multimedia documents
- Display the results of multimedia searches.

### *Laboratory topics:*

- Zipf's Law in action
- Stemming
- Automatic indexing
- Automatic classification; clustering
- Document retrieval
- Information retrieval on WWW: advances in searching

- SQL database creation, data retrieval and update
- Database security and integrity
- Using a servlet to give access to a database over the world-wide web

**Recommended Text Books:-**

1. Managing Gigabytes, by I. Witten, A. Moffat, and T. Bell.
2. Modern Information Retrieval, by R. Baeza-Yates and B. Ribeiro-Neto.
3. Information Retrieval: Algorithms and Heuristics by D. Grossman and O. Frieder

**Note : The semester theory exam shall consist of five questions with one question from each module.**

# **MIT 104 Distributed Applications**

## **MODULE 1**

### **Distributed Object Computing:**

- 1) Introduction
  - Distributed Objects and distributed data, Distributed architecture and distributed design patterns, Distribution ( Network protocols and properties).
  - Methods of distribution - sockets, Inferno, RPC, CORBA and Object adapters
  - Java – sockets, RMI, IDL, COM – Architecture, Dynamicity and multithreading.
- 2) Java RMI:
  - Streams, Sockets, Serialization, Threads, RMI registry
  - Naming services, MI, runtime,
  - Dynamic class loading, Security policies, Applications.

## **MODULE 2**

- 3) COM, DCOM, COM+:
  - Overview of Microsoft Distributed Component technologies
  - Protocols and Object lifetimes
  - Interface Definition language–MIDL (Variable types, Modules and Interfaces ).
  - Building COM+ applications

## **MODULE 3**

- 4) CORBA:
  - Basics, Object Location, ORB CORBA and Architecture
  - Objects with IDL, Security, Object persistent
  - CORBA services
  - Building CORBA applications

## **MODULE 4**

### **Distributed Databases**

- 1) Overview
- 2) Distributed Database Design:
  - Fragmentation: Reasons, degree, types: horizontal, vertical, Allocation.
- 3) Query Processing:
  - Complexity of Relational Algebra operations
  - Query Decomposition
  - Localization of distributed data.

## **MODULE 5**

### 4) Optimization of distributed Queries:

- Query optimization, Search space, Distributed Cost model
- Query optimization algorithms: INGRES, System R, Join ordering, Join v/s Semijoin

### 5) Transaction Management and Concurrency Control

- Properties of transactions
- Serialization theory
- Concurrency control algorithms
- Deadlock management

### **Recommended Reference Books:-**

1. Principles of Distributed Database Systems by M. Tamer Ozsu and Patric Valduriez. PHI
2. COM & DCOM – Microsoft version of distributed objects By Roger Sessions, John & sons.
3. Java Programming with CORBA, Advanced Techniques for building Applications by A. Vogel & K. Duddy, J Wiley & Sons.

**Note : The semester theory exam shall consist of five questions with one question from each module.**

# **MIT 201 Advanced Communication Networks**

## **MODULE 1**

### 1) Integrated Services Digital Networks (ISDN)

A conceptual view, ISDN Standards, ISDN interfaces and functions, transmission structure, user network interface, ISDN connection, Internet working, ISDN physical layer, data link layer, network layer.

ISDN services, capabilities, bearer services, tele services, basic and supplementary services.

ISDN signaling system, SS7 Architecture, signaling, data link level, network level.

Signaling connection control part (SCCP), ISDN user port (ISUP)

## **MODULE 2**

### 2) Frame Relay:

Protocols and services, frame-mode protocol architecture, frame mode call control, LAPF.

Congestion control: Approach to congestion control, traffic rate management, explicit congestion avoidance, implicit congestion control.

### 3) Broadband ISDN (B-ISDN):

Standard Broadband services, requirements, Broadband ISDN Protocols - Reference Model, Physical Layer.

SONET / SDH

## **MODULE 3**

### 4) A synchronous Transfer Mode (ATM):

ATM Protocols, Transmission of ATM cells, ATM Adaptation Layer.

ATM Traffic and congestion control: Requirements for traffic and congestion control.

ATM Service categories:

Traffic related attributes, Traffic management, ABR Traffic Management.

## **MODULE 4**

### 5) Adhoc Wireless Networks:

Body, personal and local Adhoc wireless networks, (mobile Adhoc networks). Technologies for Adhoc Networks, IEEE MANETS 802.II, Architecture and Protocols, Blue tooth, Unicast Routing Techniques for MANETS: Introduction, Protocols, Protocol performance analysis.

Multicasting techniques in MANETS: Multicast Protocols in wired network, Multicast Protocols in MANETS.

## **MODULE 5**

### 6) Quality of service in MANETS:

Routing with QOS constraints (QOS)

QOS routing in Adhoc networks: QOS Routing with security constraints.

Performance analysis of wireless adhoc networks (WANETS)

WANET Topology, spatial reuse and connectivity, capacity of a WANET, Performance of Blue tooth, performance of TCP controlled transfers over a WANET.

Power Management in MANETS: Medium access and energy conservation, Routing and energy efficiency in WANETS, Application level energy conservation.

Power conservation design in WANETS: Transmission Power Control Mechanism, MAC-Layer Power Management, Network Layer Power Management, Higher Layer Power Management.

Quality of service (QOS) models for MANETS: MANET features and QOS Models, FQMM-A Flexible QOS Model for MANETS- Framework Architecture of FQMM: Evaluation of FQMM.

Security and Privacy Aspects in MANETS (WANETS)

Vulnerable nature of WANETS, Security needs, attacks in WANETS, overview of security schemes for WANETS.

**Recommended Text Books:-**

1. Halsall, F(1999) Data Communication, Computer Networks and Open Systems, Pearson Education, Asia.
2. Stallings, W(2000), ISDN and Broadband ISDN with Frame Relay and ATM, Pearson Education, Asia.
3. Mohammad Ilyas (Ed), The Hand book of Ad Hoc Wireless Networks, CRC Press (2003)

**Recommended Reference Books:-**

4. Handel, R. Huber, M.N., and Schroder, S. (1994), ATM Networks: Concepts, Protocols, Applications (2<sup>nd</sup> edition), Addison, Wesley.
5. Kumar, B(1995), Broadband Communications, A professional guide to ATM, Frame Relay, SMDS, Sonet, and B-ISDN, New York, McGraw-Hill.
6. Bleazard, G.B. (1982), Handbook of Data Communication, NCC Publications.

**Note : The semester theory exam shall consist of five questions with one question from each module.**

# **MIT 202 Data Mining and Warehousing**

## **MODULE 1**

1. Introduction to Data Mining - Motivation
2. Data Warehouse:
  - Difference between database systems and Data warehouse.
  - Multidimensional data model
  - Data warehouse architecture and implementation
  - Data warehousing to data mining

## **MODULE 2**

3. Data Preparation for Knowledge Discovery
  - Data Preprocessing
  - Data cleaning
  - Data reduction
  - Relevant data for knowledge discovery
  - Data mining query language
4. Concept Description
  - Data generalisation and summarisation based characterisation
  - Analysis of attribute relevance
  - Mining descriptive statistical measures for large databases

## **MODULE 3**

5. Mining association rules in large databases:
  - Association rules mining.
  - Mining association rules from transactional databases.
  - Mining multidimensional association rules from relational databases and data warehouses.
6. Classification and prediction.
  - Classification based on decision tree induction
  - Bayesian classification
  - Classification based on concepts from association rules mining
  - Prediction and classifier accuracy

## **MODULE 4**

7. Cluster analysis.
  - Types of data in cluster analysis
  - Categorisation and study of major clustering methods
8. Mining Complex Types of Data
  - Descriptive mining of complex data objects
  - Mining spatial databases
  - Mining multimedia databases

## **MODULE 5**

9. Populating a Data Warehouse
  - Survey of Issues involved
  - Functional requirements of a data warehouse populating subsystem
  - Techniques and tools for a data warehouse populating subsystem

### **Recommended Text Books:-**

- 1) Data Mining, Concepts and Techniques, Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers.
- 2) Principles of Data Mining, Hand, Mannila and Smyth.
- 3) Introduction to Building the Data Warehouse, IBM, PHI.

**Note : The semester theory exam shall consist of five questions with one question from each module.**



# **MIT 204.4      Designing Web Services Applications**

## **MODULE 1**

- 1)      Web Services frameworks:
  - Web Services use cases
  - Typical web application needs from the perspective of different actors
  - Using UML to model Web Services applications
  - Web Services architecture

## **MODULE 2**

- 2)      Basic Technologies and Standards
  - XML
  - SOAP & WSDL
  - UDDI

## **MODULE 3**

- 3)      Advanced Standards
  - Conversations
  - Workflow
  - Transactions
  - Security.

## **MODULE 4**

- 4)      Design Patterns:
  - What is a design pattern? Describing design patterns, Catalog of design patterns
  - Applicability of design patterns for Web applications.
  - Design patterns for Web services
  - Patterns as given in Core J2EE Patterns

## **MODULE 5**

- 5)      Enterprise Solutions
  - The Technologies
  - J2EE & .NET
  - alternates – e.g. Zope
  - Implementing Realworld Solutions
  - Client side programming
  - User Interface Design
  - Forms Design & Processing
  - Server Side Programming

- Components, Beans
- Data handling
- Working with XML
- Data exchange across tiers
- Hosting and Security

**Recommended text Books:-**

1. Developing Enterprise Web Services – An Architect's Guide, Sandeep Chatterjee, James Webber, Pearson Education.
2. Core J2EE Patterns: Best Practices and Design Strategies 2nd Ed, Deepak Alur, John Crupi and Dan MalksCore,
3. Patterns of Enterprise Application Architecture, Martin Fowler.
4. ASP.NET 1.1 Insider Solutions, Alex Homer, Dave Sussman, Dan Wahlin and Dan Kent, Pearson Education.

**Additional References**

1. Building Web Applications with UML, Jim Conallen, Pearson Education.
2. W3C Documentation on Web Services.
  - a) -Web Services Architecture <http://www.w3.org/TR/ws-arch/>
  - b) -Web Services Architecture Usage Scenarios <http://www.w3.org/TR/ws-arch-scenarios/>
  - c) -Web Service Management: Service Life Cycle <http://www.w3.org/TR/wslc/>
  - d) -Web Services Glossary <http://www.w3.org/TR/ws-gloss/>
3. J2EE & Design Patterns : <http://java.sun.com/blueprints/patterns/>
4. ASP.Net : <http://www.asp.net/>
5. Zope : <http://www.zope.org>

**Note : The semester theory exam shall consist of five questions with one question from each module.**

## **MIT 204.1 E-Commerce (Elective - I)**

**Objective:** To impart an in-depth understanding of the laws and principles of E-commerce. The business models using E-commerce, e-banking, Supply chain management are part of the course study in detail.

### **MODULE 1**

1) **Introduction to E-Commerce:**

- Defining E C, Forces fueling E C: Electronic Forces, Marketing and customer Interaction Forces, Technology and Digital Convergence.
- E C Industry frame work: Information Super highway, Multimedia Content.
- Types of E C: Inter Organizational, Intra Organizational, Consumer to Business, Intermediaries and E C.
- EDI: Benefits, Limitations.

2) **Business Models:**

- What is a business model
- Classification schemes for new economy
- Schwab's business model.

### **MODULE 2**

3) **Market Communications and Branding**

- Categories of market communications
- Branding basics
- Branding process
- Case studies of America air lines & Monster.com
- Schwab marketing communications and branding

4) **E C and Banking:**

- Changing Dynamics in banking industry
- Changing consumer needs
- Management issues in on-line banking

### **MODULE 3**

5) **E C and SCM:**

- E C and Supply Chain Management
- Pull v/s Push Supply chain models
- Elements of SCM, Integrating functions in SCM.

### **MODULE 4**

6) **Implementation:**

- On – line Implementation
- Delivery system, Categories of off-line innovation
- New economy innovation frame work

7) **Metrics:**

- Performance dashboard
- Sources of metrics information to chart progress of a firm
- Schwab Metrics

## MODULE 5

### 8) **Security of transaction:**

- Authentication
- Signatures
- Anonymity
- Privacy
- Trace ability
- Key Certification
- Management & escrow
- Electronic digital cash
- Electronic checks
- Online credit card based systems
- Micro payments

### Recommended Books:-

- 1) EC, a Manager's Guide – Kalokota, Whinston (Pearson Education Asia)
- 2) E- Commerce – Rayport & Jaworski (Tata Mc Graw Hill)
- 3) E – Business with Net Commerce, Addison Wesley publishing

**Note : The semester theory exam shall consist of five questions with one question from each module.**

**MODULE 1**

**1. Introduction to Embedded Systems**

- An Embedded system
- Processor in the System
- Other Hardware Units
- Software Embedded into a system

**2. Processor and Memory Organization**

- Structural units in a processor
- Processor selection for an embedded system
- Memory devices
- Direct Memory access

**MODULE 2**

**3. Devices and Buses for Devices Network**

- I/O Devices
- Timer and Counting Devices
- Serial Communication using advanced I/O buses
- Computer parallel Communication

**4. Device Drivers and Interrupts Servicing Mechanism**

- Device Drivers
- Parallel Port Device Drivers in a System
- Serial Port Device Drivers in a System
- Device Drivers for Internal Programmable Timing Devices
- Interrupt Servicing (Handling) Mechanism
- 

**MODULE 3**

**5. Programming Concepts and Embedded Programming in C and C++**

- Software programming in Assembly language (ALP) and in High level language 'C'
- Embedded Programming in C++

**6. Program Modeling Concepts in Single and Multiprocessor Systems Software-Development Process**

- Modeling Processes for Software analysis before software implementation
- Programming Models for Event Controlled or Response Time Constrained
- Real Time Programs
- Modeling of Multiprocessor Systems

**7. Software Engineering Practices in Embedded Software Development Process**

- Software algorithm complexity
- Software Development Process Life Cycle and its Models
- Software Analysis, Software Design, Software Implementation
- Software Testing, Validating and Debugging
- Unified Modeling Language (UML)

## **MODULE 4**

### **8. Inter Process Communication and Synchronization of Processes, Task and Threads**

- Multiple processes in an application
- Problem of sharing data by multiple tasks and routines
- Inter process communication

### **9. Real Time Operating Systems**

- Operating system services
- I/O Subsystems
- Network Operating systems
- Real-time and embedded system operating systems
- Interrupt routines in RTOS environment
- RTOS task scheduling models

## **MODULE 5**

### **10. Case Studies of Programming with RTOS**

### **11. Hardware-Software Co-Design in an Embedded System**

- Embedded System Project Management
- Embedded system design and Co-design Issues in System Development
- Process
- Design Cycle in the Development phase for an Embedded system

### **Recommended Books:**

1. Embedded Systems: Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill, India, 2003, ISBN 0-07-049470-3
2. Fundamentals of Embedded Software: Where C and Assembly meet by Lewis Daniel W., Prentice Hall, ISBN 81-203-2375-0
3. Computers as Components: Principles of Embedded Computer Systems Design by Wayne Wolf, Morgan Kaufmann; 1st edition (October 25, 2000), ISBN 155860541X

**Note : The semester theory exam shall consist of five questions with one question from each module.**

# MIT 204.3 Multimedia Systems and Applications

**Objective:** This subject imparts understanding of concepts related to multimedia systems and applications. Speech coding standards, still image compression techniques, user interfaces, DSP programming and graphics used in multimedia systems give an in depth knowledge about the multimedia engineering.

## MODULE 1

### 1. **Multimedia Communications:**

- Introduction, Network and Network Services, Application of multimedia.
- Four traffic Hypothesis, Architectural Issues, Synchronization, Orchestration and QOS Architecture.
- Digital Audio representation and processing.

### 2. **Speech Coding Standards:**

- Introduction, Speech Analysis – Synthesis and Linear Prediction.
- LTP, Open – Loop linear prediction, Standards based on Sub-band and Transform coders.

## MODULE 2

### 3. **Audio Coding Standards:**

- ISO/MPEG Audio coding standard – MPEG -1 and -2 Compression,
- MPEG Model, Algorithm, Temporal prediction, Frequency domain decomposition, Quantization, Rate control, constraints.
- MPEG – 4 and –7, Introduction, MPEG -4 System Model, Natural Video coding, Audio and Speech coding, MPEG -7.

### 4. **Still Image Compression:**

- Lossy compression: JPEG, JPEG 2000.
- Lossless compression: JPEG, JPEG – LS.
- Bilevel compression: JBIG, JBIG2. ITU – T recommendation H.261- coding algorithm and data stream.
- ITU – T recommendation H.263- coding algorithm and data stream.
- GIF format.

## MODULE 3

### 5. **Multicasting :**

- Overview
- Multicasting in IP based Networks, Multicasting in ATM Networks
- IP Multicasting over ATM Networks
- Reliable Multicast transport Protocol.

### 6. **MPEG Compression :**

- Introduction and MPEG model
- MPEG Video, Basic Algorithm, Temporal Prediction, Freq. Domain Decomposition
- Quantization, Variable Length Coding, Rate Control,
- Constrained Parameters, Levels, and Profiles
- MPEG4 System Model, Video Coding, Audio and Speech Coding

## MODULE 4

### 7. **Computer Graphics:**

- Conceptual framework of computer graphics
- Basic Raster graphics algorithm for 2D primitive, Geometric primitives and geometric modeling
- 3D Viewing, Illumination and Shading, Visible surface determination
- Image manipulation and storage, Advanced geometric and raster algorithms, Advanced Raster graphics Architecture.
- Graphics Hardware: Hardcopy Technologies, Video controller, Display Technologies, Raster / Random scan displays.

## MODULE 5

### 8. **Synchronization:**

- Basic Synchronization Issues, Intra- and Inter- object Synchronization, Live and Synthetic Synchronization.
- Lip, Pointer and Media Synchronization
- Synchronization Reference Model,
- Synchronization Specification, QOS, Interval Based Specifications, Axes-based Synchronization, Control flow-based Specification, Event-based Synchronization

### Recommended Books:

1. Computer Graphics Principles and Practices- Foley J.D., Van Dam A., Feiner, S.K and Hughes.
2. Multimedia Communications, Jerry D. Gibson, Academic Press, ISBN 0-12-282
3. Multimedia: Computing Communications & Applications, Ralf Steinmetz, and Klara Nahrstedt, Pearson Education, ISBN 81-7808-319-1

**Note : The semester theory exam shall consist of five questions with one question from each module.**



# **MIT 203 Software Quality Assurance & Project Management**

## **MODULE 1**

1. Introduction
  - Importance of Project Management for Software Quality Assurance
  - Overview of the course
2. Processes and Lifecycles
  - Process overview
  - Selecting a software development lifecycle
  - Managing processes

## **MODULE 2**

3. Organising a Project
  - Selecting a project team
  - Defining scope and goals of a project
  - Work breakdown structures
  - Software sizing and estimation
  - Assigning resources
  - Choosing an Organisational form
4. Managing Production
  - Scheduling the work
  - Eliciting Requirements
  - Producing Quality Software Requirements Specifications
  - Identifying and dealing with risks

## **MODULE 3**

5. Managing Quality
  - Introducing Software Engineering Body of Knowledge (SWEBOK)
  - Understanding CMM
  - Reliability
  - Software Metrics
  - Validation & Verification

## **MODULE 4**

6. Writing Correct Software
  - Design by Contract
  - Importance of language and style
  - Discussion of issues like reusable components, defensive programming – are they necessarily good.

## **MODULE 5**

### 7. Testing Approaches & Tools

- Extreme Programming
- Unit framework

### **Recommended Books**

1. Robert T. Futrell, Donald F. Shafer, Linda I. Shafer, Quality Software Project Management, Pearson Education.
2. Bertrand Meyer, Object-Oriented software construction, second edition, Prentice Hall, 1997.
3. JUnit framework for testing Java programs : <http://www.junit.org>
4. Extreme Programming Resources: <http://www.xprogramming.com>

Note : The semester theory exam shall consist of five questions with one question from each module.

# **MIT 301 Internet Protocol Design**

**Objective** : Internet protocol design a relatively new subject deals with the various design aspects of protocol engineering. The network reference model, protocol specification and specification language(SDL) make a sound foundation before taking up the verification and validation aspects of protocol design.

## **MODULE 1**

### **1. Introduction**

Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases

### **2. Error Control, Flow Control**

Type of Transmission Errors, Linear Blck Code, Cyclic Redundancy Checks  
Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance.

### **3. Network reference model**

Layered Architecture, Network Services and Interfaces  
Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols

### **4. Protocol Specification**

Components of specification, Service specification, Communication Service Specification  
Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.

## **MODULE 2**

### **5. Protocol Specification Language (SDL)**

Salient Features. Communication System Description using SDL  
Structure of SDL. Data types and communication paths  
Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification  
SDL based platform for network, OSPF, BGP  
Multi Protocol Label Switching SDL components

## **MODULE 3**

### **6. Protocol Verification/Validation**

Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Nonexecutable Interactions, State Ambiguities.  
Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation.  
.SDL Based Protocol Verification: ABP Verification, Liveness Properties  
SDL Based Protocol Validation: ABP Validation.

## **MODULE 4**

### **7. Protocol Conformance and Performance Testing**

Conformance Testing Methodology and Framework.

Local and Distributed Conformance Test Architectures:

Test Sequence Generation Methods: T, U, D and W methods

Distributed Architecture by Local Methods, Synchronizable Test Sequence

Conformance testing with Tree and Tabular Combined Notation (TTCN).

Conformance Testing of RIP

Testing Multimedia Systems, quality of service test architecture(QoS)

Performance Test methods, SDL Based Performance Testing of TCP, OSPF

Interoperability testing, Scalability testing protocol synthesis problem

## **MODULE 5**

### **8. Protocol Synthesis and Implementation**

Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis

Requirements of Protocol Implementation, Objects Based Approach To Protocol Implementation

Protocol Compilers, Code generation from Estelle, LOTOS, SDL and CVOPS

#### **Reference Books:-**

1. Pallapa Venkataram and Sunilkumar S. Manvi, Communiation Protocol Engineering, Prentice Hall Private Limited, ISBN-81-203-2653-9
2. G. Holtzmann, DEsign and Validation of Computer protocols, Prentice hall, 1991

Note : The semester theory exam shall consist of five questions with one question from each module.

# **MIT 302.1 Mobile Computing**

## **MODULE 1**

### **1. Introduction to wireless networking.**

- Advantages and disadvantages of wireless networking

### **2. Characteristics of radio propagation.**

- Fading, Multipath propagation

### **3. Introduction to digital transmission.**

- Definition of bit-rate and signalling rate.
- Introduction to synchronous transmission.
- The need for pulse shaping, synchronisation and line-coding.
- Calculation of bit-error probabilities when the channel is affected by the addition of Gaussian noise.

## **MODULE 2**

### **4. Narrowband digital modulation.**

- The need for modulation.
- Binary and multi-level (M-ary) amplitude-shift keying (ASK),
- frequency-shift keying (FSK) and phase-shift keying (PSK).

### **5. Wideband modulation techniques to cope with intersymbol interference**

- Direct sequence spread spectrum Adaptive Equalization Orthogonal frequency division multiplex

## **MODULE 3**

### **6. Medium Access Control (MAC).**

- MAC protocols for digital cellular systems such as GSM.
- MAC protocols for wireless LANs such as IEEE802.11 and HIPERLAN I and II.
- The near far effect. Hidden and exposed terminals.
- Collision Avoidance (RTS-CTS) protocols.

## **MODULE 4**

### **7. Protocols supporting mobility.**

- Mobile network layer protocols such as mobile-IP, Dynamic Host
- Configuration Protocol (DHCP).
- Mobile transport layer protocols such as mobile-TCP, indirect-TCP.
- Wireless Application Protocol (WAP).

## **MODULE 5**

### **8. Mobile Computing Applications and Platforms**

- Mobile Computing Applications: Supporting M-Business and M-Government
- Wireless Internet, Mobile IP, and Wireless Web
- Mobile Computing Platforms, Middleware, and Servers

**Recommended Textbooks:**

1. Mobile communications, J.Schiller, ISBN: 0-321-12381-6, Addison-Wesley, 2003  
Mobile Computing and Wireless Communications, by Amjad Umer, Nge Solutions; (July 2004) ISBN 0975918206

Note : The semester theory exam shall consist of five questions with one question from each module.

# **MIT 302.2Real Time Systems**

## **MODULE 1**

### **1. Introduction:**

- Definitions, misconceptions about Real time systems, challenges faced by Real time systems
- Hard versus Soft Real time Systems

### **2. A Reference model of Real time systems:**

- Temporal Parameters of Real time Work load
- Periodic Task model
- Precedence constraints and data dependency

### **3. Commonly Used Approaches to Real-time scheduling:**

- Clock driven approach
- Weighted round robin approach
- Earliest Deadline First Algorithm and LST Algorithm

## **MODULE 2**

### **4. Clock-Driven Scheduling**

- Static, Timer-driven scheduler
- General structure of Cyclic Schedules
- Cyclic Executives

### **5. Priority-Driven Scheduling of Periodic Tasks**

- Fixed priority versus Dynamic priority algorithms
- Maximum schedulable utilization
- Rate Monotonic and Deadline Monotonic Algorithms
- Schedulability tests
- Sufficient Schedulability conditions for RM and DM Algorithms

## **MODULE 3**

### **6. Resources and Resource access control**

- Assumptions on Resources and their usage
- Effects of Resource Contention and Resource Access Control
- Nonpreemptive Critical Sections
- Basic Priority-Inheritance Protocol
- Basic Priority-Ceiling Protocol
- Stack-based, priority-ceiling protocol
- Use of Priority-Ceiling protocol in Dynamic priority systems
- Preemption-Ceiling protocol

## 7. Scheduling aperiodic and sporadic jobs in priority-driven systems

- Deferrable servers
- Sporadic Servers
- Constant Utilization, Total Bandwidth Servers
- Slack Stealing in deadline-driven systems
- Slack stealing in fixed-priority systems
- Scheduling of Sporadic Jobs

### **MODULE 4**

## 8. Real time Operating Systems

- Real time threads
- Control of shared resources – mutual exclusion
- Shared Variable-Based Synchronization and Communication
- Message-Based Synchronization and Communication
- Inter-task communication
- Memory management
- Distributed systems

### **MODULE 5**

## 9. Reliability and Fault Tolerance

- Reliability, failure and faults
- Failure modes
- Fault prevention and fault tolerance
- Software dynamic redundancy
- Dynamic redundancy and exceptions
- Measuring and predicting the reliability of software
- Safety, reliability and dependability

## 10. Software Engineering for Real time Systems

- Requirements analysis and specification
- Software and Program design concepts
- Diagramming
- Practical Diagramming methods
- Designing and constructing software
- Mission-Critical and Safety-Critical Systems
- Performance Engineering

### **Recommended Textbooks:**

1. Real-Time Systems, by Jane W.S. Liu, Pearson Education Inc. 2000
2. Software Engineering for Real-time Systems by Jim Cooling, Addison Wesley, 1st edition (November 11, 2002)
3. Real-Time Systems and Programming Languages (Third Edition)
4. Ada 95, Real-Time Java and Real-Time POSIX  
by Alan Burns and Andy Wellings, March 2001  
Addison Wesley Longman

Note : The semester theory exam shall consist of five questions with one question from each module.



# **MIT 302.3 Network Economics**

**Objective:** To impart an in-depth understanding of the laws and principles of economics, as applied to Information Networks, especially the Internet.

## **The Information Economy**

### **MODULE 1**

#### **1. Cost of Producing Information:**

- Production, Presentation and Packaging cost, Reproduction cost, Distribution costs, Selling costs Cost control techniques in Information technology

#### **2. Network Effects and Externalities:**

- Network effects defined, difference between effects and externalities
- Real and virtual networks, Metcalfe's law, direct and indirect network externalities
- DeLong's Law, Optimal Network size, Broad sense and narrow sense networks
- Theory of increasing returns to scale,

### **MODULE 2**

#### **3. Economic Issues in the Internet:**

- Distributed rational agents and social welfare, business models for e-commerce, from traditional to e-business
- Market mechanisms - advertising, sales, technology, distribution, competition
- Value chain and supply chain economies

## **Pricing Information Products**

#### **4. First, second, third degree discrimination**

- personalized pricing, quantity based pricing, Versioning, Group pricing
- Bundling, Pricing Models for telecommunications.

### **MODULE 3**

#### **5. Networks and Positive Feedbacks:**

- Positive-feedback loop
- Demand-side economies of scale
- Stochastic approximation and Lock-in.

#### **6. Recognizing and Managing Lock-in:**

- "Lock-in" cycle
- Switching costs
- Competition to acquire customers
- Differential pricing.

## Information Policy

### MODULE 4

1. **Managing Open Standard:**
  - a. Formal standard setting
  - b. Maximizing return
  - c. Economic growth
  - d. Technology as in Endogenous good

### MODULE 5

2. **Economic Models:**
  - e. Role of Combinatorial Optimization
  - f. Applications of Game theory
  - g. Queuing Theory
  - h. Auction Theory in Network Economics

### Recommended books :

1. “Internet Economics” - Lee W. McKnight, Joseph P. Bailey; MIT Press, 1997.
2. “Information Rules: A Strategic Guide to the Network Economy ” – Carl Shapiro and Hal R.Varian; Harvard Business School Press, 1999

### References :

1. “ The Theory of Externalities, Public goods, Club goods” – Cornes R., T. Sandler; Cambridge University Press, 1996.
2. “The Economics of Networks” – Patrick Cohendet, Patrick Werena, Hubert Stahn, Gisele Umbhauer; Springer Verlag Publishers, US, 1999
3. “The Economics of Network Industries” – Oz Shy; CUP, 2001.
4. “Combinatorial Optimization” – Eugene Lawler; Dover Publications, US, 2001.
5. “Game Theory at Work” – James Miller; McGraw-Hill, 2003.
6. “Game Theory: Analysis of Conflict” – Roger Myerson; Harvard University Press, 1997.
7. “Game Theory: A non-Technical Introduction” – Morton Davis; Basic Books, US, 1986.
8. “Technology and Market Structure: Theory and History” – John Sulton; MIT Press, 2001.
9. “Firms, Contracts & Financial Structure” – O.Hart; OUP, 1995.

### • Internet Web-links

1. <http://www.stern.nyu.edu/networks/dictionary.html>
2. [http://www.pbs.port.ac.uk/~judge/IfBE/IFBE\\_10/sld001.htm](http://www.pbs.port.ac.uk/~judge/IfBE/IFBE_10/sld001.htm) (slide 1 to 39)
3. [http://www.shoreyconsulting.com/eCommerce\\_Articles/Article\\_4\\_-\\_PDF.pdf](http://www.shoreyconsulting.com/eCommerce_Articles/Article_4_-_PDF.pdf)  
(Adobe acrobat reader file)
4. <http://mgmt.iisc.ernet.in/~netecon/term.html>
5. <http://zzyx.ucsc.edu/~boxjenk/ec139-01/139W01-11/sld001.htm>
6. <http://www.inforules.com/powerpt/standard.pdf> (Acrobat reader)

**Note : The semester theory exam shall consist of five questions with one question from each module.**

# MIT 302.4 Technology Management

**Objective:** To introduce students to the different issues and concepts in Management, Innovation, Transfer of Technology and its implementation in rural, urban, developed world and developing world scenarios.

## Technology and Transformation

### MODULE 1

#### **1. Technology and Adaptation:**

- Definition
- Technological changes
- Transformation in Organizations
- Changes in work culture, change management, Adaptation.

#### **2. Adaptation and Innovation:**

- Diffusion of Innovation,
- Factors increasing diffusion of new technologies in developed and developing countries.

### MODULE 2

#### **3. Technology Transfer and Transformation:**

- Technology transfer and its problems
- Product development, Marketing and Commercialization of New Technology
- Forces of change.

### MODULE 3

#### **4. Technology Implementation:**

- Management of Technology in Rural areas
- Problems and solutions in developing countries
- Forward and backward integration of Technology Implementation.

### MODULE 4

#### **5. Issues in Technology Management:**

- Productivity, efficiency, cost cutting, economies of scale, Corporate strategy, Planning,
- Decisions to diversify.

### MODULE 5

#### **6. Human Issues in Technology:**

- Staffing, Career planning,
- Human Resource Management,
- Motivating highly technical manpower,
- Organization Development strategies.
- An Introduction to IPR

### **Recommended books :**

1. "Technology Absorption in Indian Industry"- Ashok Dessai; Twiss Longman Group, 1998.
2. "Managing Technological Innovation " – Brian C.; Twiss Longman Group, 1986.
3. "Managing Innovation and Entrepreneurship in Technology- based Firms" – Michael J.C. Martin; Wiley-Canada, 1994.

### **References :**

1. "Knowledge Management – Enabling Business Growth" – Ganesh Natrajan, Sandhya Shekar; Tata-McGraw Hill, 2000.
2. " Forecasting and Management of Technology" – Alan Porter, A. Thomas Roper, Thomas Mason, Frederick Rossini, Jerry Banks; Wiley-Canada, 1991.
3. "Management of Technology & Operations" – R. Ray Gehani; Wiley-Canada, 1998
4. "Managing Technological Innovation: Competitive Advantage from Change" – Frederick Betz, Wiley-US/Canada, 2003.
5. "Organizational Behaviour" – Fred Luthens; McGraw –Hill, 2000

### **• Internet Weblinks**

1. [http://www.ucei.berkeley.edu/ucei/Recent\\_Presentations/From\\_Tech\\_Transfer\\_to\\_MT.pdf](http://www.ucei.berkeley.edu/ucei/Recent_Presentations/From_Tech_Transfer_to_MT.pdf). (Acrobat reader file)
2. <http://www.unu.edu/unupress/unupbooks/uu01se/uu01se0a.htm>

**Note : The semester theory exam shall consist of five questions with one question from each module.**

## **MIT 303Seminar**

The suggested seminar topics are listed below. However seminar topics need not be restricted only to these. Any other topic can be chosen from reputed journals and conference proceedings.

1. Multi protocol label switching
2. Virtual private networks
3. Genetic Algorithms
4. Internet Protocols
5. Web usability
6. Pervasive Computing
7. Advanced data Communications
8. Optical switches & routers
9. Optical Networks
10. Wireless Networks
11. Agent Based Systems
12. Mobile Agent Technology
13. Multimedia Protocols
14. Distributed Multimedia Systems
15. MPEG Standards
16. E-Commerce Models
17. Internet Traffic Models
18. Multimedia Traffic Modeling
19. M-Commerce
20. Broad – Band Network Technology
21. Internet Routing
22. Ad-hoc Network Management
23. Ad-hoc Network Operating Systems
24. Neutral Networks for Internet Management
25. High speed LANs
26. Resource Optimization in Networks

27. Distributed Information Management
28. Data Mining Techniques
29. Ware-Housing
30. Multimedia Contents Retrieval Systems
31. Internet Mark up languages
32. Mobile Communications
33. Resource Allocation in Mobile Networks
34. Dynamic Software Architectures
35. Component Based Software Engineering
36. Internet Applications
37. Internet Gadgets
38. Internet Security
39. Statistical Multiplexing & Switching
40. Web Agents
41. Electronic Payment & Security
42. Digital Libraries
43. Grid Computing
44. High Performance Parallel Computing
45. Cluster Computing
46. Agents in Data Mining
47. Agents Architectures
48. Smart Devices in Internet
49. Protocol Design Patterns
50. Protocol Specification & Validation Techniques.
51. Ethics

## **MIT 304 and MIT 401 Project Guidelines for the Project**

A Project work is a mandatory partial fulfillment requirement of the ME (IT) degree. The expected duration of the project is one year spread over third and fourth semesters. During the third semester, four credits are allotted for the project, while the fourth semester is reserved for the project with sixteen credits.

The topic of the project should be relevant to the program and must be approved by the Project Coordination Committee, consisting of the Head of the Department, a Senior member of the faculty and the project guide. The project must be chosen such that it extends the knowledge of the students beyond the subjects taught in the class, and should involve the study of current research in the chosen area.

The project work will be done under the supervision and guidance of a faculty member. It is expected to be completed within the stipulated time period. However, an extension of upto 6 months over and above the normal period of 1 year may be given at the discretion of the Project Co-ordination Committee. At the end of the extension, the committee should meet to decide about further extension/s.

The project work should be carried out by the students individually. An interim progress report must be submitted after a period of 6 months. The Project C-ordination committee will meet to decide about the continuation of the project. The project thesis can be submitted only after the Project Co-ordination Committee is satisfied about the adequacy of the quality and the quantity of the work done.

**MODULE 1**

**MODULE 2**

**MODULE 3**

**MODULE 4**

**MODULE 5**

**Note : The semester theory exam shall consist of five questions with one question from each module.**

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