Institute of Information Technology

Proposed Syllabus for
Professional Masters in Information Technologies (PMIT)

Syllabus for the
Professional Master in Information Technologies (PMIT)
2018 Onwards
Institute of Information Technology (IIT)
Jahangirnagar University

Overview of PMIT Program

- Duration of Program: One Year (Three Trimester)
- Duration of each Trimester: 4 Months
- Structure of PMIT Program: 10 (Ten) Core Courses + 6 (Six) Credit Hours Project
- Total Credit Hours: 10x3+6 = 36
- Class Time: Friday and/or Saturday

Distribution of Courses:

The entire syllabus is divided into pre-requisite courses and core courses. Core courses are divided into four groups namely Group A, Group B, Group C and Group D. A student may have to take maximum 04 (four) pre-requisite courses based on his/her academic backgrounds. A student has to take 10 (Ten) core courses from Group A, Group B, and Group C offered by the PMIT Coordination Committee. Also complete a research project which is mentioned in the Group D.

Pre-requisite Courses

Course Code	Course Title	Credit hours
PMIT-6001	Computer Programming Environment	3.0
PMIT-6002	Information System Analysis and Design	3.0
PMIT-6003	Data Structures and Algorithms	3.0
PMIT-6004	Operating System	3.0
PMIT-6005	Discrete Mathematics and Numerical Analysis	3.0
PMIT-6006	Database Management System	3.0
PMIT-6007	Web Technology	3.0
PMIT-6008	Computer Networks and Data Communication	3.0
PMIT-6009	Microprocessor and Interfacing	3.0
PMIT-6010	Software Engineering	3.0
PMIT-6011	Computer Architecture	3.0
PMIT-6012	Digital Logic Design	3.0
PMIT-6013	Telecommunication System	3.0
PMIT-6014	Signal and Systems	3.0
PMIT-6015	Object Oriented Programming (Python)	3.0
PMIT-6016	Sensor and Meaasurement Technology	3.0
PMIT-6017	E-Commerce and Mobile Application Design	3.0

Core Courses

Group A

Course Code	Course Title	Credit hours
PMIT-6101	Distributed Computing	3.0
PMIT-6102	Distributed Database	3.0
PMIT-6103	Advanced Database Management System	3.0
PMIT-6104	Database Security	3.0
PMIT-6105	Advanced Operating System	3.0
PMIT-6106	Advanced Data Structure and Algorithm	3.0
PMIT-6107	Artificial Intelligence and Neural Networks	3.0
PMIT-6108	Management Information System	3.0
PMIT-6109	Internet and Web Security	3.0
PMIT-6110	Advanced Software Engineering	3.0
PMIT-6111	Software Testing and Quality Assurance	3.0
PMIT-6112	Software Project Management	3.0
PMIT-6113	Mobile Application Development	3.0
PMIT-6114	Advanced Web Engineering	3.0

PMIT-6115	Simulation and Modeling	3.0
PMIT-6116	Information System Ethics and Cyber Law	3.0
PMIT-6117	IT Forensic	3.0
PMIT-6118	Computer Graphics	3.0
PMIT-6119	Graph Theory and Application	3.0
PMIT-6120	Embedded System	3.0
PMIT-6121	Machine Learning	3.0
PMIT-6122	Computational Thinking and Data Science	3.0
PMIT-6123	Deep learning and Data Augmentation	3.0
		3.0

Group B

Course Code	Course Title	Credit hours
PMIT-6201	Cloud and Mobile Computing	3.0
PMIT-6202	Multimedia Asset Management System	3.0
PMIT-6203	Network Security	3.0
PMIT-6204	Cryptography and Steganography	3.0
PMIT-6205	Cellular Network Planning	3.0
PMIT-6206	Fiber Optic Communication	3.0
PMIT-6207	Radio Frequency Technology	3.0
PMIT-6208	VLSI Layout Algorithms	3.0
PMIT-6209	Modeling of Data Networks	3.0
PMIT-6210	Telecommunication Network Management	3.0
PMIT-6211	Digital Signal Processing	3.0
PMIT-6212	Digital Image Processing	3.0
PMIT-6213	Speech Recognition	3.0
PMIT-6214	Information Coding	3.0
PMIT-6215	Tele-traffic Engineering	3.0
PMIT-6216	Telecommunication Traffic & Network Planning	3.0
PMIT-6217	Wireless Networks	3.0
PMIT-6218	Advanced Networking and Internet Technology	3.0
PMIT-6219	Advanced Digital Communication	3.0
PMIT-6220	Advanced Optical communication	3.0
PMIT-6221	Advanced Wireless Communication	3.0
PMIT-6222	Advanced Satellite Communication	3.0
PMIT-6223	IoT and Fog Computing	3.0
PMIT-6224	UI and UX	3.0
		3.0

Group C

Course Code	Course Title	Credit hours
PMIT-6301	Computational Biology	3.0
PMIT-6302	Computational Geometry	3.0
PMIT-6303	Advanced Neuroinformatics	3.0
PMIT-6304	Health Informatics	3.0
PMIT-6305	Bio-Informatics	3.0
PMIT-6306	Advanced Data Mining for Biological Data	3.0
PMIT-6307	Data Mining and Knowledge Discovery	3.0
PMIT-6308	Neuronal Information Discovery	3.0
PMIT-6309	Modeling of Biological Systems	3.0
PMIT-6310	Computer Vision	3.0
PMIT-6311	Human Computer Interaction	3.0
PMIT-6312	Robotics and Automation	3.0
PMIT-6313	Big Data Analysis	3.0
PMIT-6314	Information Retrieval	3.0
PMIT-6315	Natural Language Processing	3.0
PMIT-6316	Special Topics Related to ICT	3.0

Group D

Course Code	Course Title	Credit hours
PMIT-6000	Research Project	6.0

Pre-requisite Courses

In case of pre-requisite courses, course teacher may conduct lab classes (if necessary).

PMIT-6001: Computer Programming Environment

Programming concepts; Structured programming language: data types, operators, expressions, control structures; Functions and program structure: parameter passing conventions, scope rules and storage classes, recursion; Header files; Preprocessor; Pointers and arrays.
*Object Oriented Programming :*Features of Object Oriented Languages, Procedural vs. Object Oriented, Data Abstraction, Encapsulation, Inheritance, Polymorphism, Effects of OO Approach, Basic OO Design classes and encapsulation, constructors & destructors, Dynamic Memory Allocation, Pointers to Classes, I/O STREAM, overloading operators, constants, scope, & linkage, inheritance, polymorphism and dynamic binding, class and function templates.

TEXT & REFERENCE BOOKS:

1. Head First Java, Kathy Sierra and Bert Bates, O'reilly publication
2. Object Oriented Programming with C++ - E. Balagurusamy
3. Java -The Complete Reference – Herbert Schildt
4. Programming in C++ by Balagurusamy TMH.
5. Complete JAVA reference by Patrick Naughton.

6. LearningObject oriented Programming with C++ and JAVA, D.Samantha Prentice-Hall ofIndia pvt ltd.

PMIT-6002: Information System Analysis and Design

Introduction: Definition of system, Approaches to system development, System Life Cycle, Installing visible analyst, Project Management, Teaming of groups, *CASETOOL*: Using VISIBLE ANALYST for Data flow diagram, the survey phase, Information gathering and interviewing, *Tools of structured analysis:* data flow diagrams (DFD), Events and Data Stores, Entity Relationship Diagram, Data dictionary, Process specification, RMO, evaluating alternatives for requirement, *The object-oriented approach to requirements:* Class diagram, Use cases and activity diagrams, Structured Design, Transform Analysis, Using visible analyst to create structure chart, *Qualities of a good Design:* programming simplicity and system morphology, coupling, cohesion.

TEXT & REFERENCE BOOKS:

1. Systems Analysis & Design in a Changing World by Satzinger, Jackson, and Burd, Course Technology 2008, 5th edition, ISBN: 1-4239-0228-9.
2. Modern Structured Analysis by Yourdon, Prentice Hall 1989, ISBN 0-13-598624-9.
3. Practical Guide to Structured Systems Design by Page-Jones, Prentice-Hall 1988, ISBN: 0-13-690769-5.

PMIT-6003: Data Structures and Algorithms

Internal data representation; Abstract data types; Elementary data structures: arrays, lists, stacks, queues, trees, graphs; Advanced data Structures: heaps, Fibonacci heaps, B-trees; Recursion, sorting, searching, hashing, storage management. Techniques for analysis of algorithms; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound; Basic search and traversal techniques; Topological sorting; Connected components, spanning trees, shortest paths; Flow algorithms; Approximation algorithms; Parallel algorithms; Algebraic simplification and transformations; Lower bound theory; NP-completeness, NP-hard and NP-complete problems.

TEXT & REFERENCE BOOKS:

1. Data Structure and Algorithm- Schaum's Outline Series
2. Programming in C- Stephen G. Koshan
3. Data Structures and Program Design in C- Kruse/Tondo/Leung (Prentice-Hall)
4. Wirth N, Algorithms + Data Structures= Programs, Prentice Hall

PMIT-6004: Operating System

Operating System: its role in computer systems; Operating system concepts; Operating system structure; Process: process model and implementation, Inter-Process Communication (IPC), classical IPC problems, process scheduling, multiprocessing and time-sharing; Memory management: swapping, paging, segmentation, virtual memory; Input/Output: hardware, software, disk, terminals, clocks; Deadlock: resource allocation and deadlock, deadlock detection, prevention and recovery; File Systems: files, directories, security, protection; Case study of some operating systems.

TEXT & REFERENCE BOOKS:

1. Nutt G.J., Operating Systems - A Modern Perspective, Pearson Education Asia
2. Silberschatz & Galvin, Operating System Concepts, Pearson Education Asia
3. Crowley C., Operating Systems-A Design Oriented Approach, Tata McGraw Hill
4. Tanenbaum A.S., Modern Operating Systems, Prentice Hall of India / Pearson Education

PMIT-6005: Discrete Mathematics and Numerical Analysis

Set theory: Introduction, Set & its Elements, Set Description, Types of sets, Venn & Euler Diagrams, Set operations & Laws of set theory, Fundamental products, partitions of sets, minsets, Algebra of sets and Duality, Inclusion and Exclusion principle. *Mathematical logic:* Introduction, prepositional calculus, basic logical operations, Tautologies, Contradiction, Argument, Mathematical Reasoning, Method of proof, Counting, Predicate calculus. *Relations:* Binary Relations, Set operation on relations, Types of Relations, Partial order relation, Equivalence relation, Composition of relations, Functions, Composition of functions. *Graph Theory:* Basic terminology, paths, cycle & Connectivity, Sub graphs, Types of graphs, Representation of graphs in computer memory, Trees, Properties of trees, Binary trees, Tree traversing, Spanning Trees, Computer Representation of general trees. Planner Graph, Graph Coloring. *Computer Arithmetic:* floating point representation of numbers, arithmetic operations with normalized floating point numbers; Iterative methods: different iterative methods for finding the roots of an equation and their computer implementation; Solution of simultaneous Algebraic Equations, Gauss elimination; Interpolation, Least square approximation of functions, Taylor series representation, Chebyshev series; Numerical differentiation and integration and Numerical Solution of Differential Equations.

TEXT & REFERENCE BOOKS:

1. Kenith H. Rosen, Discrete Mathematics and Applications
2. S. B. Rao and C. K. Shantha,"Numerical Methods", Vantage Press
3. P. Balagurusamy and Techmadia,"Numerical Methods".
4. Knuth, Concrete Mathematics
5. Nicodemi O CBS, Discrete Mathematics

PMIT-6006: Database Management System

Introduction to concepts and methods for storing and manipulating data in stored form. File retrieval and organization. Database models and designing of database systems. The principles of database management systems. Relational database management systems. Query formulation and language. Database administration. Methods used for the storage, selection and presentation of Data. Database integrity and security. Database design: functional dependencies - normal forms - general definition of second and third normal forms - Boyce-Codd normal form - multi valued dependencies and fourth normal form - join dependencies and fifth normal form - inclusion dependencies - practical database design tuning - database design process relational model concepts - relational algebra operations - queries in SQL - insert - delete and update statements in SQL views in SQL.

TEXT & REFERENCE BOOKS:

1. Silberschatz A., Korth H.F. & Sudarshan S., "Database System Concepts", Tata McGraw Hill
2. Elmasri & Navathe, "Fundamentals of Database Systems", Addison Wesley
3. Ramakrishnan R. & Gehrke J., "Database Management Systems", McGraw Hill
4. O'neil P. & O'neil E., "Database Principles, Programming, And Performance", Harcourt Asia, Morgan Kaufman

PMIT-6007: Web Technology

Information and Distributed Systems Infrastructure: Basic Terminology, Networks, Internet, Intranet and Extranet, Client/Server Computing Paradigm, Open Systems and Communication Protocols, Middleware: Views, Definitions, Functions, Client/Server Working Mechanism: Application Programming Interface (API), Sockets, Client and Server Implementation. *Web and Programming:*

Web Elements: Browser and Web Document. Static, Active and Dynamic pages, Programming paradigms and Web programming. Object-oriented vs. Object-based programming, What should and should not be programmed on the Web, Tasks suitable for programming on the Web, Choice of programming language for Web programming. *Client-side Programming:* JavaScript for Web Programming: Introduction to the Language, JavaScript: Object Hierarchy and working with objects, JavaScript: Event-Driven Programming. *Server-side Programming:* Approaches to running Server Programs, The Classic Technology: Common Gateway Interface (CGI): Definition, Characteristics, CGI Programming Mechanism: GET and POST methods, Simple examples using Perl, Introduction to PHP Programming Language. PHP for Web Programming.

TEXT & REFERENCE BOOKS:

1. Berson: Client/Server Architecture, 2nd ed., McGraw-Hill Series on Computer Communication.
2. Chris Bates: Web Programming. Building Internet Applications, 2nd ed., John Wiley & Sons, Ltd., 2002.
3. Douglas E. Comer: Computer Networks and Internets with Internet Applications, 3rd ed., Prentice Hall International, Inc., 2001.

PMIT-6008: Computer Networks and Data Communication

Protocol hierarchies; Data link control: HLDC; DLL in Internet; DLL of ATM; LAN Topology; LAN Protocols: Standards IEEE 802.11; Hubs, Bridges, and Switches, FDDI, Fast Ethernet; Routing algorithm; Congestion control; Internetworking, WAN; Fragmentation; Firewalls; IPV4, IPV6, ARP, RARP, Mobile IP, Network layer of ATM; Transport protocols; Transmission control protocol: connection management, transmission policy, congestion control, timer management; UDP; AAL of ATM; Network security: Cryptography, DES, IDEA, public key algorithm; Authentication; Digital signatures; Gigabit Ethernet; Domain Name System: Name servers; Email and its privacy; SNMP; HTTP; World Wide Web. Internetworking Server and Services: Server Implementation, Content Servers, Performance Servers, Database Servers, Mirrored Servers, Popular Server Products, Web Servers & Databases.

Data communication networks: ISO reference model, internal architecture, protocol implementation issues, transmission media, attenuation and distortion, limited bandwidth, signal types, propagation delay, public carrier circuits, modulation, multiplexing, physical layer interfacing standards. *Data transmission basics:* transmission modes, asynchronous and synchronous transmission, bit - character and frame synchronization, coding, error detection methods, parity, block sum check, cyclic redundancy check, data compression, Huffman coding, dynamic Huffman coding, facsimile compression, transmission control circuits, communication control devices. *Protocol basics:* error control, stop-and-wait & sliding window protocol, link utilization, selective repeat and go-back-N - link management. Frame relay and ATM networks: Frame relay operation, layers and traffic control; ATM networks, Architecture switching, layers service classes.

TEXT & REFERENCE BOOKS:

1. Andrew S. Tanenbaum, Computer Networks, PHI
2. William Stallings, Data and Computer Communications, PHI
3. William Stallings, Data and Computer Communications, PHI
4. Behrouz Forouzan, Introduction to data communication and networking, Tata McGraw Hill Publishing Company Ltd.
5. Halsall F., Data Communication, Computer Networks and Open Systems, Addison Wesley
6. Leon-Garcia A. & Widjaja I., Communication Networks, Tata McGraw Hill

7. Bertsekas & Gallagar, Data Networks, PHI

PMIT-6009: Microprocessor and Interfacing

Microprocessors: Concept of microprocessor, Evolution of microprocessors, Internal architecture of Intel 8085,8086/8088 microprocessors: Instruction set and format, Programming in machine assembly language, Interrupt structure, DMA, I/O operation, Microprocessor interface ICs, peripheral interfacing, Microprocessor based system design, Coprocessor, Multiprocessor system. *Intel 80286, 80386 microprocessor:* memory management scheme, Protection mechanism, 80386 modes; Pentium microprocessor; Advanced microprocessors. *Interfacing with analog word:* A/D conversion, digital ramp ADC, successive approximation ADC, flush ADC, tristate ADC, D/A converter, DAC specifications, DAC applications, Data acquisition, sample-and hold circuits, multiplexing.

TEXT & REFERENCE BOOKS:

1. Md. Rafiquzzaman, Microprocessors and Microcomputer based system Design.
2. Gibson & Cheu, Microprocessors and System Design.
3. D. V. Hall, Microprocessors and Interfacing: Hardware and Software.

PMIT-6010: Software Engineering

Software engineering principles, life cycle models, sizing, estimation, planning, and control, requirements specifications, functional specification and design, integration and testing strategies, quality assurance, configuration management, software maintenance. Management of programming teams, programming methodologies, debugging aids, documentation and measurement of software verification and testing techniques and the problems of maintenance, modification and portability. Introduction to object oriented software engineering.

TEXT & REFERENCE BOOKS:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli; Fundamentals of Software Engineering; 2nd edition; Pearson Education Asia
2. Pressman R.S.; Software engineering - A practitioner's approach; 5th edition; McGraw Hill Higher education series.
3. Mall R.; Fundamentals of Software Engineering; Prentice Hall of India
4. Behferooz A. & Gydsib F.J.; Software Engineering fundamentals; Oxford University Press.
5. Jalote P.; An Integrated approach to Software Engineering; Narosa
6. Ian Sommervillie; Software Engineering, Pearson Education Asia

PMIT-6011: Computer Architecture

Instructions and data access methods; Arithmetic Logic Unit (ALU) design: arithmetic and logical operations, floating point operations; Processor design: data paths- single cycle and multi cycle implementations; Control Unit design: hardware and micro-programmed Pipeline- pipelined data path and control, hazards and exceptions. Memory organization: cache, virtual memory; Buses; Multiprocessors, type of multiprocessor performance, single bus multiprocessors, clusters. Information representation and transfer, instruction and data access methods, the control unit; hardware and micro-programmed; RISC and CISC machines.

TEXT & REFERENCE BOOKS:

1. D. A. Patterson, J. L. Hennessy, P. J. Ashenden J. R. Larus and D. J. Sorin,"Computer Organization and Design: The Hardware/Software Interface",Morgan Kauffmann
2. Computer Architechture and Organization, Hayes, McGraw-Hill.

PMIT-6012: Digital Logic Design

Different types of number systems, their representation, conversion and mathematical operation. Codes: BCD, alphanumeric, gray and excess-3. Digital logic: Boolean algebra, De Morgan's laws. Logic minimization. Logic gates and their truth tables. Basic logic gates in CMOS: DC characteristics, noise margin and power dissipation. Modular combinational circuit design: pass gates, multiplexer, de-multiplexer, encoder, decoder and comparators. Arithmetic logic circuit design: Half adder, full adder, half subtractor, full subtractor. Sequential circuits: Different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits. Modular sequential logic circuit design: shift registers, counters and their applications. Synthesis of digital circuits using Hardware Description Language (HDL).

TEXT & REFERENCE BOOKS:

1. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill, 2002.
2. Morris Mano, " Digital logic and Computer Design ", Prentice-Hall

PMIT-6013: Telecommunication System

Introduction to Telecommunications: Beginning of Telecommunications, Evolution of Telecommunications, Telecommunications legislative history, Telecommunications PSTN Technology. *Basic Telecom Principles:* Signals-Analog and Digital; Bandwidth – narrowband, wideband; Telecommunication Systems, Line System Characteristics, Radio System Characteristics, and Switching System Principles. Waveforms and filters, Voice frequencies, Attenuation and noise, Analog Modulation and Pulse Modulation. *Telephone Systems and Cabling:* From stand-alone to connect telephones; PBS; PBX, Centrex. *Switching and Signaling:* Step-by-step telephone exchanges, Reed relay and crossbar exchanges, EMD exchange, Stored program control, Signaling, Digital exchanges. Cable, Radio and Transmission: Local distribution networks, Carrier working: Groups and super groups, Submarine cables, Optic fibers, Radio propagation, Antennas, Satellites, Mobile Radio Systems. *Telecommunication Systems:* Public Switched Telecommunication System (PSTN), Mobile Communication System, Cellular and Wireless Communication System. *Traffic Theory:* The Erlang, Erlang's lost call formula, Queuing systems.

TEXT & REFERENCE BOOKS:

1. Fundamentals of Telecommunications-R. L. Freeman,
2. G. K. Mithal, "Radio Engineering".
3. W. Fraser, "Telecommunications"
4. Sanjeeva Gupta, "Electronic Communications".
5. B.P. Lathi, Modern digital and analog telecommunication systems–third edition, New York, NY: Oxford University Press

PMIT-6014: Signal and Systems

Concept of signals, classifications of signals like continuous time, discrete time, even and odd signals, analog and digital signal, periodic and non periodic signal, deterministic and random signal, energy signal and power signal; some special types of signals like exponential, sinusoidal, impulse, unit step, ramp; time shifting , scaling, reflection of signal. Concept of systems, properties of systems, memory-

less system, invertibility, causality, linearity, moving average system, stability; linear time-invariant (LTI) systems: introduction, convolution, impulse response representation for LTI systems, properties of the impulse response representation for LTI systems; continuous time Fourier series and transform, discrete time Fourier transform and its properties, STFT, wavelet transform, z-transform: introduction, properties of the region of convergence; properties of the z-transform; inversion of the z-transform, transform analysis of LTI systems, FIR and IIR filters; random variable and random process with their applications.

TEXT & REFERENCE BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid, S. Hamid Nawab,"Signals and Systems", Prentice Hall
2. Simon Haykin, Signals and Systems.

PMIT-6015: Object Oriented Progrmming (Python)

Features of Object Oriented Languages Python, Procedural vs. Object Oriented, Data Abstraction, Encapsulation, Inheritance, Polymorphism, Effects of OO Approach, Basic OO Design classes and encapsulation, constructors & destructors, overloading operators, constants, scope, & linkage, inheritance, polymorphism. Basic looping, list, Python libraries like pyplot, matplotlib, numpy, cv, keras. Machine learning libraries, statistical libraries, CNN libraries, Scikit learn libraries with proper examples.

TEXT & REFERENCE BOOKS:

1. The ZyBooks ebook "Programming in Python 3"
2. Python in a Nutshell, 3rd edition by Alex Martelliet al
3. Python for Everyone, 2nd edition by Cay Horstmann et al

PMIT-6016: Sensor and Meaasurement Technology

Sensor fundamentals and characteristics: Sensor Classification, Performance and Types, Error Analysis characteristics; Optical Sources and Detectors; Intensity Polarization and Interferometric Sensors; Strain, Force, Torque and Pressure sensors; Position, Direction, Displacement and Level sensors. Fiber optic liquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor; Velocity and Acceleration sensors; Flow, Temperature and Acoustic sensors. Error analysis - error propagation - accuracy and precision - quantization error Compensation - linearization - equalization Sensor fusion - sensor fusion for obtaining quantities that cannot be directly measured - sensor fusion for improved accuracy - sensor fusion for redundancy. Measurements of electrical properties with multimeter and oscilloscope. Components and functions of a measurement system; sensor, signal conditioning, linearization, signal transmission, A/D-D/A conversion, presentation, measurement data acquisition and treatment, Actuators. Tools for measurements and data treatment, Electrical disturbances and noise. Sensors for measurement of important process parameters such as temperature, flow, pressure and level. Biological and optical methods, chemical sensors, biosensors, semiconductor sensors, micromechanical sensors. Quality assurance of measurement data, calibration and traceability. Measurement data treatment and uncertainty. Simulation and numerical calculation tools.

TEXT & REFERENCE BOOKS:

1. Jacob Fraden, “Hand Book of Modern Sensors: physics, Designs and Applications”, 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, “Sensor Technology Hand Book”, 2011, 1st edition, Elsevier, Netherland.
3. Gerd Keiser,”Optical Fiber Communications”, 2012, 4th edition, McGraw-Hill Science, Delhi.

4. Bahaa E. A. Saleh and Malvin Carl Teich, “Fundamentals of photonics”, 2012, 1st edition, John Wiley, New York.

PMIT-6017: E-Commerce and Mobile Application Design

Defining E-commerce, The Development of E-commerce, E-commerce Marketing, E-commerce Security Issues, E-commerce Security Requirements, E-commerce Legal Considerations, International Legal Considerations in E-commerce, E-commerce Implementation Costs, Online Auctions Including E-Bay, Customer Service Expectations of the E-commerce Experience

Introduction to Mobile Computing, Factors in Developing Mobile Applications, UIs and Mobile Apps, Storing and Retrieving Data, Graphics, Security and Hacking, Developemnt Platforms

TEXT & REFERENCE BOOKS:

1. DotCom Secrets by Russell Brenson
2. E-business and E-commerce Management
3. Mobile Applications: Architecture, Design, and Development: Architecture, Design, and Development, by Valentino Lee , Heather Schneider, et al.

Core courses

In case of pre-requisite courses, course teacher may conduct lab classes (if necessary).

Group A

PMIT-6101: Distributed Computing

Introduction to distributed programming: Anatomy of a Distributed Application, Requirements for Developing Distributed Applications, *Introduction to sockets programming:* Sockets and Streams, URLs, URL Connections, and Content Handlers, The Class Loader. *Distributing Objects:* Features of Distributed Object Systems, Distributed Object Schemes for Java, CORBA, Java RMI, RMI vs. CORBA. *Threads:* Thread and Runnable, Making a Thread, Managing Threads at Runtime, Networked Threads. *Security:* Security Issues and Concerns, The java.security Package, Identities and Access Control, Keys: Public, Private, and Secret, Digital Signatures, Data Encryption, Cryptographic Algorithm. *Message-Passing Systems:* Message Processing, Fixed Protocols, Adaptable Protocols, Message Passing with Java Events. *Remote Objects Databases:* JDBC, Remote Database

Applications, Multi-Database Applications, *RMI:* Structure of RMI, Implementing the Basic Objects, The Rest of the Server, The Client Application The RMI Registry Examining the Registry, Limitations of the RMI Registry, Security Issues, The Context Interface, Mechanics of a Remote Method Call, Distributed Garbage Collection, RMI's Logging Facilities, Other JVM Parameters. *Service Oriented Architecture:* Introduction, Defining SOA, Identifying Service Candidates, Modeling Services, Making a Service Composable, Selecting a Pilot Project, Establishing Governance, *Introduction to Web Services:* Introduction, Using Publicly Available Web Services to Test Against, Installing Metro, Installing Oracle Web-Logic, Creating and Deploying the Simplest Web Service, Creating and Deploying a Service to Web-Logic.

TEXT & REFERENCE BOOKS:

1. Java Distributed Computing, Jim Farley, O'Reilly.
2. Java RMI Designing and Building,The Basics of RMI Applications, William Grosso, O'Reilly.
3. Java SOA Cookbook SOA Implementation Recipes, Tips, Techniques, Eben Hewitt, O'Reilly, 2009.

PMIT-6102: Distributed Databases

Introduction: Features of distributed databases, features of Centralized databases, level of distributed transparency Reference Architecture, types of Data Fragmentation, distribution Transparency, Access primitives, and Integrity constraints, *Distributed Database Design:* A frame work, the design of database fragmentation, the allocation of fragments, *Query Processing:* Translation of global queries into fragment queries, query optimization, *Distributed Transaction Management:* A framework, transaction atomicity, 2-phase commit,

Concurrency control: Foundations, distributed deadlocks, timestamps, *Reliability:* Basic concepts, commit protocols, consistent view of Network, Detection and Resolution of Inconsistencies, check points and cold restart, *Commercial Systems:* Tranclem's ENCOMPASS Distributed database systems, IBM's Inter system communication, feature of distributed ingress and Oracle. *Heterogeneous databases:* General problems – brief study of multi base.

TEXT & REFERENCE BOOKS:

1. Distributed Database systems Principles and Systems, Ceri S. Pelagatti. G, MGH.
2. Principles of Distributed Database Systems, 2/e, M. Tamer Ozsu, Sridhar, PEA.
3. Database system Concepts, 5/e,Silberschatz, F.Korth, Sundrashan,MGH,2006.

PMIT-6103: Advanced Database Management Systems

Introduction: Distributed Data Processing, Distributed Databases System, promises of DDBS, Problem areas, *Overview of Relational DBMS*: Relational Databases Concepts, Normalization, Integrity rules, Relational data languages, *Distributed DBMS Architecture:* Architectural Models for Distributed DBMS, *Distributed Database Design:* Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation. *Query Processing and Decomposition:* Query processing Objectives, Characterization of query processors, layers of query of query processing, query decomposition. *Distributed query Optimization:* Query optimization, centralized query optimization, Distributed query optimization algorithms, *Transaction Management:* Properties of transaction, types of transactions, distributed concurrency control. Serialization, concurrency control Mechanism & Algorithms, Time stamped and Optimistic concurrency control Algorithms, Dead lock Management, *Distributed DBMS Reliability:* Reliability concepts and Measures, fault-tolerance in Distributed systems, failures in Distributed DBMS, local & Distributed Reliability Protocols, site failures and Network partitioning, *Parallel Database Systems*: Parallel Architecture, Parallel DBMS Techniques, Parallel exception problems, Parallel Execution for Hierarchical architecture. *Distributed object*

Database Management Systems: Fundamental object concepts and Models, Object Distributed Design, Architectural Issues, Object Management, Object query Processing.

TEXT & REFERENCE BOOKS:

1. Principles of Distributed Database Systems, 2/e, OZSU, Valduriez, Sridhar, Pearson.
2. Distributed Databases, Stefan Seri, Pelagatti Willipse, TMH.
3. Database System Concepts, 5/e, Korth, Silberschatz, Sudershan, TMH

PMIT-6104: Database Security

Introduction to database security, Database Issues in Trust Management and Trust Negotiation, Authenticated Index Structures for Outsourced Databases, Managing and Querying Encrypted Data, Security in Data Warehouses and OLAP Systems, Security for Workflow Systems, Geospatial Database Security, Security *Re-engineering for Databases*: Concepts and Techniques, Database Watermarking for Copyright Protection, Database Watermarking: A Systematic View, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems.

TEXT & REFERENCE BOOKS:

1. M. Gertz, and S. Jajodia, Handbook of Database Security- Application and Trends, 2008, Springer.
2. Silvana Castano, Database Security, ACM Press
3. Alfred Basta and Melissa Zgola, Database Security, Information Security Professionals, 2011

PMIT-6105: Advanced Operating System

Processes Threads: Introduction to Threads, Threads in Distributed Systems. *Clients:* User Interfaces, Client-Side Software for Distribution Transparency. *Servers:* General Design Issues, Object Servers. *Locating Mobile Entities:* Naming versus Locating Entities, Simple Solutions, Home-Based Approaches, and Hierarchical Approaches, *Removing Unreferenced Entities:* The Problem of Unreferenced Objects, Reference Counting, Reference Listing, Identifying Unreachable Entities, *Synchronization:* Clock synchronization, logical clocks, global state, election algorithms, mutual exclusion, distributed transactions. *Consistency and Replication:* Data-Centric Consistency Models, Client-Centric Consistency Models, Distribution Protocols, Consistency Protocols, And *Examples*: Orca and Causally-Consistent Lazy Replication. *Fault Tolerance:* Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery, *Distributed Object-Based Systems:* CORBA, Distributed Com, Globe and Comparison of CORBA, DCOM, and Globe, *Distributed File Systems:* Sun Network File System, Coda File System, Plan~9, XFS and SFS, Scalable Security, Comparison of Distributed File Systems. *Distributed Document-Based Systems and Coordination-Based Systems: Distributed Document-Based Systems*: The World Wide Web, Lotus Notes, Comparison of WWW and Lotus Notes, *Distributed Coordination-Based Systems:* Introduction to Coordination Models, TIB/Rendezvous, JINI, Comparison of TIB/Rendezvous and JINI.

TEXT & REFERENCE BOOKS:

1. Distributed Systems, Principles and Paradigms, 2/e, Tanenbaum, M Van Steen, PHI.
2. Advanced concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, TMH, 2005.
3. Distributed Operating Systems and Algorithm Analysis, Chow, Johnson, PEA.

PMIT-6106: Advanced Data Structure and Algorithm

C++ Class Overview, Class Definition, Objects, Class Members, Access Control, Class Scope, Constructors and destructors, parameter passing methods, Inline functions, static class members, this pointer, friend functions, dynamic memory allocation and de-allocation (new and delete),exception handling, Function Overloading, Operator Overloading, Generic Programming- Function and class

templates, Inheritance basics, base and derived classes, inheritance types, base class access control, runtime polymorphism using virtual functions, abstract classes, streams I/O, Algorithms, performance analysis-time complexity and space complexity,O-notation, Omega notation and Theta notation, Review of basic data structures - he list ADT, stack ADT, queue ADT, implementation using template classes in C++, sparse matrix representation, Deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists. Priority Queues, External Sorting, Balanced search trees, Red –Black trees and Splay Trees, B-Tree of order m, Divide and Conquer methods, General method (Greedy), Minimum cost spanning trees, Job sequencing with deadlines, General method (Dynamic Programming),Optimal binary search trees, 0/1 knapsack problem, Ordering Matrix Multiplications

TEXT & REFERENCE BOOKS:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education, second edition.
2. Data structures, Algorithms and Applications in C++,S.Sahni,University press (India) pvt ltd, 2nd edition, Orient Longman pvt.ltd.
3. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and D.Mount, Seventh Edition Wiley student edition, John Wiley and Sons.

PMIT-6107: Artificial Intelligence and Neural Networks

Introduction: AI Basics, Problem reduction, Constraint satisfaction, Means-Ends Analysis. *Game Playing:* Minimax search procedure, adding alpha-beta cutoffs, additional refinements, Iterative deepening, *Statistical Reasoning:* Probability and Bayes theorem, Certainty factors and Rules based systems, Bayesian Networks, Dempster Shafer theorem. *Knowledge Representation:* Theorem proving using Predicate logic, Resolution, Natural Deduction, Knowledge representation using Rules, Forward versus Backward Reasoning, Matching, *Control Artificial Knowledge Structures:* Semantic Networks, Frames, Conceptual Dependency diagrams, *Scripts Planning:* Components of planning system, goal stack planning, nonlinear planning using constraint posting, Hierarchical planning. *Reactive systems Natural Language Processing*: NLP, Syntactic processing, Semantic analysis, Discourse and Pragmatic processing, Statistical NLP, Spell checking. *Learning*: Rote learning, learning by taking advice, learning in problem solving, Learning from examples, NN learning and Genetic learning, *Genetic Algorithms*: Genetic Algorithms, Termination parameters, Ant Algorithms, *Fuzzy Set Theory*: Classical & Fuzzy set theory, Interval Arithmetics, *Operations on Fuzzy sets Fuzzy Logic Theory*: Classical logic theory, Boolean Logic, Multivalued Logics, *Applications of Fuzzy Logic*: PQE – Decision Making Investment – Examples Fuzzy Rule base and Fuzzy Modeling: If-Then Rules, *Fuzzy Modeling*: System modeling, Static fuzzy systems, Parameter Identification. *Fuzzy Control Systems:* PLC, closed loop, fuzzy controllers, examples, Fuzzy PID controllers – type1 and type 2.

TEXT & REFERENCE BOOKS:

1. Intelligence, 3/e, E.Rich, K.Knight, TMH.
2. Introduction to Fuzzy Systems, G Chen, Trung Tat Pham, Chapman & Hall/CRC, 2009.
3. Artificial Intelligence, A Modern Approach, 2/e, Stuart Russel, Peter Norvig, PHI/PEA.

PMIT-6108: Management Information System

Introduction: Information Systems in Global Business Today, *Global E-Business*: How Businesses Use Information Systems, Ethical and Social Issues in Information Systems, Securing Information Systems, Telecommunications, the Internet and Wireless Technology, *E-Commerce*: Digital Markets, Digital Goods, Building Systems, Enhancing Decision Making, Structure project work through

assignment of roles (e.g., project manager, systems analyst, programmer, and software version manager) and use of project work breakdown structure for task management, Manage responsibility on diverse teams through peer review and task accountability arrived at through consensus methods, Assess software, hardware and networking requirements of information system applications accounting for limited funds and/or manpower, Address issues of information system access, training and confidentiality.

TEXT & REFERENCE BOOKS:

1. Laudon, Kenneth C., and Laudon, Jane P., Management Information Systems-Managing Digital Firm, Tenth Edition, Prentice Hall, 2007.
2. Microsoft Access 2000 Step by Step, Catapault, Inc. 1999.
3. Barron and Lyskawa, Microsoft FrontPage 98 Illustrated Standard Edition, Course Technology. 1998.

PMIT-6109: E-Commerce and Web Security

Overview of E-Commerce, B2C Individuals Online, B2C E-Commerce, B2C E-Commerce, Personalization & Customization, Online Communities, The New Economy - Economics of the Web, E-Commerce Business Models - how to make money on the Internet, B2B Overview, B2B Customer Support, B2B Supply Chain Management, B2B Other, Internet Marketing Plans, Organizing & Implementing Internet Marketing Plans, Traffic, Brand Building & IMC, Traffic, Brand Building & IMC, Pricing, Privacy, Security, Legal and Taxation Issues, Privacy, Security, Legal and Taxation Issues, Globalization of E-Commerce, Careers, Future Prospects & Personal Web Sites, Careers and Future Prospects.

Elements of Information and Web Security, Legal, Ethical, and Professional Issues in Information Security: Security and its history, NSTISSC Security Model, Information system components, Balancing security with access, Security implementation, System and Security, Development Life Cycles, Law and Ethics, Ethics and Codes of Ethics, *Need for Security:* Business needs, Threats, Attacks, Top ten security vulnerabilities, Secure software development. *Risk Management:* Risk identification, Quantitative and qualitative risk control, Risk assessment, Risk control strategies and selection. *Security Planning:* Security policy, standards and practices, Information security blueprint, Security education, training and awareness, Continuity strategies, *Security Technology:* Firewalls and VPN, and Intrusion Detection and Access Control, *Physical design:* Firewalls, Protecting remote connections, Intrusion detection and prevention systems, Honey pots. *Cryptography:* Cryptography Foundations, Cipher methods, Cryptographic algorithms, tools and Protocols for secure communications.

TEXT & REFERENCE BOOKS:

1. Principles of Internet Marketing by Ward Hanson, SouthWestern Publishing, 2000
2. E-Commerce By J. Botha, revised edition, 2004
3. E-Commerce By Pankaj, 1st edition, 2010
4. Principles of Information Security, Michael E. Whitman (Author), Herbert J. Mattor
5. Web Security by Amrit Tiwana, 2nd edition
6. Web Security, Privacy and Commerce By Simson Garfinkel, Gene Spafford, 2nd edition

PMIT- 6110: Advanced Software Engineering

Software Development Model: Waterfall Model, Spiral (Incremental) Model, the Unified Development Process, Best Practices. *The Universal Modeling Language*: UML, Domain and *Problem Modeling*: Summary, UML Overview, Use Cases, Object Model, Interaction Diagrams, *Sequence Diagrams, Collaboration Diagrams*: Packages, State Diagrams, Activities. *Mapping UML to Code:* The Unified Development Process- Model Dynamics, Architecture-Centric Process, Use Case Driven Process, Iterative and Incremental Process, *Workflows:* Project management Workflow, Inception Workflow,

Requirements Workflow, Use cases and Requirements Specifications, Analysis Workflow, Design Workflow, Implementation Workflow, Iteration Workflow, Other Workflows *Management:* Project planning & management, Quality management, Configuration management, Process improvement. *Advanced Topics*: Software reuse, component based engineering, distributed software engineering, Service-oriented Architecture (SOA), embedded software, Aspect-oriented software engineering.

TEXT & REFERENCE BOOKS:

1. Craig Larman: Applying UML and Patterns, Prentice-Hall.
2. Terry Quatrani: Visual Modeling with Rational Rose 2000 and UML, Addison Wesley.
3. CT Arrington: Enterprise Java with UML, John Wiley.

PMIT-6111: Software Testing and Quality Assurance

Introduction to Software Testing: Testing Definition, Why Testing,Testing Process Overview, V-Model, Verification and Validation Definition, Test Coverage, *Test Levels*: Unit Test, Smoke Test, Integration Test, System Test, User Acceptance Test – UAT, Test Types, Static vs. Dynamic Test, Regression Test, Performance Test, Security Test, Others, *Test Team* : Career Path and Test Engineer Capabilities, Team/Development Collaboration and Conflicts, Communication Skills, *Writing Testable Requirements: Types of Requirements*: Business Requirements, System Requirements, Technical Requirements, Customer Early Involvement, Requirements Modeling, Requirements Traceability, Requirements Documentation, Requirements Validation, *Test Techniques*: Static Test Review- Dynamic Testing, Test Coverage, *Test Design Techniques*: White vs. Black Box Test Techniques, Boundary Value, Equivalence Partitioning, Decision Tables, Cause Effect, Network Graphing, Guess Testing, Structure Testing, Procedure (Scenario) testing, *Test Design and Defect Tracking*: Test Case, Design- Identify Scenarios, Identify test cases, Document Test procedure, *Review Procedure Defect Tracking*: Standards, Process, Defect Types, Defect Severity, Defect Priority Test Process, Test Management and Measurement.

TEXT & REFERENCE BOOKS:

1. Software Testing and Continuous Quality Improvement, by W. Lewis (2000)
2. Software Testing in the Real World, by E. Kit (1995)
3. Managing the Testing Process, by R. Black (2002)

PMIT-6112: Software Project Management

Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered By Software Project Management, Overview Of Project Planning, Stepwise Project Planning. Project evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques , Risk Evaluation. *Activity Planning:* Objectives, Project Schedule, Sequencing and Scheduling Activities, Network. Planning Models , Forward Pass , Backward Pass , Activity Float , Shortening Project Duration , Activity on Arrow Networks , Risk Management , Nature of Risk , Types of Risk, Managing Risk , Hazard Identification , Hazard Analysis , Risk Planning And Control. *Monitoring and Control:* Creating Framework , Collecting The Data , Visualizing Progress , Cost Monitoring , Earned Value , Priortizing Monitoring , Getting Project Back To Target , Change Control , Managing Contracts , Introduction , Types Of Contract, Stages In Contract Placement , Typical Terms Of A Contract , Contract Management , Acceptance. Managing People and Organization Teams: Introduction , Understanding Behavior, *Organizational Behaviour:* A Background , Selecting The Right Person For The Job , Instruction In The Best Methods , Motivation – The Oldman , Hackman Job Characteristics Model , Working In Groups , Becoming A Team ,Decision Making , Leadership , Organizational Structures , Stress –Health And Safety , Case Studies.

TEXT & REFERENCE BOOKS:

1. Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill,2004.

2. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
3. Royce, “Software Project Management”, Pearson Education, 1999.
4. Jalote, “Software Project Management in Practice”, Pearson Education, 2002.

PMIT-6113: Mobile Application Development

Introduction to Mobile Computing, Android Development Environment, *Factors in Developing Mobile Applications:* Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User, VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs, *Intents and Services*: Android Intents and Services, Characteristics of Mobile Applications, Successful Mobile Development, *Storing and Retrieving Data*: Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider, *Communications Via Network and the Web*: State Machine, Correct Communications Model, Android Networking and Web, *Telephony*: Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony, *Notifications and Alarms*: Performance, Performance and Memory Management, Android Notifications and Alarms, *Graphics*: Performance and Multithreading, Graphics and UI Performance, Android Graphics, *Multimedia*: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia, *Location*: Mobility and Location Based Services, Android, *Putting It All Together*: Packaging and Deploying, Performance Best Practices, Android Field Service App, *Security and Hacking*: Active Transactions, Hacking Android.

TEXT & REFERENCE BOOKS:

1. The Design of Everyday Things, Norman, Basic Books, 2002
2. Beginning iPhone 3 Development: Exploring the iPhone SDK by Jeff LaMarche, and David Mark, Apress, July 21, 2009, 978-1430224594
3. iPhone SDK Development, by Bill Dudney & Chris Adamson.

PMIT-6114: Advanced Web Engineering

Introduction to advanced web technology, XML processing, RDF processing, Taxonomies and ontologies for advanced web applications, Ontology modeling, Languages for representing ontologies on the web, Rules and inferences, Web services, Design and modelling of web services, Technologies for implementing web services, Current applications of advanced web technologies;Basics of the World Wide Web, Hypertext MarkUp Language I, Hypertext MarkUp Language II, Cascading Style Sheets (CSS), XML - eXtensible MarkUp Language, XML - eXtensible MarkUp Language II, Document Object Model (DOM), HTTP Protocol, Web Servers, Web Performance, Forms and CGI (Common GateWay Interface), CGI Scripts and Perl, Client-Side Programming – JavaScript, Client-Side Programming - JavaScript II, Server-Side Programming: Java Servlets and Java Server Pages, AJAX Programming, XML Technologies*: XSL, XML Schemas, Web Services, SOAP, Search Engines and Google, The Web and Security.*

TEXT & REFERENCE BOOKS:

1. Grigoris Antoniou and Frank van Harmelen, "Semantic Web Primer", MIT Press
2. Web Technologies: Concepts, Methodologies, Tools, and Applications by Arthur Tatnall, vol: 1-4, 2009
3. Web Technologies by Uttam Kumar Roy, Oxford University Press, Nov 1, 2010.

PMIT-6115: Simulation and Modeling

Simulation modeling basics: systems, models and simulation; Classification of simulation models; Steps in a simulation study; Concepts in discrete-event simulation: event-scheduling vs. process-interaction approaches, time-advance mechanism, organization of a discrete-event simulation model; Continuous simulation models; Combined discreet-continuous models; Monte Carlo simulation; Simulation of queuing systems. *Building valid and credible simulation models:* validation principles and techniques, statistical procedures for comparing real-world observations and simulated outputs,

input modeling; Generating random numbers and random varieties; Output analysis. *Simulation languages*: Analysis and modeling of some practical systems.

TEXT & REFERENCE BOOKS:

1. Modeling and Simulation, Giuseppe Petrone, Giuliano Cammarata – InTech
2. Simulating Humans: Computer Graphics Animation and Control, N. I. Badler, C. B. Phillips, B. L. Webber - Oxford University Press
3. Averill M. Law, Simulation Modeling & Analysis, McGraw Hill, 4th edition 2007, ISBN 978-0-07-298843-7

PMIT-6116: Information System Ethics and Cyber Law

Privacy and personal information, Encryption and interception of communications, Can we trust the computer?, Freedom of speech in cyberspace, Intellectual property, Computer crime, Computers and work, Broader issues on the impact and control of computers, Professional ethics and responsibilities, *Fraud*: Conditions for Fraud, Assessing the Risk of Fraud, Corporate Governance Oversight to Reduce Fraud, Responding to the Risk of Fraud, Specific Fraud Risk Areas, Responsibilities When Fraud is Suspected. *Nature of Systems Development:* Creation of alternatives, Systems Analysis, System Design, Systems Implementation, Systems Evaluation. *Controls:* Enterprise Risk Management, Controls and Exposures, Common Exposures, examples, Fraud and White-collar Crime, Forensic Accounting, Seriousness of Fraud, Computer Processing and Exposures, Control Objectives and Transaction Cycles.

Cyber Law: Legal Dimensions in Cyber World, IT Acts and Cyber Crime, IT Act, Information Assurance & E-governance / Data Information & Cryptography , Identity & Access management, Security Audit, Process Management & Consultancy, Problems in cyberspace, aspect of academics, technologists, businesspeople, regulators, and social entrepreneurs, The structure of ITA-2000, Key provisions, Offences, Adjudication, Some Cyber Crime Cases, Information Security, Authentication, Passwords, Digital Signatures, Concept of Virtual Property, Trademarks, Copyrights, Patents, Data Protection Laws, Requirements of a Website, E-Marketing, E-Advertising, Online Payment Collection System, CyLawCom, Techno-Legal Audit of System Security, Impact of Non Compliance on Organizational Quality.

TEXT & REFERENCE BOOKS:

1. Gary Pollice, Book review: A Gift of Fire, 2nd edition.
2. Ethical Issues of Information Systems by Ali Salehnia.
3. Information Ethics: Privacy and Intellectual Property By Lee Freeman, A. Graham Peace
4. Jonathan Rosenoer, “Cyber Law: The Law of the internet.”
5. Pavan Duggal, “cyberlaw- the indian perspective" 2009 edition with it act amendments 2008.
6. Cyber Law and Cyber Security in Developing and Emerging Economies by Zeinab Karake-Shalhoub, Lubna Al Qasimi, 2nd edition. 2010.

PMIT-6117: IT Forensic

Introduction to Cyber forensics: Information Security Investigations, Corporate Cyber Forensics, Scientific method in forensic analysis, investigating large scale Data breach cases. Analyzing Malicious software. Types of Computer Forensics Technology, Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised Internet Tracing Methods, Security and Wireless Technologies, Avoiding Pitfalls with Firewalls Biometric Security Systems. Types of Computer Forensics Systems: Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security

Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems, Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems, Identity Theft, Biometric Security Systems. Ethical Hacking: Essential Terminology, Windows Hacking, Malware, Scanning, Cracking. Digital Evidence in Criminal Investigations: The Analog and Digital World, Training and Education in digital evidence, Evidence Collection and Data Seizure: Why Collect Evidence, Collection Options Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody, Reconstructing the Attack, The digital crime scene, Investigating Cybercrime, Duties Support Functions and Competencies.

TEXT & REFERENCE BOOKS:

1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005.
2. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, 2 nd Edition, Springer's, 2010.
3. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts, Ali Jahangiri, 2009.
4. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010.

PMIT-6118: Computer Graphics

Advanced Graphic Techniques: Graphic basics, Three dimensional drawings. Geometric forms and models. Hidden surface, Fractals; Advanced rendering Techniques: Shadow generation techniques, Texture and environment mapping techniques. Procedural texture mapping and modeling. Ray tracing, Radiosity methods, Global illumination models. Volume rendering techniques; Advanced animation: animation articulated structures. Soft object animation, procedural animation.

TEXT & REFERENCE BOOKS:

1. Simulating Humans: Computer Graphics Animation and Control- Norman I. Badler, Cary B. Phillips, Bonnie Lynn Webber
2. Computer Graphics & Animation (Computer Guides)- Asha Kalbag, Russell Punter , Philippa Wingate, Jane Chisholm, Carrie A. Seay, Michael Wheatley, Merrick Brewer, Howard Allman
3. 3D Math Primer for Graphics and Game Development (Wordware Game Math Library) - Fletcher Dunn
4. Flash out Of the Box - Robert Hoekman, Jr.
5. Dreamweaver CS3 For Dummies (For Dummies (Computer/Tech)) - Janine C. Warner, For Dummies

PMIT-6119: Graph Theory and Application

Introduction to graphs and digraphs; Fundamental concepts: isomorphism, adjacency and connectivity; Trees, spanning trees, shortest paths, distances in graphs; Hamiltonian and Eulerian graphs, Travelling Salesman problem, Chinese Postman problem; Matchings and covers: Hall's theorem, marriage theorem, optimal assignment, vertex covers, edge covers; Connectivity and cuts: vertex and edge connectivity, Menger's theorem, Maxflow_Min-cut theorem in networks; Graph coloring: vertex coloring and edge coloring, chromatic graphs, application to scheduling; Planar graphs: embeddings, dual graphs, Euler's formula, Kuratowski's theorem; Perfect graphs.

TEXT & REFERENCE BOOKS:

1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", PHI
2. R.J. Wilson, "Introduction to Graph Theory", Fourth Edition, Pearson Education

PMIT-6120: Embedded System

Introduction to embedded systems and their design constraints; High level synthesis, scheduling, allocation, binding; Pipelined data path and controller design; Software task scheduling and schedulability analysis; Static and dynamic methods for scheduling and priority assignment; Implementation architectures for embedded systems; Communication architectures; bus and memory systems; System synthesis; partitioning of specifications into hardware and software parts; Integrated hands-on exercises covering microcontroller programming, hardware / software interaction and cyclic executive scheduling of software tasks.

TEXT & REFERENCE BOOKS:

1. G. Buttazzo: Hard Real-Time Computing Systems. 2nd edition, Springer, 2005.
2. P. Eles, K. Kuchcinski, Z. Peng: System Synthesis with VHDL. Kluwer Academic Publishers, 1998.
3. P. Marwedel: Embedded Systems Design. Springer, 2006.

PMIT-6121: Machine Leaning

Introduction to Machine Learning; Classification of learning: Unsupervised and supervised learning, Connectionist learning, Reinforcement learning, Machine discovery; Supervised learning: Information theoretic decision tree learner, Best current hypothesis search, Candidate elimination (version space) algorithm, Unsupervised learning: Hierarchical clustering, Category utility, Incremental and nonincremental algorithms for hierarchical clustering, Applications; Connectionist learning: Introduction to Neural Network, Feedforward and recurrent network, Perceptron, Multilayer feedforward network, Backpropagation algorithm for training a feedforward network, Applications; Genetic Algorithms: Genetic operators, Fitness function, Genetic algorithm in supervised learning framework, Applications

TEXT & REFERENCE BOOKS:

1. INTRODUCTION TO MACHINE LEARNING, Nils J. Nilsson
2. Machine Learning Tom M. Mitchell

PMIT-6122: Computational Thinking and Data Science

Computational thinking for problem-solving: Logical problem solving, decomposition, pattern recognition, abstraction, representation, algorithm design, and generalization. Python Programming: Variables, constants, data types, data structures, strings, math operators, boolean operators, expressions, program constructs, functions, looping, I/O files, modules, and database.
Data science fundamentals, Importing and formatting data sets, Displaying data, Data pre-processing. Introductory statistical analysis with Python: Elementary statistics, randomness, sampling, probability distributions, Confidence intervals, hypothesis testing, and A/B testing. Basic data analysis, visualization, and machine learning: Data pre-processing, Supervised/unsupervised learning, Performance evaluation metrics.

TEXT & REFERENCE BOOKS:

1. Guttag, John. Introduction to Computation and Programming Using Python: With Application to Understanding Data. 2nd ed. MIT Press, 2016. ISBN: 9780262529624.
2. Ani Adhikari and John DeNero, Computational and Inferential Thinking, The Foundations of Data Science, Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0).

PMIT-6123: Deep Learning and Data Augmentation

Deep learning basics: Introduction, history, capabilities, the perceptron; Neural network learning: Back-Propagation; Practical network training, Auto encoders, Batch-normalization; Why does it work? Over fitting and generalization. Deep Neural Network, Shallow Neural Network, Optimization for Training Deep Models, Practical aspects of deep learning.

Convolutional neural networks (CNN): Introduction to CNNs, Convolution, Deep Convolutional Models, Correlation, Filtering; CNN architectures; Detection and Segmentation; Visualizing and Understanding; Advanced CNNs for computer vision. ConvNets Applications.

Advanced Deep architectures: Recurrent Neural networks (RNNs); Advanced RNN: LSTM, GRU; Generative Adversarial Networks (GANs); Advanced GANs. Sequence-to-Sequence Models

Data augmentation: Importance, benefits, challenges, process of uses in image classification and segmentation. Advanced models for data augmentation: Adversarial training/Adversarial machine learning; Generative adversarial networks (GANs); Neural style transfer; Reinforcement learning.

Augmentation in NLP: Easy Data Augmentation (EDA) operations, Back translation, Word Embeddings, Contextualized word embeddings

Image Augmentation: Pipelining, Integration, size-preserving rotations, size-preserving shearing, and cropping etc.

TEXT & REFERENCE BOOKS:

1. Goodfellow, I. and Bengio, I. and Courville Deep Learning MIT Press
2. Neural Networks and Deep Learning, Michael Nielsen
3. Deep Learning with Keras, By Antonio Gulli, Sujit Pal

Group B

PMIT-6201: Cloud and Mobile Computing

Review of cloud computing: Types of cloud computing; enabling technologies-virtualization, Web services, SOA, Web 2.0,mashup; cloud features; platforms. *Comparable technologies:* Grid computing; Utility Computing; The role of grid computing in cloud computing; Difference between cloud and utility computing. *Cloud architecture:* Cloud scheduling; Scalability, reliability and security of the cloud; Workflow management in cloud; Network infrastructure for cloud computing. *Cloud service Models:* SaaS, PaaS, IaaS, DaaS. *Cloud computing applications and solutions:* Virtual private cloud; Scientific services and data management in cloud; Enterprise cloud; Medical information systems. Cloud business models.

Introduction to Mobile and Wireless Landscape: Definition of Mobile and Wireless, Components of Wireless Environment, Challenges, Infrastructure and Ad-hoc Network, IEEE 802.11, HIPERLAN, Bluetooth. *Global System for Mobile Communications (GSM):* GSM Architecture, GSM Entities, Call Routing in GSM, PLMN Interfaces, GSM Addresses and Identifiers, Network Aspects in GSM, GSM Frequency Allocation, Authentication and Security. *Mobile Network Layer:* Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP), *Mobile Ad-hoc networks*: Routing, destination Sequence Distance Vector, Dynamic Source Routing, *Mobile Transport Layer*: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP, *Broadcast Systems*: Overview, Cyclical repetition of data, Digital audio broadcasting: Multimedia object transfer protocol, *Digital video broadcasting*: DVB data broadcasting, DVB for high-speed internet access, Convergence of broadcasting and mobile communications, Protocols and Tools, Wireless Language and Content, Mobile and Wireless Security.

TEXT & REFERENCE BOOKS:

1. Mobile Communications, 2/e, Jochen Schiller, PEA, 2008.

2. Mobile and Wireless Design Essentials, Martyn Mallick, Wiley, 2008.
3. Mobile Computing, Asoke K Talukder, et al,, MGH, 2008.
4. Handbook of Cloud Computing, First Edition, 2010, Springer.2. Advanced Database Technology and Design (Artech House Computer Library), Author: Mario Piattini.
5. "Cloud Computing, Implementation, Management, and Security", by John W. Rittinghouse and James F. Ransome, ISBN:978-1-4398-0680-7, CRC Press, 2010.
6. "Cloud Application Architectures", by George Reese, ISBN: 978-0-596-15636-7, O'Reilly, 2009.

PMIT-6202: Multimedia Asset Management System

Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video. *Fundamental Concepts in Cideo and Digital Audio:* Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio. *Application Development:* An OOP Application Frame work, Using Components with ActionScript MovieClip Subclasses, *Multimedia Data Compression: Lossless compression algorithm*: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, *Lossy compression algorithm*: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zero tree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), *Basic Video Compression Techniques:* Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques. *Multimedia Networks:* Basics of Multimedia Networks, *Multimedia Network Communications and Applications*: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).

TEXT & REFERENCE BOOKS:

1. Fundamentals of Multimedia , Ze-Nian Li , Mark S. Drew, PHI/PEA.
2. Essentials ActionScript 2.0, Colin Moock, SPD O,REILLY.
3. Digital Multimedia, Nigel chapman & jenny chapman, Wiley-Dreamtech.

PMIT-6203: Network Security

Introduction to Network Security: Attacks, services, Security, A model of Inter network Security, Steganography, One time PADS, *Basic and ESOTERIC Cryptographic Protocols:* Key Exchange, Authentication, Formal Analysis of Authentication and key Exchange Protocols, Multiple & Public Key Cryptography, Secret Splitting & Sharing Secure elections, Secure multiparty, Communication, Digital Cash. *Crypto Graphic Algorithms (Block Cipher):* RC2, GOST, CAST, BLOW FISH, SAFEER, RC5, NEWDES, CRAB, Theory of Block Cipher design, *Key Management:* Key lengths, Generating Keys, Transferring, Verification, Updating, Storing, Backup, Compromised, Lifetime of, Destroying Keys, Public key Management. *Digital Signature Algorithms:* Digital Signature, DSA, DSA variants, Gost, Discrete Lagorithm, One – Schnorr – Shamir digital Signatures, Esign, Cellular Automata,

Mails and Security: Web Security Web Security requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction, *Viruses and Threats:* Intruders, Viruses, Worms and Firewalls Intruders, Viruses and Related Threats, Firewall Design Principles, Trusted Systems.

TEXT & REFERENCE BOOKS:

1. Applied Cryptography, 7/e, Bruce SCHNEIER John Wiley & Sons Inc.
2. Cryptography and Network Security, William Stallings, PHI.
3. Introduction to cryptography with coding Theory, 7/e, Wade Trappe, C. Washington, PEA.

PMIT-6204: Cryptography and Steganography

Overview: Security services, mechanisms, threats and attacks, model for network security and access security model. *Classical Encryption Techniques:* Substitution and transportation techniques block ciphers and serial ciphers. *Symmetric Ciphers:* Data Encrypting Standard, Advanced Encrypting Standard, Contemporary symmetric ciphers, serial encryption and RC4, block cipher modes. *Public Key Cryptography:* RSA algorithm, Diffie-Hellman Key Exchange, discrete logarithms, elliptic curve arithmetic and elliptic curve cryptography. *Authentication:* Message authentication and entity authentication, message authentication code, hash functions, MD5, secure Hash algorithm, RSA digital signature, digital signature standard, biometrics. *Key Management:* Session keys and management of secret keys, key distribution center, public key distribution and certificate authority, key storage and key revocation, X.509 standard, Public key Infrastructure**.**

Steganographic methods: Least significant bit substitution (LSB), Transform domain techniques, Cover generation methods, Random interval method, Pseudorandom permutations, Image downgrading, Cover regions and parity bits, Palette-based images, Digital Watermarking; Steganographic tool; Digital watermarking; *Applications of digital watermarking*: Broadcast monitoring, Owner identification, Transaction tracking, Content authentication, Scrambling attack, Synchronization attack, Copy attack, Ambiguity attack.

TEXT & REFERENCE BOOKS:

1. Applied Cryptography, 7/e, Bruce SCHNEIER John Wiley & Sons Inc.
2. Cryptography and Network Security, William Stallings, PHI.
3. Introduction to cryptography with coding Theory, 7/e, Wade Trappe, C. Washington, PEA.

PMIT-6205: Cellular Network Planning

Introduction: Objectives of Radio Network Planning, Grade of Service, System Specification, Equipment Specifications, Available Frequency Band, Service Area Topography, Traffic Distribution, Existing Infrastructure, Phases of The Planning Procedure. *Radio Network Definition including Capacity planning:* Starting Points and Objectives, Frequency Reuse, Prediction of Offered Traffic, Propagation Analysis and Coverage Planning: Starting Points and Goals of Coverage Planning, Multipath Propagation: Path Loss, Hata Model, Walfish-Ikegami Model, Path Loss Corrections, Slow and Fast Fading, Connection Between Coverage and Quality of Service, *Radio Link Power Budget*: Antenna Feeder Loss, Antenna Gain, Application Example, *Frequency Allocation:* Starting Points and Objectives, Regular Frequency Reuse Patterns, Methods Applied in Frequency Planning: Interference Levels, Minimum Reuse Distances, Adjacent Channel Interference Avoidance, *Application Example*: Simple Frequency Planning Method Using Regular Reuse Patterns, Advanced Frequency Planning Method Using Pairwise Interference Analysis, *Cellular Network Planning Tools:* Digital Maps, Capacity Planning in Radio Network Definition, *Propagation Analysis and Coverage Planning*: Hata Model and Walfish-Ikegami Model, Morphography, Antenna Height and Topography Corrections, Frequency Allocation, Route Calculations: Comparison of Predicted and Measured Data, Simulation of Calls Along Routes, *Cellular Network Measurement*: NMS/X, TIM and SAM of Nemo Technologies.

TEXT & REFERENCE BOOKS:

1. Ajay R. Mishra, Fundamentals of Cellular Network Planning and Optimisation: 2G/2.5G/3G … Evolution to 4G, Wiley, 2004
2. Ajay R. Mishra, Advanced Cellular Network Planning and Optimisation: 2G/2.5G/3G... Evolution to 4G, John Wiley, 2007.
3. *Md. Imdadul Islam and Liton Jude Rozaio, "Telecommunications Traffic and Network Planning"*

PMIT-6206: Fiber Optic Communication

Overview of Optical Fiber Communication: Introduction, single mode fiber, cutoff wave length, mode filed diameter. *Optical Fibers:* fiber materials, photonic crystal, fiber optic cables specialty fibers. *Transmission characteristics of optical FIBERS:* Introduction, Attenuation, absorption, scattering

losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion. *Optical Sources and Detectors:* Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors, *Fiber Couplers and Connectors:* Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers. *Optical Receiver:* Introduction, Optical Receiver Operation, eye diagrams, coherent detection, burst mode receiver operation, Analog receivers. *Analog and Digital Links:* Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics, *WDM Concepts and Components:* WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources, *Optical Amplifiers and NETWORKS:* optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. *Optical Networks*: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT & REFERENCE BOOKS:

1. Optical Fiber Communication, Gerd Keiser, 4th Ed., MGH, 2008.
2. Optical Fiber Communications, John M. Senior, Pearson Education. 3rd Ed., 2007.
3. Fiber optic communication, Joseph C Palais: 4th Edition, Pearson Education.

PMIT-6207: Radio Frequency Technology

Antennas: Launching of waves, transmission, definition of antennas, reciprocity, wave propagation, principal of equivalent sources: electric and magnetic surface current, uniqueness principle, Huygens principle, Hertzian vector, image theory; Aperture antennas: Rectangular apertures, horn antenna, corrugated horn, circular aperture, reflector and lens antennas; Linear antennas: Field calculation, current distribution, linear dipoles and monopoles, design and feeding of dipole antennas, electrically short antennas, elementary dipole, receiving antennas - group antennas: Directivity, group factor, phased arrays, parasitic antennas; Electronic noise: Characteristics of noise voltages and currents, calculations with noise: Fourier analysis, correlation, superposition of noise quantities, transmission through linear networks, noise of 2-port networks: noise factor and temperature, noise matching, concatenation of noisy 2-port-networks; RF amplification: 2-terminal amplifiers, 2-port amplifiers: design with scattering parameters, selection of the point of operation, stability, unilateral design, wide-band amplifiers.

TEXT & REFERENCE BOOKS:

1. T. H. Lee, Planar Microwave Engineering, Cambridge, 2004
2. Luong and Leung, Low Voltage CMOS RF Frequency Synthesizers, Cambridge, 2004
3. Carusone, Johns, and Martin, Analog Integrated Circuit Design, 2nd ed., Wiley, 2012
4. T. H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits, Cambridge, 2004
5. C. Coleman, An Introduction to Radio Frequency Engineering, Cambridge, 2004
6. B. Razavi, RF Microelectronics, Prentice Hall, 1998
7. D. M. Dobkin, RF Engineering for Wireless Networks, Elsevier, 2005

PMIT-6208: VLSI Layout Algorithms

Introduction: VLSI design process, layout styles, difficulties in physical design, definitions and notations; Circuit Partitioning: problem definition, cost functions and constraints, Kernighan-Lin algorithm and its variations, simulated annealing; Floorplanning: problem definition, models, cost functions and constraints, cluster growth, simulated annealing, dual graph technique; Placement: problem definition, models and cost functions, approaches to placement; Grid routing: problem definition, cost functions and constraints, maze routing algorithms, line search algorithms; Global routing: problem definition, cost functions and constraints, routing regions, sequential global routing, hierarchical global routing; Channel routing algorithms; Layout generation.

TEXT & REFERENCE BOOKS:

1. N. Sherwani, Algorithms for VLSI Physical Design Automation, Kluwer.

2. M. Sarrafzadeh and C. K. Wong. An Introduction to VLSI Physical Design. McGraw-Hill.
3. P. Banerjee. Parallel Algorithms for VLSI Computer-Aided Design Prentice Hall,
4. Korte, L Lovasz, H. J. Promel, and A. Schrijver (eds.). Paths, flows, and VLSI-layout. Springer Verlag.
5. M. Sarrafzadeh and D.T. Lee (editors). Algorithmic Aspects of VLSI Layout (Lecture Notes Series on Computing, Vol 2) World Scientific.

PMIT-6209: Modeling of Data Networks

Delay Models in Data Networks: Queuing Models, M/M/1, M/M/m, M/M/∞, M/M/m/m and other Markov System, M/G/1 System, Networks of Transmission Lines, Time Reversibility, Networks of Queues. *Multi-access Communication:* Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Multi-access Reservations, Packet Radio Networks. *Routing in Data Networks:* Introduction, Network Algorithms and Shortest Path Routing, broadcasting. *Routing Information:* Coping with Link Failures, Flow models, Optimal Routing, and Topological Design, Characterization of Optimal Routing, Feasible Direction Methods for Optimal Routing, Projection Methods for Optimum Routing and Routing in the Codex Network. *Flow Control:* Introduction, Window Flow Control, Rate Control Schemes, Overview of Flow Control in Practice, Rate Adjustment Algorithms.

TEXT & REFERENCE BOOKS:

1. Dimitri Bertsekas and Robert Gallager, “Data Networks," 2nd edition, Prentice Hall of India, 2003.
2. William Stallings, “High-Speed Networks and Internets,” Pearson Education (Asia) Pte. Ltd, 2004.
3. J. Walrand and P. Varaya, ”High Performance Communication Networks,” 2nd edition, Harcourt India Pte. Ltd. & Morgan Kaufman, 2000.

PMIT-6210: Telecommunication Network Management

Introduction: Network management standards, network management model, organization model, information model abstract syntax notation 1 (ASN.1), encoding structure, macros, functional model, *Network management application functional requirements:* Configuration management, fault management, performance management, security management, accounting management, common management, report management, polity based management, service level management. *Telecommunication management network (TMN) architecture:* Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI. *Common management information service element (CMISE):* CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification. *Information Modeling for TMN:* Rationale for information modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB).*Simple network management protocol (SNMP):* SNMPv1, SNMPv2 communication model, functional model, SNMPv3, MIB security, remote monitoring (RMON) SMI and MIB, RMQN1 and RMON2, *Network management examples:* ATM integrated local management interface, ATM MIB, ATM digital exchange interface management, ADSL configuration management, performance management. *Network management tools:* Network statistics management, *network management system, management platform case studies*: OPENVIEW, ALMAP.

TEXT & REFERENCE BOOKS:

1. Network Management: Principles and Practice - Mani Subramanian, Addison Wesley, Pearson Education Asia publication.
2. Fundamentals of Telecommunication Network Management - Lakshmi Raman IEEE Communication Society.
3. Telecommunication Network Management: Technologies and Implementations - Airdarous Salah, Plevyak Thomas. Prentice Hall

PMIT- 6211: Digital Signal Processing

Introduction to DSP, classifications of signals, continuous time and discrete time (DT) sinusoids, concept of frequency, advantages and limitations of DSP, applications of DSP, steps of ADC, sampling theorem, abasing, quantization, coding. Classification of DT signals, classification of DT systems, impulse response, FIR and IIR, block diagram of DT systems, analysis of LTI systems, convolution, properties of convolution, causality and stability of LTI systems, recursive and non-recursive systems, correlation, properties and applications of correlations. Z-transform, ROC, Inverse z-transform, properties of ztransform, concept of pole-zero, one-sided z-T. Frequency analysis, Fourier series and Fourier transforni for continuous time and discrete time signals, power density and energy density spectrums, DFT, properties of FT and DFT, invertibility of LTI systems, DFT as linear transformation, FFT, divide and conquer approach, radix-2 FFT. Structures of DT systems: Direct form, lattice structure, transposed structure. State-space system analysis. Digital filter: advantages and limitations of digital filters, adaptive filters, applications: inverse modeling, system identification, noise cancellation etc., characteristics of ideal and practical filters. Filter design: designing steps, window method, optimal method, IIR filter design methods.

TEXT & REFERENCE BOOKS:

1. Immanuel C.Ifrehor, Barrier W. Jervis, Digital Signal Processing- A Practical Apporach.
2. Tatsuo Higuchi, Shoukoudou, Introduction to Digital signal processing.
3. A. V. Oppenheim & R. W. Schafe, Digital Signal Processing.
4. A.V. Oppenheim & R. W. Schafe, Digital Time Signal Processing.
5. Marvin E Frerking, Digital Signal Processing in Communication Systems.
6. Ralph D Hippenstiel, Detection Theory: Applications and Digital.

PMIT-6212: Digital Image Processing

Digital Image Fundamentals: Digital Image Fundamentals, A simple Image Model, Sampling and Quantization, Basic Relationship between pixels, Image Geometry. Image Transform: Introduction to the Fourier Transform, The Discrete Fourier Transform, Properties of 2D Fourier Transform, The Fast Fourier Transform, Other Separable Image Transform. Image Enhancement: Background, Enhancement by point Processing, Spatial Filtering, Enhancement in Frequency Domain, Color Image Processing. Image Restoration: Degradation Model, Diagonalization of Circulant and Block- Circulant Matrices, algebraic Approach to Restoration, Inverse Filtering, Geometric Transformation. Morphological Image and Single Processing: The Principle of Mathematical Morphology, Erosion and Dilation in the Euclidean Space, Closing and Opening, Grayscale Morphology, Links between Links and Sets, Grayscale Morphological Transformations. Image Segmentation: Detection of discontinuities,

Edge Linking and Boundary Detection, Thresholding, Region-Oriented Segmentation, The use of Motion in Segmentation.

TEXT & REFERENCE BOOKS:

1. Digital image processing. Author: Gonzalez R.C, Woods R.E
2. Fundamentals of digital image processing. Author: Anil.K.Jain
3. Computer vision and image processing. Author: Umbaugh S.E
4. Digital image processing. William K. Pratt

PMIT- 6213: Speech Recognition

Introduction; Modeling human speech perception: Auditory, neural and cognitive processing, pattern matching, linguistic processing; Representations of speech signal: Band pass filter energies, formants, LPC and ARMA, cepstrum and mel-cepstrum, auditory model based representations, difference coefficients, comparison of parametric representations; Recognition modes and modalities: Speaker dependency, isolated and continuous words, vocabulary size, speaking environment, perplexity, real time operation; Stochastic models, linguistic models, prosodic knowledge sources; Knowledge-based approaches: Templates versus features, segmentation, labeling, fuzzy reasoning; Stochastic approaches: Hidden Markov Models (HMM), training and testing algorithms; Connectionist approaches: Neural networks, learning algorithms; Applications: Dictation systems, voice- voice-based communications, system control, security systems, speaker verification.

TEXT & REFERENCE BOOKS:

1. Speech and Language Processing, 2nd Edition D. Jurafsky and J. Martin
2. Speech Synthesis and Recognition, 2nd edition J. Holmes and W. Holmes
3. Spoken Language Processing: A guide to theory, algorithms, and system development X. Huang, A. Acero, and H.-W. Hon

PMIT-6214: Information Coding

Information Entropy Fundamental: Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem. *Data and voice Coding:* Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC). *Error Control Coding:* Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes. *Compression Techniques:* Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards. *Audio and Video Coding:* Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

TEXT & REFERENCE BOOKS:

1. Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002.

3. Mark Nelson, "Data Compression Book", BPB Publication 1992.
4. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

PMIT-6215: Tele-traffic Engineering

Random Processes: Definition of random processes; Statistics of random processes Stationarity and ergodicity; Markov chains and Markov processes. *Fundamentals of Queuing Theory:* Poisson processes*;* Little's formula*;* Poisson arrivals see time average (PASTA); Birth and death processes*;* M/M/x/x queues*;* Erlang formulas*;* Dimensioning of loss and delay systems. *Networks of Queues:* Jackson networks; Reversibility and Burke's theorem*;* Open and closed queuing networks*;* BCMP queues and networks. *Non-M/M/x/x Queues:* M/G/1 queues; PK Formula; G/M/1 queues; Priority queues*;* Polling. *Fluid Flow Analysis:* On-off sources2. Infinite and finite buffers*;* Leaky bucket; Equivalent bandwidth*;* Long range dependent (LRD) traffic. *Traffic Simulation:* Random number generation; Discrete event simulation*;* Time driven simulation*;* Event driven simulation. *Traffic Measurement:* Common traffic parameters; Measurements recommended by ITU-T.

TEXT & REFERENCE BOOKS:

1. J.F. Hayes and T.V.J.G. Babu: Modeling and Analysis of Telecommunications Networks, Wiley-Interscience, 2004.
2. D.P. Bertsekas and R.G. Gallager: Data Networks, 2nd Edition, Prentice Hall, 1992.
3. J.Y. Hui: Switching and Traffic Theory for Integrated Broadband Networks, Springer, 1990.
4. A. Kumar, D. Manjunath, and J. Kuri: Communication Networking: An Analytical Approach, Morgan Kaufmann, 2004.

PMIY-6216: Telecommunication Traffic and Network Planning

Introduction to radio wave propagation, large scale fading: (reflection, diffraction and scattering), small scale fading and multipath propagation, path loss models, diversity and combining schemes, different pdf of path loss, evolution of 3G mobile cellular communication, cell planning and traffic analysis, concept of CDMA, convolutional coding, block inter leaver, Walsh function, PN sequence generator, QPSK and OQPSK modulation, long code generator, pilot channel, synch channel, paging channel, access channel and traffic channel, rake receiver, satellite based mobile cellular communication, mobile IP, WCDMA, UMT-2000, IMT- 2000, CDMA-2000, MIMO and STBC, OFDM and concept of wireless sensor network.

TEXT & REFERENCE BOOKS:

1. Wireless Communications Principles and Practice, Theodore S. Rappaport, LPE2002
2. Mobile and Personal Communication Systems and Services, Rajpandya, LPE-2004
3. Modern Wireless Communications, Simon Haykin and Michael Moher, LPE-2008
4. CDMA Mobile Communications, Man Young Rhee, 1998
5. Principles of Wireless Networks, K. Pahlavan and P. Krishnamurthy, LPE-2005.

PMIT-6217: Wireless Networks

Overview of wireless communication networks and protocols, The cellular concept: system design fundamentals, Brief introduction to wireless physical layer fundamentals, Multiple access control protocols for wireless systems, Wireless networking (routing/rerouting, wireless TCP/IP), Mobility management, Call admission control and resource allocation, Revolution/evolution towards future generation wireless networks, Overview of wireless mesh networks, mobile ad hoc networks and wireless sensor networks, Wireless security, RFID.

TEXT & REFERENCE BOOKS:

1. Theodore S. Rappaport, Wireless Communications: Principle and Practice, Second Edition, Prentice-Hall, 2002. ISBN-10: 0130422320. ISBN-13: 978-0130422323.
2. Principles of Wireless Networks: A Unified Approach by K. Pahlavan and P. Krishnamurthy, Prentice-Hall, 2002.
3. Wireless and Mobile Network Architecture by Yi-Bing Lin and Imrich Chlamtac, John Wiley & Sons, 2000.

PMIT-6218: Advanced Networking and Internet Technologies

Overview of networking and enabling technologies, Wireless LAN, Mobile networking, Multimedia networking, Internet multimedia protocols, voice over IP (VoIP), QoS for IP based networks, Directory Services, Future trends in networking and Internet technologies,
System/Storage area network (SAN), Issues in switching, routing, and application API design for achieving high bandwidth/low latency communication, cut-through/store-and-forward/wormhole switching, high speed interconnect design, deadlock free routing and load balanced deadlock free routing, and case study, Internet inter-domain routing, BGP, BGP routing instability/slow convergence problems and solutions, BGP security problems and solutions, new inter-domain routing protocol proposals, *Internet security*: Detection and prevention of distributed denial of service (DDOS) attacks, IP traceback, techniques to deal with IP spoofing, intrusion detection, anti-spam, *Internet QoS and traffic engineering*: Issues in packet scheduling, routing, middle-ware support for QoS provision, MPLS, traffic engineering techniques, multi-path routing, *Internet traffic measurement and analysis:* Traffic distribution and workload models, topology characterization, self similarity, statistical multiplexing.

TEXT & REFERENCE BOOKS:

1. James F. F. Kurose and Keith W. Ross, "*Computer Networking: A Top-Down Approach Featuring the Internet*", 3nd edition, Addison Wesley; 3 edition (May 13, 2004)
2. Andrew Tanenbaum, Computer Networks Prentice Hall PTR; 4 edition (August 9, 2002)
3. Douglas E. Comer, "Internetworking with TCP/IP, Volume 1: Principles, Protocols, and Architectures", 4th edition, Prentice Hall, Feb 2000.

PMIT-6219: Advanced Digital Communication

Digital Modulation Techniques: QPSK, DPSK, FQPSK, QAM, M-QAM, OFDM, Optimum Receiver for Signals Corrupted by AWGN, Performance of the Optimum Receiver for Memory-less Modulation, Optimum Receiver for CPM Signals, Optimum Receiver for Signals with Random Phase in AWGN Channel, *Coding Techniques:* Convolutional Codes, Hamming Distance Measures for Convolutional Codes, Various Good Codes, Maximum Likelihood Decoding of Convolutional codes, Error Probability with Maximum Likelihood Decoding of Convolutional Codes, Sequential Decoding and Feedback Decoding, Trellis Coding with Expanded Signal Sets for Band-limited Channels, Viterbi decoding. *Communication through band limited linear filter channels:* Optimum receiver for channels with ISI and AWGN, Linear equalization, Decision-feedback equalization, reduced complexity ML detectors, Iterative equalization and decoding-Turbo equalization, *Adaptive equalization:* Adaptive linear equalizer, adaptive decision feedback equalizer, adaptive equalization of Trellis- coded signals, Recursive least squares algorithms for adaptive equalization, self recovering (blind) equalization. *Spread Spectrum Signals for Digital Communication:* Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Frequency-Hopped Spread Spectrum Signals, CDMA, time-hopping SS, Synchronization of SS systems, *Digital Communication through fading multi-path channels:* Characterization of fading multi-path channels, channel model, frequency-Nonselective, slowly fading channel.

TEXT & REFERENCE BOOKS:

1. John G. Proakis, “Digital Communications," 4th edition, McGraw Hill, 2001.
2. Stephen G. Wilson, “Digital Modulation and Coding,” Pearson Education (Asia) Pte. Ltd, 2003.
3. Kamilo Feher,” Wireless Digital Communications: Modulation and Spread Spectrum Applications,” Prentice-Hall of India, 2004.

PMIT-6220: Advanced Optical Communication

Optical Fibers: Structure and properties of optical fibers; Signal propagation in optical fibers; Single-mode and multi-mode fibers; Attenuation; Dispersion and inter-symbol interference; Nonlinear effects. *Optical Sources;* Basics of semiconductor physics; Light emitting diodes (LEDs)*;* Laser diodes*;* Modulation of light sources; Power launching and coupling. *Optical Receivers:* PIN and

avalanche photodiodes*;* Photo detector noise*;* Preamplifiers*;* Receiver performance; Receiver sensitivity and quantum limit; *Digital Transmission Systems:* Link power budget; Rise-time budget*;* Line coding: NRZ, RZ, and block codes*;* Error correction*;* Noise effects on system performance. *WDM Concepts and Components*: Principles of WDM*;* Couplers*;* Multiplexers and filters*;* Tunable sources*;* Tunable filters*;* Optical wavelength converters. *Optical Amplifiers:* Types of optical amplifiers; Erbium-doped fiber amplifiers (EDFAs)*;* Amplifier noise*;* Amplifier gain control. *Optical Networks:* Broadcast and wavelength-routed networks*;* SONET/SDH*;* Optical switching*;* WDM networks*;* Routing and wavelength assignment*;* Passive optical networks*;* Optical CDMA.

TEXT & REFERENCE BOOKS:

1. G. Keiser: Optical Fiber Communications, 4th Edition, McGraw Hill, 2010.
2. J.G. Proakis and M. Salehi: Communication Systems Engineering, 2nd Edition, Prentice Hall, 2001.
3. R.E. Ziemer and W.H. Tranter: Principles of Communications, 6th Edition, Wiley, 2008.

PMIT-6221: Advanced Wireless Communication

The wireless channel Point-to-point communication: detection, diversity and channel uncertainty, Cellular systems: multiple access and interference management, Capacity of wireless channels, Multiuser capacity and opportunistic communication, *MIMO I:* spatial multiplexing and channel modeling, *MIMO II:* capacity and multiplexing architectures, *MIMO III:* diversity-multiplexing trade-off and universal space-time codes.

TEXT & REFERENCE BOOKS:

1. Garg, V. (2007). Wireless communications and networking. San Francisco: Morgan Kaufmann.
2. Stallings, W. (2005). Wireless communications and network (2nd ed.)s. Upper Saddle River, NJ: Prentice-Hall.
3. Agrawal, D. and Zeng, Q. (2006). Introduction to wireless and mobile systems (3nd ed.). Toronto, Canada: Thomson.
4. Akin, D. (ed), (2002). CWNA, certified wireless network administrator official CWNA study guide. Arvada, CO: WestNet Learning Technologies.
5. Cooklev, T. (2004). Wireless Communications Standards. New York, NY: IEEE Press.

PMIT-6222: Advanced Satellite Communication

Satellite Orbits: Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, Geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion. *Space Segment and Satellite Link Design:* Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime. *Satellite Access:* Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption. *Earth Segment:* Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain. *Satellite Applications:* INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- Worldspace services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

TEXT & REFERENCE BOOKS:

1. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
2. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.
3. Bruce R. Elbert, 'The Satellite Communication Applications' Hand Book, Artech House Bostan London, 1997.
4. Tri T. Ha, 'Digital Satellite Communication', II edition, 1990.
5. Robert G. Winch, 'Telecommunication Trans Mission Systems', McGraw-Hill Book Co., 1983.

PMIT-6223: IoT and Fog Computing

Introduction to IoT and embedded systems: The introductory concept of IoT and big data, cloud computing, and edge computing.
IoT system architectures: IoT-oriented standards, protocols, and databases.
IoT devices: The IoT device design space and platform design.
Smart sensors fundamentals: Basic sensor technology, Sensor systems; Smart sensors definitions.
Smart sensors: Characteristics; Smart sensors architectures; Smart sensors buses and interfaces; Smart sensors software; Data acquisition methods for smart sensors; Virtual sensor systems; Smart sensors for electrical and non-electrical variables.
Sensor networks architectures: Single node architecture; Multi-node architectures; Design principles; Energy efficient topologies; wired sensor networks and wireless sensor networks; Applications.
Communication protocols: Physical layer; MAC protocols; Link layer protocols; Localization and positioning; routing protocols; Transport layer.
Data gathering and processing: Protocols for gathering information; Data processing techniques; Energy management: Energy consumption of sensor nodes; Techniques for reducing consumption and communication energy; Energy-aware routing.
Edge computing: Infrastructure, end node mobility, resourse management, scalability, real-time processing.
Security, reliability, and fault-tolerance: Security and privacy protection; IoT security vulnerabilities: authentication, authorization, encryption, filtering; IoT security architectures; Reliability support; Fault-tolerance; Sensor networks standards; platforms and tools: IEEE 802.15.4 and IEEE 802.11; Berkeley motes; Operating systems.

TEXT & REFERENCE BOOKS:

1. "Data Acquisition and Signal Processing for Smart Sensors", N. V. Kirianaki, S. Y. Yurish, N., O. Shpak V. P. Deynega, John Wiley, 2004
2. "Protocols and Architectures for Wireless Sensor Networks", H. Karl, A. Willig, John Wiley, 2005.
3. "Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems", M.Ilyas, I. Mahgoub (ed.), CRC, 2004.

PMIT-6224: UI/UX

UI/UX Overview, Intro to UI/UX, Good/Bad UX, Notion & Figma Setup, Design Thinking, Team Design Sprint, Empathy Fieldguide, User Research, How to identify stakeholders, Defining Stakeholders, Interaction Design, User Journeys, Mapping the user journey, User Journey Maps + HMW , UX Principles , Blocking Grayscales + User Flow, Understanding user testing, Usability Testing, UI Principles, UI Analysis, UI Design, Non-Traditional UI, Create UI for other Technologies, Creating UI Design, UI Components, Style Guide Analysis, Visual Display of Information.

TEXT & REFERENCE BOOKS:

1. The Visual Display of Quantitative Information, Book by Edward Tufte
2. ui designer, Adham Dannaway
3. Design of Everydaaay things, Don Norman

Group C

PMIT-6301: Computational Biology

Introduction to Computational Genomics, A Spectrum of Computing Issues, Programming and Languages, Operating Systems, Computer Architecture, Computer Networks, Algorithms, Data Structures, Databases, Bio-Computing Technologies, Introduction to UNIX, Introduction to Perl, Introduction to BioPerl, *Sequence similarity:* local and global alignment, brute-force approach, Needleman-Wunsch algorithm, global alignment, Smith-Waterman algorithm and their complexity analysis, *Multiple sequence alignment(MSA):* dynamic-programming solution for MSA, center star method, *Genome rearrangement:* genome rearrangement problem, 4-approximation algorithm, 2-approximation algorithm, *Phylogeny reconstruction*: Different parsimony problems, Fitch's algorithm, approximation algorithm for the large parsimony problem ultrametric tree UPGMA, Genome Modeling, Gene Prediction Concepts and Techniques, Coding, non-coding, Intron/Exon Boundaries, Promoters, TF Binding sites, UTR Indentification, Hidden Markov Models and Domain Finding, Protein Structure Prediction and Analysis, Map Building Methods, Linkage Analysis Algorithms, Tools and Applications, Micro-Arrays and Expression Analysis Methods, Pathway Elucidation Techniques and Tools.

TEXT & REFERENCE BOOKS:

1. Bioinformatics For Dummies, 2nd Edition, Jean-Michel Claverie, Cedric Notredame.
2. Algorithms in Bioinformatics: A practical Introduction, Wing-Kin Sung
3. Richard Durbin, S. Eddy, A. Krogh, G. Mitchison. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids; Cambridge University Press, 1998. ISBN: 0521629713.
4. Warren J. Ewens, Gregory R. Grant. Statistical Methods in Bioinformatics : An Introduction (Statistics for Biology and Health); Springer, 2005. ISBN: 0387400826.

PMIT-6302: Computational Geometry

Algorithms and Complexity of fundamental geometric objects: Polygon triangulation and art gallery theorem, Polygon partitioning, Convex-hulls in 2-dimension and 3-dimension, Dynamic convex-halls;

Geometric Intersection: Line segment intersection and the plane-sweep algorithm, Intersection of polygons; *Proximity:* Voronoi diagrams, Delunay triangulations, closet and furthest pair; *Visualization:* Hidden surface removal and binary space partition(BSP) trees; Graph Drawings: Drawings of rooted trees(Layering, Radial drawings, HV-Drawings, Recursive winding), Drawings of planar graphs(Straight-line drawings, Orthogonal drawings, Visibility drawings); Survey of recent developments in computational geometry.

TEXT & REFERENCE BOOKS:

1. Computational Geometry: Algorithms and Applications (2nd Edition), M. de Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, Springer-Verlag, 2000.
2. J. O'Rourke, Computational Geometry in C, 2nd ed., Cambridge Univ. Press, 1998.
3. T. Cormen, et.al., Introduction to Algorithms, 2nd ed., MIT Press, 2001.
4. J. O'Rourke, Art Gallery Theorems and Algorithms, Oxford Univ. Press, 1987.
5. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge Univ. Press, 1995.

PMIT- 6303: Advanced Neuroinformatics

Data and metadata types in neurosciences, Elements of database design, Representation of neuroscience data and metadata in database formats, *Introduction in mapping of neuroanatomical data (I)*: gene expression data, and neurons, Neuroinformatic databases for gene expression data and developmental databases, Introduction in cytoarchitecture and cytology, *Neuroinformatic databases for neurons and neural components*: Senselab and CoCoDat, *Introduction in mapping of neuroanatomical data (II)*: brain regions, and fiber tracts, Introduction in brain regions and major fiber tracts of the mammalian central nervous system, *Neuroinformatic databases for brain regions and neuroanatomical connections*: CoCoMac and Temporal Lobe, *Data mining*: Principles and main techniques, *Neuroinformatic databases for brain regions and neuroanatomical connections*: BAMS, Neuroinformatics systems for literature and experimental data management, Neuroscholar, *Neural models repositories*: Brain Operating Principles Database (BODB), Senselab, Brain imaging databases, Allen Brain Institute Databases, and Nesys, BrainMap and Brede databases.

TEXT & REFERENCE BOOKS:

1. Michael A. Arbib, and Jeffrey S. Grethe, Computing the Brain: A Guide to Neuroinformatics, San Diego: Academic Press, 2001.
2. Stephen H. Koslow, Michael F. Huerta, Neuroinformatics: An Overview of the Human Brain Project, New Jersey: Lawrence Erlbaum Associates Inc., 1997.
3. Eric R. Kandel, James H. Schwartz, and Thomas M. Jessel, Principles of Neural Science, 4th Ed., New York: McGraw-Hill, 2000.

PMIT-6304: Health Informatics

HealthCare Information Systems: Health Care Information Systems, Strategic Planning, Selecting a Health Care Information System, System Implementation and Maintenance, Information Systems Training, Information Security and Confidentiality, System Integration, and Interoperability, The Electronic Health Record, Regulatory and Accreditation Issues, *Foundations of Healthcare Informatics*: Major Theories Supporting Health Care Informatics (System Theory), Computer, Information Health Care Informatics Literacy, Supporting Administrative Decision Making, Supporting Clinical Decision Making. System *Analysis/System Planning*: System Planning, Applications for HealthCare Information Systems, Strategic and Tactical Planning for Health Care Information Systems, Work Flow Analysis, *The Impact of Informatics on the Socio-cultural Environment of Health Care/Work Systems*: The Impact of HealthCare Informatics on the Organization, The Implications of Information Technology for Research, *Using Technology To deliver Health Care Education*: Technological Approaches to Communication, Technology and Distributed Education.

TEXT & REFERENCE BOOKS:

1. Sheila P. Englebardt, Ramona Nelson, Ramona Nelson. Health Care Informatics: An

Interdisciplinary Approach. Mosby, Nov 2001, ISBN: 0323014232.
2. Atler Steven. Information Systems: Foundation of E-business (4th ed.). ISBN: 10: 0130617733 and/or 13: 978-0130617736

PMIT-6305: Bio-Informatics

Introduction to Bioinformatics, Algorithm basics, Overview of Genbank, Introduction to programming with perl, Introduction to statistics using R, Sequence comparison, Pair wise sequence alignment, Pair wise sequence alignment: scoring matrix & local alignment, Sequence database searching, Multiple sequence alignment, Motif & HMM, Phylogeny, Sequencing techniques & genome assembly, Gene finding, Genome comparison & Genome variation, RNA folding & non-coding RNA finding, Protein bioinformatics & structural bioinformatics, Function annotation, Biological pathways & networks, Microarray & clustering algorithm, Mass spectrometry in proteomics, RNA-Seq, R Basics,

TEXT & REFERENCE BOOKS:

1. Bio Informatics Computing, Bryan Bergeron, PHI, 2003.
2. Introduction to Bio Informatics, Attwood, Smith, Longman, 1999.
3. Bio Informatics Methods and Applications, Rastogi, Mendiratta, Rastogi, PHI

PMIT-6306: Advanced Data Mining for Biological Data

Introduction to Data mining: Classification, Clustering, Data Warehousing, Applications of Data Mining, *Data Bases*: Nucleic Acid Sequences, Genomes, Protein Sequence and Structures, *Bibliographic Access to Molecular Biology Data Bases*: Entrez, Sequence Retrieval System (SRS), Protein Identification Resource (PIR), *Grid-based clustering*: A statistical information grid approach, clustering by wavelet analysis, clustering high-dimensional space, *Clustering high-dimensional data*: subspace clustering, frequent pattern-based clustering, clustering by wavelet analysis, *Advanced outlier analysis*: Statistical-based outlier detection, distance-based outlier detection, deviation-based outlier detection, analysis of local outliers, *Collaborative Filtering*: Mining DNA, RNA, and *proteins*: Mining motif patterns, searching homology in large databases, phylogenetic and functional prediction, *Mining gene expression data*: clustering gene expression, e.g., gene regulatory net-works, classifying gene expression, e.g., for disease-sensitive gene discovery, Mining mass spectrometry data, Mining and integrating knowledge from biomedical literature, Mining inter-domain associations.

TEXT & REFERENCE BOOKS:

1. Biological Data Mining, Stefano Lonardi, Jake Y. Cheng, Chapman & Hall/CRC, 2010
2. Date, C.J. An Introduction to Database Systems, Vol I & II. Addison Wesley.
3. Baxevanis, A. and Ouellette, F.B.F (Editors) 1998 Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. John Wiley and Sons, New York.

PMIT-6307: Data Mining and Knowledge Discovery

Introduction to Data Mining: Types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, *Exploring Data*: Data Set, Summary Statistics, Visualization, OLAP and multi-dimensional data Analysis, *Classification:* Basic Concepts, Decision Trees, and model evaluation: General approach for solving a classification problem, Decision Tree induction, *Model over fitting*: Due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier, *Classification-Alternative techniques:* Nearest Neighborhood classifier, Bayesian Classifier, *Support Vector Machines*: Linear SVM, Separable and Non Separable case, *Association Analysis:* Problem Definition, Frequent Item-set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithms, Handling categorical, continuous attributes, concept hierarchy, sequential, sub-graph patterns. *Clustering:* Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN. *Cluster Evaluation:* Overview, Unsupervised Cluster evaluation using cohesion and separation, using the proximity matrix, Scalable clustering algorithms, *Web Data mining:*

Introduction, Web terminology and characteristics, web content mining, web usage mining, web structure mining, *Search Engines*: Characteristics, Functionality, Architecture, Ranking of web pages, Enterprise search.

TEXT & REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, PEA.
2. Introduction to Data Mining with Case Studies, GK Gupta , Prentice Hall.
3. Data Mining: Introductory and Advanced Topics, Margaret H Dunham, PEA, 2008.

PMIT-6308: Neuronal Information Discovery

Random variables and stochastic processes in Neuronal Signals: Random variables, Moments and Cumulates, Multivariate distributions, *Statistical independence and stochastic processes*: Examples of biomedical signal processing Probabilistic estimation, Linear discriminants - detection of motor activity from MEG, Harmonic analysis - estimation of hart rate in ECG, Auto-regressive model - estimation of the spectrum of cognitive processes in EEG, Matched and Wiener filter - filtering in EMG, Independent components analysis - analysis of EEG signals for signal source localization.

TEXT & REFERENCE BOOKS:

1. Eugene N. Bruce, Biomedical Signal Processing and Signal Modeling, John Wiley & Sons, 2000.
2. Steven Kay, Fundamentals of Statistical Signal Processing, Prentice Hall, 1998.
3. Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley & Sons, 1996.

PMIT-6309: Modeling of Biological Systems

Protein Secondary Structure Prediction Methods: Statistical Methods of Chou and Fasman, Garnier-Osguthorpe-Robson, Stereochemical Method of Lim and Neural Network Method, etc, Fold Recognition and Threading Methods Profiles, Motifs – Regular Expressions, Position Specific Scoring Matrices Repeat Finding and pattern Recognition. Classification of *Three Dimensional Structures of Proteins*: Prediction of Structural Classes, Motifs, Folds and Domains, Classification of Three Dimensional Structures in Brookhaven Protein Data Bank (HSSP, SCOP, FSSP, CATH), Protein Structure Prediction: Structural Alignment Methods, Homology Modeling, Dynamical Programming, Molecular Simulation, Rational Drug design and Docking.

TEXT & REFERENCE BOOKS:

1. Wilkins, M.R., Williams, K.L., Appel, R.D., Hochstrasser, D.F. (Editors) 1997 Proteome Research: New Frontiers in Functional Genomics. Springer Verlag Berlin Heidelberg.
2. Baxevanis, A.D. and Francis Ouellette, B.F. 2004 Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Second Edition, Wiley.
3. Graur, D. and Li, W-H. 2000 Fundamentals of Molecular Evolution. Sinauer Ass., USA. 4. Tisdall, D., 2003 Mastering Perl for Bioinformatics. O'Reilly.

PMIT- 6310: Computer Vision

Introduction: Human Vision, Computer Vision, and Robots Vision System, Sensing, Seeing and perceiving, the role of Vision. *Image formation:* The physics of imaging, Representing, acquiring and displaying images, Gray scale, Color, Noise, Lens distortion, Blurring, and Filtering, Image processing, Preprocessing, and image correction, Binary image analysis, Enhancing features and correcting imperfections, Image understanding, Fourier Transform. *Computer Vision Paradigms:* Pixels, Lines, Boundaries, Regions, and Object representations, "Low-level", "Intermediate-level", and "High-level" vision. *Image Analysis:* Finding edges(low-level), Gradients, Zero crossing detectors, Line models. Finding and grouping lines(intermediate-level), Boundary tracing, Line fitting, Hough transform, Finding and processing regions, Finding "Elementary regions"(low-level) Merging, splitting, and grouping regions(intermediate-level),Grouping and analyzing lines and regions(high-level). *Feature Analysis:* feature extraction/analysis Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, feature vectors, distance/similarity measures, data preprocessing,

Segmentation/ Morphological Filtering, texture. *Stereo and Motion:* Optical Flow and FOE, motion Understanding. Pattern classification using computer vision applications in medicine, industry, and surveillance.

TEXT & REFERENCE BOOKS:

1. D. A. Forsyth and J. Ponce, "Computer Vision – A modern Approach," Prentice Hall Inc., (PHI),2004.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision,"Brooks/Cole Publishing Company, 2nd Ed., 1999.
3. A. K. Jain, "Fundamentals of Digital Image Processing," Prentice Hall Inc., (PHI), 1990.

PMIT- 6311: Human Computer Interaction

Foundations of Human Computer Interaction: Humans and Machines, Interaction, Collaboration. *Models in HCI*: Cognitive Models, Socio-organizational Issues and Stakeholder Requirements. Importance of cognitive abilities. Design Process: Interaction Design Basics, HCI in Software Process, Design Rules, Universal Design, User Center Design. Design. Prototyping, Task Analysis, GOMS and other key HCI methods. Lifecycle Models. *User Interfaces:* Interfaces Basics, Interaction Techniques, System Control of Interfaces, Human Factors and Strategies in Designing Interfaces. *Evaluation and User Support:* Evaluation, Evaluation of Interfaces, User Support. *Tasks Models and Dialogs:* Analyzing the Task, Dialog Notations and Design. Groupware, Ubiquitous Computing, Virtual and Reality. Social-Cultural Contexts of HCI.

TEXT & REFERENCE BOOKS:

1. Julie A. Jacko. Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition. CRC Press, 2012.
2. Yvonne Rogers. HCI Theory Classical, Modern, and Contemporary. Synthesis Lectures on Human-Centered Informatics, 2012.
3. Encyclopedia of Human-Computer Interaction. Available at http://www.interaction-design.org/

PMIT- 6312: Robotics and Automation

Introduction, Translations and rotations, Composition and parameterization of rotations, Rigid motions and homogeneous transformations, Kinematic chains, Denavit-Hartenberg parameters Proposal, Spherical wrists, workspaces, Inverse kinematics, Differential kinematics and angular velocity, Jacobians, Singularities, Manipulability, Configuration, space, potential fields, Roadmaps for planning, Dynamics: Euler-Lagrange formulation, Dynamic equations of motion, Properties of robot dynamics, Dynamics: Newton-Euler formulation, Single-joint control, Control by feedback linearization, Adaptive/robust control
Nonholonomic mobile robots

TEXT & REFERENCE BOOKS:

1. Spong, Hutchinson, and Vidyasagar, Robot Modeling and Control, Wiley, 2005.
2. Peter Corke, Robotics Toolbox for Matlab, an open-source freely available toolbox, download from http://www.petercorke.com
3. Sciavicco and Siciliano, Modelling and Control of Robot Manipulators, Springer, 2000.
4. Murray, Li, and Sastry, A Mathematical Introduction to Robotic Manipulation, CRC, 1994.
5. Craig, Introduction to Robotics: Mechanics and Control Addison-Wesley, 1989.

PMIT- 6313: Big Data Analysis

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, The Data Scientist, Big Data Analytics in Industry Verticals, Data Analytics Lifecycle. *Review of the Basic Data Analytic Methods using R:* Introduction to R – look at the data, Analyzing and Exploring the Data,

Statistics for Model Building and Evaluation. *Advanced Analytics:* K-means clustering, Association rules, Linear Regression, Logistic Regression, Naïve Bayes, Decision Trees, Time Series Analysis, Text Analysis. *Advanced Analytics:* Analytics for Unstructured Data, The Hadoop Ecosystem, In-database Analytics – SQL Essentials, Advanced SQL and MADlib for in-database Analytics.
TEXT & REFERENCE BOOKS:

1. Frank J. Ohlhorst, Big Data analytics: Turning Big Data into Big Money, Wiley and SAS Business Series.
2. Vignesh Prapjapati, Big Data Analysis with R and Hadoop, 2013.
3. Viktor Mayer-Schonberger and Kenneth Cukier, Big Data: A Revolution That Will Transfer How We Live, Work and Think, 2013.

PMIT-6314: Information Retrieval

Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation, *Introduction to Data structures and algorithms related to Information Retrieval*: Basic Concepts, Data structures, Algorithms, *Inverted Files:* Introduction, Structures used in Inverted Files, Building an Inverted file using a sorted array, Modifications to the Basic Techniques, *Signature Files:* Introduction, Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning. *New Indices for Text:* PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays. *Lexical Analysis and Stop-lists:* Introduction, Lexical Analysis, Stop-lists, *thesaurus Construction:* Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri. *String Searching Algorithms:* Introduction, Preliminaries, the Naive Algorithm, the Knutt – Morris - Pratt Algorithm, the Boyer-Moore Algorithm, the Shift-Or Algorithm, the Karp-Rabin Algorithm.

TEXT & REFERENCE BOOKS:

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA,2007.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press, 2000.
3. Information Retrieval: Algorithms and Heuristics, Grossman, Ophir Frieder, 2/e, Springer, 2004.

PMIT- 6315: Natural Language Processing

Introduction, Estimation Techniques, and Language Modeling, Parsing and Syntax, The EM Algorithm in NLP, Stochastic Tagging, and Log-Linear Models, Probabilistic Similarity Measures and Clustering, Machine Translation, Discourse Processing: Segmentation, Anaphora Resolution, Dialogue Systems, Natural Language Generation/Summarization, Unsupervised Methods in NLP.

TEXT & REFERENCE BOOKS:

1. Jurafsky, David, and James H. Martin. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*. Upper Saddle River, NJ: Prentice-Hall, 2000. ISBN: 0130950696.
2. Manning, Christopher D., and Hinrich Schütze. *Foundations of Statistical Natural Language Processing*. Cambridge, MA: MIT Press, 1999. ISBN: 0262133601.

PMIT- 6316: Special Topic relate to IT

A special topic of current interest on information technology. Syllabus should be approved by Academic Committee prior to the commencement of the trimester. In each trimester only one such course title under this course number can be offered. However a student can register only once for this

course within the entire program regardless of the topic offered under this course number and title.