M. Tech. in Information Technology (IT)
## Curriculum & Syllabus for M. Tech. in Information Technology

### M. Tech in IT: 1st Year 1st Semester Syllabus:

#### Theory

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Paper Code</th>
<th>Paper Name</th>
<th>Contact Hrs per Week</th>
<th>Credit Point</th>
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<tbody>
<tr>
<td>1</td>
<td>MATH5103</td>
<td>Advanced Mathematics</td>
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<td>2</td>
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#### Laboratory

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<tr>
<td>6</td>
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#### Sessional

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**Total Semester** 20 0 9 25

### Elective – I Papers (any one):

- 5(a) INFO5151 Communication Systems
- 5(b) INFO5152 Artificial Intelligence
- 5(c) INFO5153 VLSI Design
- 5(d) INFO5154 Software Engg. & Case Tools
Elective – I Laboratories (Corresponding to Elective – I theory paper opted for):

- (a) INFO5161 Communication Systems Laboratory
- (b) INFO5162 Artificial Intelligence Laboratory
- (c) INFO5163 VLSI Design Laboratory
- (d) INFO5164 Software Engg. & Case Tools Laboratory

M. Tech in IT: 1st Year 2nd Semester Syllabus:

### Theory

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Elective – II Papers (any one):

- (a) INFO5251 Wireless and Mobile Communication
- (b) INFO5252 Advanced Computer Network
- (c) INFO5253 Advance JAVA and Web Technology
- (d) INFO5254 Pattern Recognition
**Elective – III Papers (any one):**

5(a) INFO5256 Cloud Cluster & Grid Computing  
5(b) INFO5257 Data Warehousing and Data Mining  
5(c) INFO5258 Distributed Computing System  
5(d) INFO5259 Information Theory & Coding  

**Elective – II Laboratories (Corresponding to Elective – II theory paper opted for):**

7(a) INFO5261 Wireless and Mobile Communication Laboratory  
7(b) INFO5262 Computer Network Laboratory  
7(c) INFO5263 JAVA and Web Technology Laboratory  
7(d) INFO5264 Pattern Recognition Laboratory  

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<th>Subject Name: ADVANCED MATHEMATICS</th>
<th>Paper Code: MATH5103</th>
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**Module – I: [10L]**  
*Probability and Stochastic Process:*  

**Module-II: [10L]**  
*Graph Theory:*  
Tree, Binary Tree, Spanning Tree, Steiner Tree, Greedy, Divide and Conquer, Walk, Path, Cycle, Hamiltonian Graph ,The Travelling Salesman Problem,  Euler Graph, The Chinese Postman Problem , Planar Graph, Euler’s Formula for Planar Graph and Related Problems, Matchings and Augmenting Paths, Hall’s Marriage Theorem and Related Problems, Vertex Colouring, Chromatic Polynomial.

**Module-III: [10L]**  
*Linear Algebra:*  
Definition of Field, Vector Spaces, Subspaces, Linear Dependence, Basis and Dimension, Inner Product Space, Gram-Schmidt Orthogonalization Process, Linear Transformations, Kernels and Images, Matrix Representation of Linear Transformations, Change of Basis, Eigen Values and Eigen Vectors
Module-IV: [10L]
Optimization:

References:
4. Graph Theory with Applications to Engineering and Computer Science: N. Deo (PHI Learning Pvt. Ltd.)
5. A First Look at Graph Theory: John Clark and Derek Allan Holton (Allied Publishers Ltd.)
7. Linear Algebra: Seymour Lipschutz, Marc Lipson (SCHAUM’S Outlines, Mc Graw Hill)
8. Matrices and Linear Transformations: Charles G. Cullen (Dover)
10. Introductory Operations Research: H.S.Kasana, K.D.Kumar (Springer-Verlag)

Subject Name: DIGITAL IMAGE PROCESSING
Paper Code: INFO5101

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Module-I: [5L]
Introduction:

Module-II: [6L]
Digital Image Formation:
A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Module-III: [7L]
Mathematical Preliminaries:
Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.
Module-IV: [8L]

*Image Enhancement:*

Module-V: [7L]

*Image Restoration:*

Module-VI: [7L]

*Image Segmentation:*
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

References:
1. Digital Image Processing, Gonzalves, Pearson
2. Digital Image Processing, Jahne, Springer India
3. Digital Image Processing & Analysis, Chanda & Majumder, PHI
5. Image Processing, Analysis & Machine Vision, Sonka, VIKAS

<table>
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<th>Subject Name: REAL TIME OPERATING SYSTEM</th>
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<tr>
<td>Paper Code: INFO5102</td>
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Module-I: [4L]

Introduction: Definition of real time, applications of real-time systems, a basic Model of a real-time systems, characteristics of real-time systems, safety and Reliability, types of real-time tasks, timing constraints, modeling timing constraints.

Module-II: [8L]

Real-time task scheduling some important concepts, types of real time tasks and Their characteristics, task scheduling, clock-driven scheduling, hybrid schedulers, Event-driven scheduling, earliest deadline first (EDF) scheduling. Rate monotonic Algorithm. Some issues associated with RMA, issues in using RMA in practical Situations. Handling resource sharing and dependencies among real-time tasks:
Resource sharing among real time tasks, priority inversion, priority inheritance Protocol, highest locker protocol, priority ceiling protocol, different types of Priority inversions under PCP, important features of PCP, some issues in using a Resource sharing protocol, handling task dependencies.

**Module-III: [6L]**
Scheduling real-time tasks in multiprocessor: Multiprocessor task allocation, Dynamic allocation of tasks, fault-tolerant scheduling of tasks, clocks in Distributed real-time systems, centralized clock synchronization, distributed Clock synchronization.

**Module-IV: [8L]**
Real-time communication: examples of applications requiring, real-time Communication, basic concepts, real-time communication in a LAN, hard real-time Communication in LAN, bounded access protocols for LANs, performance comparison, Real-time communication over packet switched networks, QOS framework, routing, Resource reservation, TATE control, QOS models.

**Module-V: [6L]**
Real-time databases example applications of real-time databases, review of basic Database concepts, real-time databases, characteristics of temporal data, Concurrency control in real-time databases, commercial real-time databases.

**Module-VI: [5L]**
Commercial real-time operating systems: time services, features of a real-time Operating system, UNIX as a real-time operating system, UNIX - based real-time Operating systems, Windows as real-time operating system, POSIX, a survey of Contemporary real time operating systems, benchmarking real-time systems.

**References:**
1. Rajib Mall “Real time system theory & practice” Pearson Education Asia.
2. Jane w.s. Liu “Real time system”, Pearson Education Asia-200 i

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<th>Subject Name: DESIGN AND ANALYSIS OF ALGORITHM</th>
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**Module-I: [5L]**
*Basics of Analysis of algorithm:*
- Time and Space complexity
- Asymptotic Notation
- Master Theorem
- Lower Bound Theory
Module-II: [18L]

Algorithm paradigms:
- Divide and Conquer: Merge sort, Quick Sort, Binary Search
- Dynamic Programming: Matrix-chain multiplication, Bellman-Ford single source shortest path, Floyd Warshall all pair shortest path.
- Greedy Method: Knapsack problem, Job sequencing with deadlines and penalty, minimum spanning tree algorithms, Dijkstra’s algorithm.
- Branch and Bound: n-Puzzle problem
- Backtracking: Eight queens problem, Graph coloring problem, Hamiltonian problem

Module-III: [6L]

Computational Geometry:
- Robust Geometric primitives
- Convex Hull
- Triangulation
- Nearest Neighbor search

Module-IV: [8L]

Tractable and Intractable Problems:
- Notion of NP completeness: P class, NP-hard class, NP-complete class, Circuit Satisfiability problem, Clique Decision Problem.
- Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem

References:
Module-I: [2L]
A layered view of digital communication

Module-II: [6L]
Discrete source encoding, Memory-less sources, prefix free codes, and entropy, Entropy and Asymptotic equipartition property, Markov sources and Lempel-Ziv universal code.

Module-III: [6L]
Fourier series and Fourier transforms, Discrete-time Fourier transforms and sampling theorem, Quantization, highrate quantizers, and waveform encoding, Nyquist theory, pulse amplitude modulation (PAM), quadrature amplitude modulation (QAM), and frequency translation, Degrees of freedom, orthonormal expansions, and aliasing.

Module-IV: [4L]
Signal space analysis, projection theorem, and modulation

Module-V: [4L]
Random processes, Jointly Gaussian random vectors and processes and white Gaussian noise (WGN), Linear functional and filtering of random processes.

Module-VI: [4L]
Introduction to detection, Detection for random vectors and processes, Theorem of irrelevance, M-ary detection, and coding

Module-VII: [4L]
Review of theorem of irrelevance and introduction to wireless communication, Discrete-time baseband models for wireless channels.

Module-VIII: [4L]
Doppler spread, time spread, coherence time, and coherence frequency.

Module-IX: [6L]
References:
3 Digital and Analog Communication Systems, 7th Ed. – Leon W. Couch, Phi.
4 Principles of Digital Communication – Haykin
5 Digital Communication – Zeimer, Tranter.
7 Digital Communications, 2nd Ed. – Bernard Sklar, Pearson Education.
8 Electronic Communications, 4th Ed. – Dennis Roddy, John Coolen, Phi.

Subject Name: ARTIFICIAL INTELLIGENCE
Paper Code: INFO5152

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Module-I: [2L]

Introduction:
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Module-II: [4L]

Intelligent Agents:
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Module-III: [4L]

Problem Solving:
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Module-IV: [4L]

Search techniques:
Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Module-V: [3L]

Heuristic search strategies:
Module-VI: [3L]
Adversarial search:
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module-VII: [3L]
Knowledge & reasoning:
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Module-VIII: [2L]
Using predicate logic:
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Module-IX: [3L]
Representing knowledge using rules:
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Module-X: [4L]
Probabilistic reasoning:
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory.

Module-XI: [2L]
Planning:
Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Module-XII: [2L]
Natural Language processing:
Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Module-XIII: [2L]
Expert Systems:
Representing and using domain knowledge, expert system shells, knowledge acquisition. Basic knowledge of programming language like Prolog & Lisp.
References:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
7. Artificial Intelligence, Russel, Pearson

Subject Name: VLSI DESIGN

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Module-I: [6L]

Introduction to CMOS circuits:
MOS Transistors, MOS transistor switches, CMOS Logic, NAND gate, NOT Gate, Cell Generation – PLA, Layout Environments – Gate Array, FPGA, Layout Methodologies

Module-II: [12L]

Placement:
Partitioning, Floor Planning, Placement

Module-III: [8L]

Routing:
Global Routing, Detail Routing

Module-IV: [4L]

Compaction:
Compression-Ridge Techniques, Graph-based Techniques, Wire-Length Minimization

References:

1. “An Introduction To VLSI Physical Design”, Majid Sarrafzadeh , C. K. Wong
Module-I: [5L]

Principles and Motivations:
Definitions and need for engineered approach to software development; software Development process models from the points of view of technical development and project management: waterfall, rapid prototyping, incremental development, spiral model.

Module-II: [5L]

Design of Software Systems:
System Design – Context diagram and DFD, Cohesion, Coupling, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object-Oriented approach.

Module-III: [8L]

Software Testing:
Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control, CASE TOOLS-CLASSIFICATION, FEATURES, STRENGTHS AND WEAKNESSES; ICASE; CASE STANDARDS.

Module-IV: [10L]

Software Project Management:
Principles of software projects management; organizational and team structure; project planning; project scheduling, project initiation and project termination; technical, quality, and management plans; project control; cost estimation methods - function points and COCOMO.

Module-V: [12L]

Object Modeling and Design:
Classes, objects, relationships, key abstractions, class diagrams, advanced classes, advanced relationships, interfaces, types, roles, packages, instances, object diagrams, interactions, use cases, use case diagrams, interaction diagrams, activity diagrams, events and signals, state chart diagrams, components, deployment, collaborations, component diagrams, systems and models, reverse engineering.

References:
1. Roger pressman; software engineering - a practitioner’s approach, McGraw hill, New York.
2. Ian sommerville; software engineering, addison-wesley publishing company, England
3. Pankaj Jalote; an integrated approach to software engineering, Narosa publishing House, New Delhi.
Subject Name: DIGITAL IMAGE PROCESSING LABORATORY

<table>
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<th>Paper Code: INFO5111</th>
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1. Image enhancement - contrast stretching technique, histogram equalization, Laplacian
2. Develop a method to add random noise to an image for user specified parameters without the use of Matlab’s in built functions
3. Filter Design - order statistic filter, Max filter, Min filter, Geometric mean filter, Median filter, homomorphic filter, high boost filter, Gaussian lowpass and highpass filter, etc.
4. Noise adding and removal from an image
5. Entropy of an image.
6. Transformation – Log, power-law
7. Region growing and merging algorithm.
8. Segmentation - global and adaptive thresholding.

Subject Name: COMMUNICATION SYSTEMS LABORATORY

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1. Amplitude modulation and Demodulation.
2. Frequency Modulation and Demodulation
3. Pulse Modulation – PAM / PWM / PPM
4. Pulse Code Modulation
6. Digital Modulation & Demodulation – ASK, PSK, QPSK, FSK
8. PLL and Frequency Synthesizer
9. Line Coding
10. Error Control Coding using MATLAB.
11. Sampling & Time Division Multiplexing.
12. Frequency Division Multiplexing
Subject Name: ARTIFICIAL INTELLIGENCE LABORATORY

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1. Write a program to implementation of DFS
2. Write a program to implement BFS
3. Write a program to implement Traveling Salesman Problem
4. Write a program to implement Simulated Annealing Algorithm
5. Write a program to implement 8 puzzle problems
6. Write a program to implement Tower of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. To Study JESS expert system
10. To Study RVD expert system

Subject Name: VLSI DESIGN LABORATORY

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1. Design Entry and Simulation of Combinational Logic Circuits
2. Design Entry and simulation of sequential logic circuit
3. Study of place and root annotation
4. Layout of a CMOS Inverter
5. Design of a 10 bit number controlled oscillator
6. Automatic Layout Generation
7. Implementation of Flip-flops
8. Implementation of Counters
9. Implementation of Registers
Prepare the following documents for each experiment and develop the software using software engineering methodology.

1. Problem Analysis and Project Planning Thorough study of the problem – Identify project scope, Objectives, infrastructure.
2. Software Requirement Analysis Describe the individual Phases/ modules of the project, Identify deliverables.
3. Data Modelling Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
5. Software Testing Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

List of Experiments:

1. Course Registration System
2. Quiz System
3. Online ticket reservation system
4. Remote computer monitoring
5. Student marks analysing system
6. Expert system to prescribe the medicines for the given symptoms
7. ATM system
8. Platform assignment system for the trains in a railway station
9. Stock maintenance
10. E-mail Client system.

Software Required:

Case Tools: Rational Suite, Win runner, Empirix
Languages: C/C++/JDK 1.3, JSDK, INTERNET EXPLORER, UML
Front End: VB, VC++, Developer 2000
Back End: Oracle, MS-Access, SQL
Module-I: [10L]
Structure of relational Databases, Relational Algebra, Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Lossless Decomposition ,Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF; Introduction to Object Oriented DBMS – Object Oriented Model and Object Relational Model.

Module-II: [5L]
Transaction processing, Concurrency control and Recovery Management, conflict and view serializability, lock base protocols, two phase locking.

Module-III: [9L]

Module-IV: [6L]

Module-V: [2L]
Introduction to Oracle RDBMS

References:
Module-I: [4L]
Introduction:
Basic objectives of cryptography, Secret-key and Public-key cryptography, one-way and trapdoor one-way functions, Cryptanalysis, Attack models, Classical cryptography.

Module-II: [12L]
Block ciphers and Stream cipher:
Modes of operation, DES and its variants, RC5, IDEA, SAFER, FEAL, Blowfish, AES, linear and differential cryptanalysis.

Module-III: [5L]
Message digest:
Properties of hash functions, MD2, MD5 and SHA-1, Keyed hash functions (HMAC), Attacks on hash functions.

Module-IV: [5L]
Public-key parameters:
Modular arithmetic, GCD, Primality testing, Chinese remainder theorem, modular square roots, finite fields.

Module-V: [5L]
Public-key encryption and Key exchange:
RSA, Rabin and ElGamal schemes, side channel attacks, Diffie-Hellman Key Exchange algorithms.

Module-VI: [5L]
Network issues:
Certification, public-key infrastructure (PKI), secured socket layer (SSL), Kerberos.

Module-VII: [4L]
Network issues:

References:
Module-I: [10L]

Module-II: [12L]
Pipelined processor design, Pipeline performance measurement parameters – speedup factor, efficiency, throughput of a linear pipeline, comparing performance of a N stage pipeline with a N processor architecture, Pipeline design principles – Uniform subcomputations, Identical computations, Independent computations, Examples from design of Arithmetic pipelines – Floating point Adders, Multipliers, Dividers etc., Classifications of Unifunction, Multifunction & Dynamic pipelines, Scheduling in a pipelines with feedback, Pipeline hazards and their solutions

Module-III: [12L]
RISC architecture, characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC, necessity of using optimizing compilers with RISC architecture, Superpipelining (MIPS architecture), Superscalar architecture, Diversified pipelines and out of order execution, VLIW architecture, Hardware multithreading (Coarse grained, fine grained & simultaneous multithreading.

Module-IV: [6L]
Parallel Architecture: Necessity of high performance, Constraints of conventional architecture, Parallelism in uniprocessor system, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture

References:
1. Computer Organization & Design – Patterson & Hennessy (Morgan Kaufmann)
3. Computer Architecture & Parallel Processing – Hwang & Briggs(TMH)
4. Computer organization and architecture, designing for performance – Stallings (PHI)
5. Modern Processor Design – Shen & Lipasti (TMH)
6. Advanced Computer Architecture – Hwang (TMH)
7. Computer Architecture – Flynn (Narosa)
8. Structured Computer Organization – Tanenbaum (PHI)

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<thead>
<tr>
<th>Subject Name: WIRELESS AND MOBILE COMMUNICATION</th>
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**Module-I: [5L]**

*Fundamentals of wireless communication and computer networking:*
- Electromagnetic spectrum; Characteristics of wireless channel; Modulation techniques; Multiple access techniques; Voice coding; Computer network architectures (reference models)

**Module-II: [14L]**

*Fundamentals of wireless LANs, PANs, WANs, MANs and Wireless Internet:*
- IEEE 802.11, HIPERLAN standards; Bluetooth; HomeRF; Cellular concept and architecture; First, second, and third generation cellular networks; Wireless in local loop systems, standards, and future trends; Mobile IP; TCP over wireless; Wireless application protocol; Optimizing Web over wireless.

**Module-III: [5L]**

*Ad hoc wireless networks:*
- Issues and challenges in infrastructure-less networks; MAC protocols; Routing protocols; Multicast routing protocols; Transport and security protocols; Quality of service provisioning; Energy management.

**Module-IV: [10L]**

*Hybrid wireless networks and wireless sensor networks:*
- Architectures and routing protocols for hybrid wireless networks; Load balancing schemes; Pricing schemes for multi-hop wireless networks; Issues and challenges in wireless sensor networks: Architectures and routing protocols; MAC protocols; Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

**Module-V: [2L]**

*Recent advances in wireless networks:*
- Wide Band (UWB) communication; Issues and challenges in UWB communication; Applications of UWB communication; Wireless Fidelity (Wi-Fi) systems; Issues in Wi-Fi Systems.
Module-VI: [4L]

Mobile phone forensics:
Crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, and evidences in memory card, operators systems- Android forensics:
Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques.

References:
2. Jochen Schiller, Mobile Communications, Person Education.

Subject Name: ADVANCED COMPUTER NETWORK
Paper Code: INFO5252

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Module-I: [16L]
Module-II: [8L]
Wireless Internet: MIPv4, MIPv6, TCP Performance, I-TCP, TCP SNOOP, Freez TCP, WWP, TCP Real.

Module-III: [8L]
Congestion Control: General Principles, Congestion Prevention Policies, Choke Packet, RED, ECN, ELN, ELN-ACK.

Module-IV: [4L]

References:
2. Computer Networks – A.S. TANNENBAUM.
3. Data and Computer Communications – WILLIAM STALLINGS

Subject Name: ADVANCE JAVA AND WEB TECHNOLOGY
Paper Code: INFO5253

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Module-I: [4L]
Static Web Pages:
Web Pages - types and issues, tiers; comparisons of Microsoft and java technologies, WWW-Basic concepts, web client and web server, http protocol (frame format), universal resource locator (URL), HTML different tags, sections, image & pictures, listings, tables, frame, frameset, form.

Module-II: [2L]
Dynamic Web Pages:
The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation.

Module-III: [2L]
Active Web Pages:
Need of active web pages; java applet life cycle, Java Swing.

Module-IV: [3L]
Java Script:
Data types, variables, operators, conditional statements, array object, date object, string object.
Module-V: [4L]

*Java Servlet:*
Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

Module-VI: [12L]

*JSP:*
JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

Module-VII: [7L]

*J2EE:*
An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs. Java Beans, basics of RMI, JNI.

Module-VIII: [6L]

*XML:*
Extensible Markup Language (XML), basics of XML, elements and attributes, document type definition, XML parsers, sequential and tree approach.

References:
1. Web Technologies - Godbole A. S. & Kahate A., TMH.
3. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers

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Module-I: [6L]

*Introduction:*

Module-II: [2L]

*Metric and Non-Metric Proximity Measures:*
Dissimilarity Measures, Distance between Pattern Collections.
Module-III: [10L]
Classification:
Linear and non-linear Discrimination functions, Bayesian decision theory-Two category classification, Minimum error rate classification, Error probability, error bound and Normal density, Density estimation, Minimum distance classifiers, k-NN rule.

Module-VI: [6L]
Learning methodologies:
Training and test sets, parametric and nonparametric learning, Neural network models for pattern recognition: learning, supervised and unsupervised classification.

Module-V: [6L]
Clustering:
Process, Algorithms (basic hierarchical, Agglomerative, Partitional, K-means, divide and conquer)

Module-VI: [6L]
Feature selection:
Dimensionality reduction, similarity measures, feature selection criteria and algorithms, principal components analysis, branch and bound, and some applications.

Module-VII: [6L]
Advance Topic:
Fuzzy logic- Linguistic variables, membership function, and basic operations (union, Intersection, Complement, De Morgans law, Associativity, Commutativity, Distributivity) on fuzzy set, Genetic algorithms- introduction, Types of Operators (Selection, Crossover and Mutation), support vector machines and applications.

References:
4. Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press.
5. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
Module-I: [12L]

Cluster Computing:
A general introduction to the concept of cluster based distributed computing.
Hardware technologies for cluster computing, including a survey of the possible node hardware and high-speed networking hardware and software.
Software and software architectures for cluster computing, including both shared memory (OpenMP) and message-passing (MPI/PVM) models
MPI-2 extension, dynamic process creation, one-sided communication, parallel I/O.
Variants based on new low level protocols (MVAPICH), evaluation and tuning of system and software performance. Performance evaluation tools, HINT, netperf, netpipe, ttcp, Iperf.

Module-II: [16L]

Grid Computing:
The concept of virtual organizations – Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids
Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling, Setting up Grid, deployment of Grid software and tools, and application execution

Module-III: [16L]

Cloud Computing:
Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS
Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing
Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo.
Issues in cloud computing, Implementing real time application over cloud platform
Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.
Subject Name: DATA WAREHOUSING AND DATA MINING

Paper Code: INFO5257

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Module-I: [3L]

**Introduction:**
Data warehousing – definitions and characteristics, Multi-dimensional data model, Warehouse schema.

Module-II: [4L]

**Data Marts:**
Data marts, types of data marts, loading a data mart, metadata, data model, maintenance, nature of data, software components; external data, reference data, performance issues, monitoring requirements and security in a data mart.

Module-III: [3L]

**Online Analytical Processing:**
OLTP and OLAP systems, Data Modeling, LAP tools, Star schema for multi-dimensional view, snowflake schema.

Module-IV: [4L]

**Developing a Data Warehousing:**
Building of a Data Warehousing, Architectural strategies & organizational issues, design considerations, data content, distribution of data, Tools for Data Warehousing.
Module-V: [4L]
Data Mining:
Definitions; KDD(Knowledge Discovery database) versus Data Mining; DBMS versus Data Mining, Data Mining Techniques; Issues and challenges; Applications of Data Warehousing & Data mining in Government.

Module-VI: [4L]
Association Rules:
A priori algorithm, Partition algorithm, Dynamic inset counting algorithm, FP –tree growth algorithm; vgeneralized association rule.

Module-VII: [5L]
Clustering Techniques:
Clustering paradigm, Partition algorithms, CLARA, CLARANS; Hierarchical clustering, DBSCAN; Categorical clustering.

Module-VIII: [4L]
Decision Trees:
Tree construction principle, Best split, Splitting indices, Splitting criteria, Decision tree construction with presorting.

Module-IX: [4L]
Web Mining:
Web content Mining, Web structure Mining, Web usage Mining, Text Mining. Temporal and Spatial

Module-X: [5L]
Big Data Handling:
Introduction, Challenges, data storage (Hadoop), retrieval (Script languages) and computing for Big Data (Map reduces)
Dimensionality Reduction: PCA, Supervised Dimension Reduction.

References:
1. Data Warehousing –Concepts, Techniques, products, application; Prabhu; PHI.
3. Data Warehousing, Data Mining and OLAP; Alex Berson and Stephen J Smith; TMH.
4. Data Warehousing in the real world; Anahory; Pearson Education.
5. Data Mining Introductory & Advanced Topic; Dunham; Pearson Education.
Module-I: [9L]

*Distributed Systems:*
Computer architecture: CICS, RISC, Multi-core Computer networking: ISO/OSI Model
Evolution of operating
Systems Introduction to distributed computing systems. DCS design goals, Transparencies,
Fundamental issues

Module-II: [7L]

*Distributed Coordination:*
Temporal ordering of events, Lamport's logical clocks, Vector clocks; Ordering of messages,
Physical clocks, Global state detection

Module-III: [6L]

*Process synchronization:*
Distributed mutual exclusion algorithms, Performance matrix

Module-IV: [6L]

*Inter-process communication:*
Message passing communication, Remote procedure call, Transaction communication, Group
communication; Broadcast atomic protocols

Module-V: [6L]

*Distributed file systems:*
Deadlocks in distributed systems and Load scheduling and balancing techniques

References:
1. Distributed Systems Concepts and Design, G. Coulouris, J. Dollimore, Addison Wesley
3. Distributed Operating Systems and Algorithms, Randy Chow, T. Johnson, Addison
Wesley
Hall International

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<tr>
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Module-I: [4L]
Information Theory: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Module-II: [4L]
Source Coding: Encoding of the source output, Shannon’s encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

Module-III: [4L]
Fundamental Limits on Performance: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

Module-IV: [4L]
Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

Module-V: [6L]
Introduction to Error Control Coding: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

Module-VI: [6L]
Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

Module-VII: [6L]
RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

Module-VIII: [6L]
Convolution Codes, Time domain approach. Transform domain approach.
References:

Subject Name: ADVANCED DBMS LABORATORY  
Paper Code: INFO5211

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Introduction to Database Administration
1) Introduction to Oracle Architectural components
2) Managing Privileges
   - Creating User
   - System Privileges
   - Granting System Privileges
   - SYSDBA and SYSOPER Privileges
   - System Privilege Restrictions
   - Revoking System Privileges
   - Revoking System Privileges WITH ADMIN OPTION
   - Object Privileges
   - Granting Object Privileges
   - Revoking Object Privileges
   - Revoking Object Privileges WITH GRANT OPTION
   - Obtaining Privileges Information
   - Managing Roles
3) Managing Password Security and resources
   - Profiles
   - Password Management
   - Enabling Password Management
   - Password Account Locking
   - Password Expiration and Aging
   - Password History
   - Password Verification
   - Creating a Profile: Password Settings
- Altering a Profile: Password Setting
- Dropping a Profile: Password Setting

4) Maintaining Data Integrity
- Types of Constraints
- Constraint States
- Constraint Checking
- Enabling and Disabling Constraints
- Using the EXCEPTIONS Table
- Obtaining Constraint Information from data dictionary

**PL/SQL**
- Introduction to PL/SQL
- PL/SQL Variables
- PL/SQL Constants
- PL/SQL Records
- PL/SQL Conditional Statements
- PL/SQL Iterative Statements
- PL/SQL Cursors
- PL/SQL Procedures
- PL/SQL Exception Handling
- PL/SQL Triggers

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**Subject Name:** WIRELESS AND MOBILE COMMUNICATION LABORATORY  
**Paper Code:** INFO5261

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1. UNDERSTANDING Wireless Networking (Mobile IP, Indirect TCP, IEEE 802.11)
2. Configuring Wireless Network with
   - E200 Advanced Wireless-N Router
   - Wireless N PoE Access Point
   - Wireless Ethernet Bridge 802.11b g
   - Dual Band Wireless-N USB Network Adapter
4. Wireless Sensor Network Laboratory Method:
   - transducers / sensors with signal conditioners
   - IR/RF transreceiver with microcontroller based DAS (RS232 compatible)
   - IR/RF transreceiver at computer end (base station)
   - Stargate processor + daughter card
   1. MICA, IMOTE2, IRIS and CRICKET mote platform and TinyOS
   2. Implementation of “Oscilloscope”
   3. Implementation of “OscilloscopeRF” application
   4. Implementation of Surge application
   5. Develop featured sensor board according to requirements, test it using Surge
Subject Name: COMPUTER NETWORK LABORATORY  
Paper Code: INFO5262

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1. IPC (Message queue) 
2. TCP/UDP Socket Programming 
3. Multicast & Broadcast Sockets 
4. Implementation of a Prototype Multithreaded Server 
5. Implementation of 
   • Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) 
   • Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) 
   • Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N) 
6. Server Setup/Configuration 
   • File Transfer Protocol (FTP) 
   • Network File System (NFS) 
   • Domain Name Server (DNS) 
   • Firewall Configuration using `iptables`

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Subject Name: JAVA AND WEB TECHNOLOGY LABORATORY  
Paper Code: INFO5263

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1. HTML 
2. CSS [Inline, External] 
3. JavaScript Control Structure JavaScript Events and Functions 
4. JavaScript Validation and implementation in HTML Form 
5. Servlet 
6. JSP 
7. JDBC for Database Connectivity using JSP 
8. Java Applet and its implementation through JSP 
9. Java Bean Creation 
10. Basic Concepts of EJB and RMI and its implementation by creating Bean 
11. XML Document Creation, DTD, Schema

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Subject Name: PATTERN RECOGNITION LABORATORY  
Paper Code: INFO5264

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1. Bayes Decision Theory 
   • the Normal Distribution 
   • Bayesian Classification 
   • Estimating Probability Density Functions 
   • Nearest Neighbor Rules 
   • Bayesian Networks
2. Linear Classifiers
   - the Perceptron Algorithm
   - Least-Squares Methods
3. Nonlinear Classifiers
   - Multilayer Perceptron's
   - Back Propagation Algorithm
   - Decision Trees
4. Dimensionality Reduction
   - Singular Value Decomposition
   - Independent Component Analysis
   - PCA
5. Clustering
   - Hierarchical Algorithms
   - Agglomerative Algorithms
   - Partitional Algorithms
   - K-means Algorithms
   - Clustering High Dimensional Data
Heritage Institute of Technology
Anandapur, Kolkata - 700107
Structures of Syllabus for M. Tech. in Information Technology

M Tech in IT: 2\textsuperscript{nd} Year 1\textsuperscript{st} Semester Syllabus:

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Elective – IV Papers (any one):

2(a) INFO6151 Project Management & Entrepreneurships
2(b) INFO6152 Teaching & Research Methodologies
2(c) INFO6153 Management Information System

Elective – V Papers (any one):

3(a) INFO6155 Soft Computing
3(b) INFO6156 Bio-Informatics
3(c) INFO6157 E-Business and ERP
3(d) INFO6158 Machine Learning

M Tech in IT: 2\textsuperscript{nd} Year 2\textsuperscript{nd} Semester Syllabus:

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Course Name: ADVANCED COMPUTER GRAPHICS AND MULTIMEDIA
Course Code: INFO6101

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After successful completion of this course the students will be able to:

- Demonstrate activities and applications of device dependant and independent colour models, image representation techniques (raster and random graphics), activities of active and passive graphics devices and computer graphics software.
- Compare effectiveness of DDA algorithm, Bresenham’s line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm, Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method.
- Implement 2D and 3D transformation techniques (translation, rotation, scaling, shearing, reflection)
- Analyze and implement curve and surface representation techniques using Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves algorithms
- Describe hidden surface representation using Z-buffer algorithm, Back face detection, BSP tree method, the Painter’s algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry
- Demonstrate activities and applications of device dependant and independent color models, image representation techniques (raster and random graphics), activities of active and passive graphics devices and computer graphics software.
- Compare between image (.bmp, .jpg, .gif, .tiff), audio (.wav, .midi, .mp3), text (.txt, .doc, .pdf) and video (.mpeg, .wmv, .swf) formats according to their way of representing data, merits and demerits.
- Demonstrate image, video, text analysis tools and techniques.

**Detailed Syllabus:**

**Module-I: [15 L]**

*Review: Bresenham’s algorithms, 2D transformation; devices.*

**3D transformation & viewing:**
Translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

*Curves:*
Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

**Module-II: [8 L]**

*Hidden surfaces:*
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer’s algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

*Color & shading models:*
Light & color model; interpolative shading model; Texture;

Module-III: [10 L]
Multimedia:
Review-hypermedia; authoring and tools; data type and file formats; audio and video signals; digitization - audio and video; Animation - concepts and design paradigms.
Compression:
MPEG, JPEG; transformations; lossy and lossless algorithms, audio and video compression standards.

Module-IV: [9 L]
Multimedia data base:
Data structures – quad trees, R-trees; image data box, image processing and retrieval; text and document database; video database; audio database; design and architecture of a MM database.
MM Servers:
Architecture; scheduling, storage and cache management. Mobile multimedia. Watermarking and stenography. MM over Internet and wireless network.
MM communication:
Protocols and standards; Broadband networks.

References:
4. Shanar: Multimedia: a practical approach, Jaico,

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<tr>
<th>Course Name</th>
<th>PROJECT MANAGEMENT &amp; ENTREPRENEURSHIP</th>
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After successful completion of this course the students will be able to:

To develop an appreciation for the evolution of entrepreneurship as an academic discipline. To gain understanding of the entrepreneurial process through analysis of various situations. To learn diverse research themes in the area of entrepreneurship

Detailed Syllabus:

Module-I: [14L]
What “project management” means. About the context of modern project management. How to manage projects throughout the five major process groups. How the triple constraint affects the project manager. How to develop an effective project plan. How to gain commitment to the project plan. How to efficiently execute the project plan. How to minimize or eliminate scope creep. How to organize and develop successful project teams. How to develop an effective project control system. How to develop realistic project schedules. How to efficiently close out a project.

Module-II: [8L]
Entrepreneurship is an intensive course involving the study of journals articles, analysis of cases, to
evolve perspective on entrepreneurship as an academic discipline

Module-III: [10L]
Entrepreneurship: an introduction, new venture creation, financing entrepreneurial ventures and the business plan, family business management, managing a growing business, venture growth strategies, entrepreneurial skills and strategies, entrepreneurial skills and strategies, entrepreneurship: entrepreneurial ventures in a corporate setting, entrepreneur as change agent, sustainable innovation and entrepreneurship, social entrepreneurship

References:
4. Udayan gupta (editor), done deals: venture capitalists tell their stories.
5. Steve kemper, code name ginger: the story behind segway and dean kamen's quest to invent a new world.
6. Paul a. Gompers and josh lerner, the money of invention: how venture capital creates new wealth.
7. Larry bossidy, ram charan and charles burck, execution: the discipline of getting things done.
11. Tracy kidder, the soul of a new machine, avon books, 1990.
12. H. L. Morgan, a. Kallianpur, and l. M. Lodish, entrepreneurial marketing

| Course Name : TEACHING & RESEARCH METHODOLOGIES |
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| Course Code: INFO6152       |                             |
| Contact hrs per week:       | L  | T  | P  | Total | Credit points |
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Detailed Syllabus:

MODULE A: TEACHING METHODOLOGY [16 Lectures]

Unit 1 Instruction:
Introduction to content, Elements of instruction, Learning objectives, Roles of the teacher and the learner in instruction. [4 Lectures]

Unit 2 Teaching and Learning:
Application of theories of learning to teaching and learning, Sequence of learning and Strategies of learning, Teaching methods, their merits and demerits, Use of ICT in teaching & learning, Classroom management, Individual differences. [4 Lectures]

Unit 3 Planning for teaching and learning:
: Understanding the syllabus, Preparation of a scheme of work, Lesson plan preparation, Micro teaching. [4 Lectures]

Unit 4 Assessment and Evaluation:
: Define measurement, assessment, test, evaluation, Purpose of assessment and evaluation, Types of tests, Grading and reporting the results assessment, Evaluating teaching and learning. [4 Lectures]
MODULE B: RESEARCH METHODOLOGY [28 Lectures]

Unit 1 Definition and explanation of research: Types and Paradigms of Research, History and Philosophy of Research (esp. Philosophical evolution, pathways to major discoveries & inventions), Research Process decision, planning, conducting, Classification of Research Methods; Reflective Thinking, Scientific Thinking.

Research problem formulation: Literature review- need, objective, principles, sources, functions & its documentation, problem formulation esp. sources, considerations & steps, Criteria of a good research problem, Defining and evaluating the research problem, Variables esp. types & conversion of concepts to variables. Research design esp. Causality, algorithmic, quantitative and qualitative designs, Various types of designs. Characteristics of a good research design, problems and issues in research design; Hypotheses: Construction, testing, types, errors; Design of experiments especially classification of designs and types of errors. [8 lectures]

Unit 2 Problem solving: Understanding the problem- unknowns, data & conditions, conditions - satisfiability, sufficiency, redundancy & contradiction, separation of parts of the problem and conditions, notations; devising a plan- connection between data and unknown, similarRELATED problems, reuse of previous solutions, rephrasing/transforming the problem, solving partial or related problem, transforming data and unknowns; carrying out the plan- esp. correctness of each step in multiple ways; evaluation of solution and method- checking correctness of solution, different derivations, utility of the solution. [5 lectures]

Unit 3 Theoretical methods of research: Algorithmic methods including probabilistic, soft computing, and numerical methods; Modeling and Simulation; Engineering Design & Optimization (techniques); Statistical methods in research: Central tendency, Dispensions, Skewness, Moments, Kurtosis, esp. Distributions, Time series, Overview of Non-parametric tests & Multivariate analysis; Emerging techniques in discrete mathematics, algorithms, probability-statistics, internet technology and software engineering, and their application to research in computer science and information technology. [8 lectures]

Unit 4 Foundation of Hypothesis: Meaning of assumption, postulate and hypothesis, nature of hypothesis, function and importance of hypothesis, Characteristics of good hypothesis, formulating hypothesis. [2 Lectures]

Unit 5 Data & Reports: Infrastructural setups for research; Methods of data collection esp. validity and reliability, Sampling; Data processing and Visualization esp. Classification; Ethical issues esp. bias, Misuse of statistical methods, Common fallacies in reasoning. Research Funding & Intellectual Property; Research reports: Research Proposal & Report writing esp. Study objectives, study design, problems and limitations; Prototype micro-project report implementing a major part of all the above (compulsory assignment) [5 lectures]

Course guidelines:
Faculty member will introduce the elementary ideas of most of the topics with emphasis on 3-5 topics preferably from those that are highlighted.

References:
1. Teaching Methodology, Caroline W. Ndirangu, African Virtual University.
2. R. Paneerselvan: Research Methodology, Prentice-Hall India
3. G. Polya, How to Solve It, Princeton University Press

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Detailed Syllabus:

1. Management Information Systems – Need, Purpose and Objectives – Contemporary Approaches to MIS – Information as a strategic resource – Use of information for competitive advantage – MIS as an instrument for the organizational change (8)

[Signature]

3. Information Technology – Definition, IT Capabilities and their organizational impact – Telecommunication and Networks – Types and Topologies of Networks – IT enabled services such as Call Centers, Geographical Information Systems etc. (6)

4. Data Base Management Systems – Data Warehousing and Data Mining (3)


References:
3. Management Information Systems, Davis and Olson, Tata McGraw Hill
5. Decision Support Systems and Intelligent Systems, Turban and Aronson, Pearson Education Asia

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**Detailed Syllabus:**

Introduction [3L]

Fuzzy Sets & Logic [10L]
Introduction to Fuzzy Sets; Classical and Fuzzy Sets; Fuzzy Sets - Membership Function, Basic Operations, Linguistic Variable, Properties; Fuzzy relations - Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; De-fuzzification methods; Basic Applications of Fuzzy Sets and Logics.

Artificial Neural Networks [13L]
Hopfield Networks, Associative Memories, The boltzman machine; Applications of ANN.

Genetic Algorithms [10L]
Introduction, Single and Multi-Objective Optimization, Encoding, Fitness Function, Genetic Operations, Genetic Parameters; Schema theorem; Convergence Theory; Multiobjective optimization using GA (MOGA); Non-Dominated Sorting Genetic Algorithm; Basic Applications.

Rough Set Theory [5L]

Hybrid Systems [6L]
Hybrid systems, GA based ANN (Optimal Weight Selection); Neuro Fuzzy Systems, fuzzy Neuron, architecture, learning, application;

References:
1. “Neuro-Fuzzy and Soft computing”, Jang, Sun, Mizutani, Pearson
4. “Genetic Algorithms”, Goldberg, Pearson

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**Detailed Syllabus:**

**INTRODUCTION TO MOLECULAR BIOLOGY [5L]**
Cells, tissues, types of cells, components of cells, organelles. Functions of different organelles.
Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept.
Concepts of RNA: Basic structure, Difference between RNA and DNA. Types of RNA.
Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Biochemical Pathways- Types of bio-chemical pathways.

**Sequence Databases [2L]**
Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;

**DNA SEQUENCE ANALYSIS [14L]**
DNA Mapping and Assembly: Size of Human DNA, Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph.

**Introduction to Probabilistic models used in Computational Biology [8L]**

**Biological Data Classification and Clustering [6L]**
Assigning protein function and predicting splice sites: Decision Tree
Gene Expression Clustering, K Means Algorithm.

References:
1. David W. Mount: Bioinformatics: Sequencing and Genome Analysis

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<th>Course Name</th>
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Detailed Syllabus:

**Introduction to E-Business [3L]**

**E-Business Business Models [3L]**

**E-Business Infrastructure [3L]**
The Internet: Technology Background, The Internet today, Internet II: The Future Infrastructure
The Intranet: What is an Intranet, Applications of Intranet - Generic functions, Application areas, Industry-specific solutions, Intranet application cases
The Extranet: Basic concept, Structure, Applications of Extranet – Industry-Specific solutions

**Online Security & Payment Systems [4L]**
Security Threats in E-Business environment, Technology Solutions – Symmetric key and Public key encryptions, Digital signature, Digital Envelope, Digital Certificates, SSL, SET, S-HTTP, VPN

**E-Business Marketing Concepts and Communications [6L]**
The Internet audience and consumer behaviour, Basic marketing concepts, B2C and B2B Marketing and Branding strategies – Advertising Networks, Permission Marketing, Affiliate, Viral, Blog and Social Network Marketing, Personalization and one-to-one marketing, Net Pricing Strategies – Free, Versioning, Bundling and Dynamic Pricing
Online Advertising, Social Marketing – Blog advertising, Social Network advertising, Game advertising, targeted Marketing, Web Site as marketing communication tool, Search Engine Optimization
Case Study of Liquidation.com – a B2B marketing success story
Adware, Spyware, AdBombs, Ambush Marketing, Customer Hijacking – Growth of Invasive marketing Techniques on the Web

**B2B E-Business - Electronic Data Interchange [2L]**
Introduction to EDI, Benefits of EDI, EDI standard – EDIFACT, EDI communications, EDI implementations, EDI security

Net Marketplaces – E-Distributors, E-Procurement, Exchanges, Industry Consortia
Private Industrial networks

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"Signature"
E-Tailing and Online Services [5L]
E-Tailing business models – Virtual merchants, Multi-channel merchants, Catalog merchants, Manufacturer-Direct,
Case study of Amazon.com
Online Financial Services, Online Travel Services and Online Career Services

Online Content and Media [4L]
Content audience and market, Media Convergence – Technology, Content and Industry structure
Online Content Revenue Models and Business Processes
The Online Publishing Industry – The Online Newspapers and E-Books
The Online Entertainment Industry – Content, Convergence and Revenue Models
Case Study – Google and YouTube Together : The Next Advertising Platform

Social Networks, Auctions and Portals [4L]
Types of social networks and their business models, Features and Technologies, The Future of Social Networks
Online Auctions – Auctions as an E-Business business model, Types of Internet Auctions, Auctions and Dynamic
Pricing
Portals – Growth and Evolutions, Types and Business Models

Enterprise Resource Planning [6L]
The Emergence of ERP Systems – The Evolution of ERP, Business Benefits of ERP, Different ERP Modules, How
Information Technology facilitates ERP, ERP and Business Process Change
ERP Systems: Sales and Marketing – Management Control Processes in Sales & Marketing, Sales and Marketing
Modules in ERP systems, ERP and Customer Relationship Management
ERP Systems : Production and Materials Management – Management Control Processes in Production and
Manufacturing, Production Planning and Manufacturing Modules in ERP, Materials Management Modules in ERP
Systems, The Future of ERP in Manufacturing and Supply Chain
Supply Chain Management and The eMarketplace – Impact of SCM on Productivity, E-Business & ERP, E-Supply
Chain & ERP, Business Intelligence & ERP, Future Directions for ERP

References:
2. Electronic Commerce 2010 – A Managerial Perspective by Efraim Turban, David King, Jae Lee, Ting Liang,
Deborah Turban, 6th Edn., Pearson Education

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