Syllabus

For

M.Tech. (Computer Science & Engineering)

(Effective from the Session: 2016-17)
**SEMESTER –I**

<table>
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<tr>
<th>S. No.</th>
<th>Subject Code</th>
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<th>Periods</th>
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<th>Evaluation Scheme</th>
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**SEMESTER –II**

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# SEMESTER –III

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# SEMESTER –IV

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**Departmental Elective I**

1. MTCS011: Software Requirements & Specifications
2. MTCS012: Software Process & Management
3. MTCS013: Cloud Computing
4. MTCS014: Embedded Systems
5. MTCS015: Advanced Database
6. MTCS016: Modeling and Simulation

**Departmental Elective II**

1. MTCS021: Sensor Network
2. MTCS022: Software Testing & Auditing
3. MTCS023: Real Time Systems
4. MTCS024: Data Warehousing & Data Mining
5. MTCS025: Genetic Algorithms
6. MTCS026: Neural Networks

**Departmental Elective III**

1. MTCS031: Machine Learning
2. MTCS032: High Performance Networking
3. MTCS033: Software Metrics & Quality Assurance
4. MTCS034: Big Data Analytics
5. MTCS035: Cyber Security and Laws
6. MTCS036: Multimedia Systems
**Departmental Elective IV**

1. MTCS041: Distributed Databases
2. MTCS042: Software Project Planning & Management
3. MTCS043: Network Management
4. MTCS044: Robotics
5. MTCS045: Data Centre Management
6. MTCS046: Digital Forensics

**Departmental Elective V**

1. MTCS051: Optimization Techniques
2. MTCS052: Digital Image Processing
3. MTCS053: Professional Aspects in Software Engineering
4. MTCS054: Storage Area Network
5. MTCS055: Optical Networks
6. MTCS056: Advanced Data Modeling
UNIT-I: DATA STRUCTURE
List, Stack, Queue, Tree, Hash Table, Graph, Search and Sorting Algorithms.

UNIT-II: OPERATING SYSTEM
Scheduling Algorithm, Synchronization Technique, Paging and Segmentation, Virtual Memory.

UNIT-III: AUTOMATA THEORY
Finite Automata, Regular Expression, Context Free Grammar, Push Down Automata, Turing Machine, P and NP Class.

UNIT-IV: DATABASE SYSTEM
Concepts and Architecture; Data Model; Normalization; SQL Advanced Transaction Processing, Deadlock and Concurrency Control; Object Oriented and Object Relational Databases: Parallel and Distributed Databases; Backup and Recovery Concepts, Emerging Database Technologies.

REFERENCES:
7. Alexis Leon, Mathews Leon, ”Database Management Systems

ADVANCED ALGORITHM (MTCS102)

Algorithm Fundamentals: Basic Concept, Analysis of Algorithm, Growth of Functions, Master’s Theorem.

Analysis of sorting Algorithms: Overview, Merge sort, Quick sort, Heap sort, radix sort.

Advance Data Structure: Red-Black Trees, B/B+ Trees.


Graph Algorithm: DFS and BFS algorithm.
NP Complete Problem
REFERENCES:
1. Coreman, Rivest, Lisserson, “Algorithm”, PHI.

LAB-1: FOUNDATION OF COMPUTER SCIENCE (MTCS151)

1. Implementation of List, Stack, Queue, Tree, Hash Table, Graph, Search and Sorting Algorithms
2. Implementation of Scheduling Algorithm, Synchronization Technique, Paging and Segmentation, Virtual Memory.

LAB-II: ADVANCED ALGORITHM (MTCS152)

1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods: a) Linear search b) Binary search
2. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
3. Write a Java program to implement Dijkstra’s algorithm for Single source shortest path problem.
4. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in a) Preorder b) Inorder c) Postorder.
5. Write Java programs for the implementation of bfs and dfs for a given graph.
6. Write Java programs for implementing the following sorting methods: a) Bubble sort b) Insertion sort c) Quick sort d) Merge sort e) Heap sort f) Radix sort g) Binary tree sort
7. Write a Java program to perform the following operations: a) Insertion into a B-tree b) Searching in a B-tree
8. Write a Java program that implements Kruskal’s algorithm to generate minimum cost spanning tree.
9. Write a Java program that implements KMP algorithm for pattern matching.
UNIT-I:

UNIT-II:

UNIT-III:
**Threading and Parallel Programming Constructs:** Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control-based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs:** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

UNIT-IV:

UNIT-V:

REFERENCES:
2. Introduction to Parallel Processing, Sashi Kumar, PHI
3. Parallel Programming, Wilkinson, Pearson
4. Elements of Parallel Computing, Rajaraman, PHI

WIRELESS AND MOBILE NETWORKS (MTCS202)

1. Introduction to Wireless and Mobile Networks
3. Wireless Medium Access Control: Common Problems, SDMA, FDMA, TDMA, CDMA
9. Mobile Transport Layer: Effects of mobility and wireless transmissions on reliable transport protocols such as TCP.
10. Support for Mobility: File Systems, databases, WWW and Mobility, WAP, Application layer for mobile networks.

REFERENCES:

Lab-III: Wireless and Mobile Networks (MTCS251)

Tools:
1. Wireshark
2. Cisco Packet Tracer
3. NS-2 / NS-3
4. OmNet++, OverSim

Lab Exercises:
- The above mentioned tools can be used to experiment with Wireless Network.
- Different protocols can be implemented and tested using the tools viz. AODV, DSR, DSDV etc.
- Wireless topologies (WLAN) can be created for analysis and debugging purpose.
- Test-beds can be developed for testing and performance analysis purposes.
UNIT-I: Basics of requirements Engineering

- Definition of requirements engineering.
- Importance of requirements engineering.
- Place of requirements engineering in development process.
- Types of requirements: functional requirements, non-functional requirements, quality attributes.
- Main requirements engineering activities, documents and processes.

UNIT-I: Requirements inception and elicitation

- Product vision and project scope.
- Traditional elicitation approaches (interviews, stakeholders study, workshops).
- Scenario/use case approaches.
- Prototyping.
- Requirements negotiation and risk management.

UNIT-III: Requirements analysis and specification - modeling techniques

- Inception vs. specification.
- Techniques for writing high-quality requirements.
- Documentation standards (e.g., IEEE 830-1998).
- Goal-oriented modeling.
- Structured analysis and other techniques.
- UML v2 and URN notations.
- External qualities management, contract specification.

UNIT-IV: Requirements verification and validation

- Detection of conflicts and inconsistencies, completeness.
- Techniques for inspection, verification and validation.
- Feature interaction analysis and resolution.

UNIT-V: Requirements management

- Traceability, priorities, changes, baselines.
- Tool support (e.g., DOORS).
- Requirements for various types of systems: embedded systems, consumer. Systems, web-based systems, business systems, systems for scientists and other engineers.
- Requirements engineering in RUP.
- Requirements engineering in agile methods.

REFERENCES:
1. Ian K. Bray, An Introduction to Requirements Engineering, Addison Wesley, 2002
2. Ian F. Alexander, Richard Stevens, Writing better requirements, Addison-Wesley, 2002
3. Elizabeth Hull, Ken Jackson, Jeremy Dick, Requirements Engineering, Springer-Verlag, 2004

SOFTWARE PROCESS & MANAGEMENT (MTCS012)

UNIT-I: DEVELOPMENT LIFE CYCLE PROCESSES

UNIT-II: REQUIREMENTS MANAGEMENT

UNIT-III: ESTIMATION, PLANNING, AND TRACKING

UNIT-IV: CONFIGURATION AND QUALITY MANAGEMENT
identifying artifacts to be configured – naming conventions and version control – configuration control – quality assurance techniques – peer reviews – Fegan inspection – unit, integration, system, and acceptance testing – test data and test cases – bug tracking – causal analysis Tutorial: version control exercises, development of test cases, causal analysis of defects

UNIT-V: SOFTWARE PROCESS DEFINITION AND MANAGEMENT

REFERENCES:

CLOUD COMPUTING (MTCS013)

UNIT-I:
Overview of Computing Paradigm


UNIT-II:
Cloud Computing Architecture Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS) Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS) Deployment Models Public cloud, Private cloud, Hybrid cloud, Community cloud

UNIT-III:
Infrastructure as a Service(IaaS) Introduction to IaaS IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) Resource Virtualization Server, Storage, Network Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service) Examples Amazon EC2 Renting, EC2 Compute Unit, Platform and Storage, pricing, customers Eucalyptus
Platform as a Service(PaaS) Introduction to PaaS What is PaaS, Service Oriented Architecture (SOA) Cloud Platform and Management Computation Storage Examples Google App Engine Microsoft Azure Software as a Service (PaaS) Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS

UNIT-IV:
Service Management in Cloud Computing Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously Managing Data Looking at Data, Scalability & Cloud Services Database & Data Stores in Cloud Large Scale Data Processing
UNIT-V:
Cloud Security Infrastructure Security Network level security, Host level security, Application level security Data security and Storage Data privacy and security Issues, Jurisdictional issues raised by Data location Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

REFERENCES:
- Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

EMBEDDED SYSTEMS (MTCS014)

UNIT -I

UNIT -II:
Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:
Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:

UNIT -V:
Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

REFERENCES:
1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, TMH.
5. An Embedded Software Primer - David E. Simon, Pearson Education.
UNIT-I:

UNIT-II:

UNIT-III:
Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock Based Concurrency Control, Deadlocks, Performance of Locking, Transaction Support in SQL. Concurrency Control: Serializability, and recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Dead Locks, Specialized Locking Techniques, Concurrency Control without Locking. Crash recovery: Introduction to Crash recovery, Introduction to ARIES, the Log, and Other Recovery related Structures, the Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media recovery.

UNIT-IV:

UNIT-V:
Distributed databases: Introduction to distributed databases, Distributed DBMS architectures, Storing data in a distributed DBMS, Distributed catalog management, Distributed query processing Updating distributed data, Distributed transactions, Distributed concurrency control, Distributed Recovery.

REFERENCES:
UNIT-I:


UNIT-II:

GPSS: Program model, entities and transactions, blocks in GPSS, user defined functions, SNA, logic switches, save locations, user chains, tabulation of result, programming examples. Random Number Generation: Congruence generators, long period generators, statistical quality measures of generators, uniformity and independence testing, chi-square and other hypotheses testing, runs testing

UNIT-III:

Random Variable Generation: random variable, probability density and distribution functions, Location, scale and shape parameters, discrete and continuous probability distributions; Inverse transform method, composition and acceptance-rejection methods, efficiency and quality measures of generators; Input Modelling, selection of distribution for a random source, fitting distributions to data, constructing empirical distributions from data.

UNIT-IV:

Random Processes and Queuing Models: random process, discrete/continuous time processes, Markovian property, Markov chain, state transition diagrams, birth-death process, Little’s theorem, steady state analysis of M/M/1 model; multi-server models, M/G/1 and other queuing models, Burke’s theorem, network of queues, Jackson theorem.

UNIT-V:

Network Simulation: SimEvent tool box in MATLAB, general features of network simulation packages, case study of OMNET++/ns2/ns3/NetSim.

REFERENCES:

UNIT-I:
**Basics of wireless sensor networks**

UNIT-II:
**Medium Access Control Protocols for Wireless Sensor Networks**

UNIT-III:
**Routing Protocols for Wireless Sensor Networks**

UNIT-IV:
**Transport Control Protocols and Operating Systems for WSN**
Traditional Transport Control Protocols: TCP (RFC 793), UDP (RFC 768), Mobile IP Feasibility of Using TCP or UDP for WSNs, Introduction of Operating Systems, Examples of Operating Systems: Tiny OS, Mate, Magnet OS

UNIT-V:
**Network Management for Wireless Sensor Networks**

REFERENCES:

SOFTWARE TESTING AND AUDITING: (MTCS022)

UNIT-I: TESTING BASICS


UNIT-II: TEST CASE DESIGN

Introduction to testing design strategies – The smarter tester – Test case design strategies – Using black box approach to test case design – Random testing – Equivalence class partitioning – Boundary value analysis – Other black box test design approaches – Black box testing and COTS – Using white box approach to test design – Test adequacy criteria – Coverage and control flow graphs – Covering code logic – Paths – Their role in white box based test design – Additional white box test design approaches – Evaluating test adequacy criteria.

UNIT-III: LEVELS OF TESTING

The need for levels of testing – Unit test – Unit test planning – Designing the unit tests – The class as a testable unit – The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – System test – The different types – Regression testing – Alpha, beta and acceptance tests.

UNIT-IV: TEST MANAGEMENT -CONTROLLING AND MONITORING


UNIT-V: AUDITING

Software audit review, software audits Vs software peer reviews and software management reviews. Objectives and participants Initiator, Lead Auditor, Recorder, Auditors, Audited Organization.

REFERENCES:
REAL TIME SYSTEMS  (MTCS023)

UNIT-I:

UNIT-II:

UNIT-III:

UNIT-IV:

UNIT-V:
Real Time Operating Systems and Databases Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

REFERENCES:
UNIT-I:
Data Warehousing and Business Analysis: - Data warehousing Components, Building a Data warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, DBMS Schemas for Decision Support, Data Extraction, Cleanup, and Transformation Tools, Metadata reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT-II:
Data Mining: - Data Mining Functionalities – Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.
Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT-III:
Classification and Prediction: - Issues Regarding Classification and Prediction, Classification by Decision Tree Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods, Model Section.

UNIT-IV:
Cluster Analysis: - Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High- Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

UNIT-V:
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

REFERENCES:
1. Jiawei Han and Micheline Kamber “Data Mining Concepts and Techniques” Second Edition,
UNIT-I:  
**Introduction:** Robustness of Traditional Optimization and Search Methods, The goals of Optimization, How are Genetic Algorithms Different from Traditional Methods?, A simple genetic algorithm, Genetic algorithms at work – a simulation by hand, Grist for the Search Mill – important similarities, Similarity templates (Schemata), Learning the Lingo.

UNIT-II:  
**Genetic Algorithms Revisited:** Mathematical Foundations – Who shall live and who shall die? The fundamental theorem, Schema Processing at work: An example by hand revisited, the two-armed and K-armed bandit problem, How many schemata are processed usefully?, The building block hypothesis, another perspective: the minimal Deceptive problem, Schemata revisit: similarity templates as hyper planes.

UNIT-III:  
**Computer Implementation Of A Genetic Algorithm** – Data structures, reproduction, crossover, and mutation, A time to reproduce, a time to cross, get with the main program, How well does it work? Mapping objective functions to fitness form, fitness scaling, codings, a multiparameter, mapped, fixed-point coding, discretization, Constraint Handling.

UNIT-IV:  
**Techniques In Genetic Search** – Dominance, diploidy and abeyance, inversion and other reordering operators, other micro operators, niche and speciation, multiobjective optimization - Knowledge-based techniques, genetic algorithms and parallel processors.

UNIT-V:  
**Multi objective evolutionary optimization:** Pareto optimality, multi-objective evolutionary algorithms: MOGA, NSGA-II, etc. Applications of GA in engineering problems, job-shop scheduling and routing problems

REFERENCES:  
2. Genetic algorithms in search, optimization and Mechine learning, By David E. Gold Berg Pearson Edition  
3. An Introduction to Genetic Algorithm by Melanie Mitchell  
4. The Simple Genetic Algorithm Foundation & Theores by Michael P. Vosk
UNIT-I:
**Basics of ANN:** Models to Neuron; Basic learning laws. Activation and Synaptic Dynamics: Activation dynamics models; Synaptic dynamics models; Stability and Convergence.

UNIT-II:
**Analysis of Feed forward Neural Networks:** Linear associative networks for pattern association; Single layer and Multilayer Perception network for pattern classification; Multilayer feed forward neural networks for pattern mapping.

UNIT-III:
**Analysis of Feedback Neural Networks:** Linear auto associative networks; Hopfield model for pattern storage; stochastic networks; Boltzmann machine for pattern environment storage.

UNIT-IV:
**Competitive Learning Neural Networks:** Basic competitive learning laws; Analysis of pattern clustering networks; Analysis of self-organizing feature mapping networks.

UNIT-V:
**Applications of ANN:** Pattern classification problems; Optimization; Control.

REFERENCES:
1. J.A. Anderson, An Introduction to Neural Networks, MIT
2. Hagen Demuth Beale, Neural Network Design, Cengage Learning
4. Kosko, Neural Network and Fuzzy Sets, PHI
ELECTIVE-III

MACHINE LEARNING (MTCS031)

UNIT-I:
INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning;
THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

UNIT-II:
DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning;
ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation Algorithm-Convergence, Generalization;

UNIT-III:
BAYESIAN LEARNING – Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;

UNIT-IV:
COMPUTATIONAL LEARNING THEORY – Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning;
INSTANCE-BASED LEARNING – k-Nearest Neighbor Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

UNIT-V:
GENETIC ALGORITHMS – an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms-General to specific beam search-FOIL;
REINFORCEMENT LEARNING - The Learning Task, Q Learning.

REFERENCES:
UNIT-1:

UNIT-2:
Multimedia Networking Applications: Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, RSVP- differentiated services.

UNIT-3

UNIT-4:
Packet Queues And Delay Analysis: Little's theorem, Birth and Death process, queueing discipline- Control & stability -, Markovian FIFO queueing system, Non-markovian - Pollaczek-Khinchin formula and M/G/1, M/D/1, self-similar models and Batch-arrival model, Networks of Queues – Burke's theorem and Jackson Theorem.

UNIT-5:

REFERENCES:
UNIT-I:

UNIT-II:
Applying The Seven Basic Quality Tools In Software Development: Ishikawa’s Seven Basic Tools, Checklist, Pareto Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause And Effect Diagram. The Rayleigh Model: Reliability Models, The Rayleigh Model Basic Assumptions, Implementation, Reliability And Predictive Validity.

UNIT-III:

UNIT-IV:

UNIT-V:

REFERENCES:
UNIT-I:
INTRODUCTION TO BIG DATA: Big Data and its Importance, Four V’s of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications.

UNIT-II:
BIG DATA TECHNOLOGIES: Hadoop’s Parallel World, Data discovery, Open source technology for Big Data Analytics, cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics, Information Management.

UNIT-III:
PROCESSING BIG DATA: Integrating disparate data stores, Mapping data to the programming framework, Connecting and extracting data from storage, Transforming data for processing, subdividing data in preparation for Hadoop Map Reduce.

UNIT-IV:
HADOOP MAPREDUCE: Employing Hadoop Map Reduce, Creating the components of Hadoop Map Reduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs, monitoring the progress of job flows, The Building Blocks of Hadoop Map Reduce Distinguishing Hadoop daemons, Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT-V:
BIG DATA TOOLS AND TECHNIQUES: Installing and Running Pig, Comparison with Databases, Pig Latin, User- Define Functions, Data Processing Operators, Installing and Running Hive, Hive QL, Querying Data, User-Defined Functions, Oracle Big Data.

REFERENCES:
3. Rajaraman, A., Ullman, J. D., Mining of Massive Datasets, Cambridge University Press, United Kingdom, 2012
UNIT-I:
**Introduction**: Review of TCP/IP and TCP, IP Header analysis, Introduction to Cyber World, Cyber attacks and cyber security, Information warfare and cyber terrorism, Types of cyber attacks, Cyber Crime and Digital Fraud, Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations)

UNIT-II:
**Issues in cyber security**: Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right-source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Loss.

UNIT-III:

UNIT-IV:
**Procedural Issues**  Duty of Care, Criminal Liability, Procedural issues, Electronic Contracts & Digital Signatures, Misappropriation of information, Civil Rights, Tax, Evidence.

UNIT-V:
**Legal aspects of cyber security**: Ethics, Legal Developments, Late 1990 to 2000, Cyber security in Society, Security in cyber laws case. studies, General law and Cyber Law-a Swift Analysis.

REFERENCES:

MULTIMEDIA SYSTEMS (MTCS036)

UNIT-I:
**Introduction:** Concept of Multimedia, Media & data stream, main properties of multimedia system, Data stream characteristics & for continuous media Multimedia Applications, Hardware Software requirements, Storage Technologies: RAID, Optical Media.

UNIT-II:
**Components of multimedia and file formats:** Text, Basic sound concepts , MIDI , Speech , Basic concept of Images, Graphics format, Basic concepts of Video & animation, Conventional system, Computer based animation, Authoring Tools, Categories of Authoring Tools.

UNIT-III:
**Compression Techniques:** Lossless and Lossy compression, Run length coding, Statistical Coding, Transform Coding, JPEG, MPEG, Text compression using static Huffman technique, Dynamic Huffman Technique, Arithmetic Technique.
**Animation:** Introduction, Basic Terminology techniques, tweaning & morphing, Motion Graphics 2D & 3D animation

UNIT-IV:

UNIT-V:

REFERENCES:

ELECTIVE-IV

DISTRIBUTED DATABASE (MTCS041)

UNIT-I:
Introduction: Features of Distributed databases, Features of Centralized databases, Level of Distributed Transparency, Reference Architecture, Types of Data Fragmentation, Distribution Transparency, access primitives, integrity constraints in Distributed Database.

UNIT-II:

UNIT-III:
QUERY DECOMPOSITION AND DATA LOCALIZATION: Overview of Query Processing objectives, Characterization of Query Processors, Layers of Query Processing, Query Decomposition and Data Localization, Localization of Distributed Data, Optimization of Distributed Queries, Centralized Query Optimization, Join Ordering in Distributed Queries, Distributed Query Optimization.

UNIT-IV:

UNIT-V:

REFERENCES:
UNIT-I:
**Metrics:** Introduction, The Metrics Roadmap, A Typical Metrics Strategy, What Should you Measure?, Set Targets and track Them, Understanding and Trying to minimize variability, Act on data, People and Organizational issues in Metrics Programs, Common Pitfalls to watch out for in Metrics Programs, Matrices implementation checklists and tools, **Software configuration management:** Introduction, Some Basic Definitions and terminology, the processes and activities of software configuration management, configuration status accounting, configuration audit, software configuration management in geographically distributed teams, Metrics in software configuration management, software configuration management tools and automation.

UNIT-II:

UNIT-III:
**Software Requirements gathering:** Inputs and start criteria for requirements gathering, Dimensions of requirements gathering, Steps to be followed during requirements gathering, outputs and quality records from the requirements phase, skill sets required during requirements phase, differences for a shrink-wrapped software, challenges during the requirements management phase, Metrics for requirements phase. **Estimation:** What is Estimation? when and why is Estimation done?, the three phases of Estimation, Estimation methodology, formal models for size Estimation, Translating size Estimate into effort Estimate, Translating effort Estimates into schedule Estimate, common challenges during Estimation , Metrics for the Estimation processes. **Design and Development Phases:** Some differences in our chosen approach, salient features of design, evolving an architecture/ blueprint, design for reusability, technology choices/ constraints, design to standards, design for portability, user interface issues, design for testability, design for diagnose ability, design for maintainability, design for install ability, inter-operability design, challenges during design and development phases, skill sets for design and development, metrics for design and development phases.

UNIT-IV:
**Project management in the testing phase:** Introduction, What is testing?, what are the activities that makeup testing?, test scheduling and types of tests, people issues in testing, management structures for testing in global teams, metrics for testing phase. **Project management in the Maintenance Phase:** Introduction, Activities during Maintenance Phase, management issues during Maintenance Phase, Configuration management during Maintenance Phase, skill sets for people in the maintenance phase, estimating size, effort, and people
resources for the maintenance phase, advantages of using geographically distributed teams for the maintenance phase, metrics for the maintenance phase.

UNIT-V:
Globalization issues in project management: Evolution of globalization, challenges in building global teams, Models for the execution of global projects, some effective management techniques for managing global teams. Impact of the internet on project management: Introduction, the effect of internet on project management, managing projects for the internet, Effect on the project management activities. People focused process models: Growing emphasis on people centric models, people capability maturity model(P-CMM), other people focused models in the literature, how does an organization choose the models to use?

REFERENCES:

NETWORK MANAGEMENT (MTCS043)

UNIT – I:

UNIT – II:
SNMP Management: RMON : What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

UNIT – III:

UNIT – IV:
UNIT – V:

REFERENCES:
2. The Cuckoo’s Egg : Tracking a Spy Through the Maze of Computer Espionage;by Clifford Stoll;Pocket Books;ISBN 0671726889

ROBOTICS (MTCS044)

UNIT-I:

UNIT-II:
END EFFECTORS AND ROBOT CONTROLS Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT-III:

UNIT-IV:

UNIT-V:
MICRO/NANO ROBOTICS SYSTEM Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.

REFERENCES:
UNIT-1: AN INTRODUCTION TO THE DATA CENTRE
The purpose of this unit is to explain the basics of the history of the data centre, why businesses build them and how various designs are classified. The student should understand
1.1. Understand the history of the data centre, from its humble beginnings as a computer room to the football field sized behemoths of today.
1.2. Understand the critical services data centres provide and how they are embedded across most things we do throughout a typical day without us knowing.
1.3. Understand the important role data centres play and how they enable the digital, and likely low carbon economy, of the future.
1.4. Describe and explain the most used definitions in the data centre industry.
1.5. Explain the market forces that are shaping the industry and how they are impacting today’s designs.
1.6. Understand the design process and how criticality, the importance/impact of downtime, and the needs of the business inform the design.

UNIT-2: SITE SELECTION AND ENVIRONMENTAL CONSIDERATIONS, AND ARCHITECTURE DESIGN AND STANDARDS
The purpose of this unit is to help the candidate comprehend what should be taken into account when selecting the location for a data centre. Specifically, candidates must be able to:
2.1. Understand the standards recommendations.
2.2. Explain how the availability of resources affects a design, including power, connectivity and water.
2.3. Understand how geography influences the location of a data centre, including air-quality and localised risks.
2.4. Align design and architecture to business strategy today and into the future.
2.5. Business impact of decisions – looking at design from a TCO perspective over lifecycle for External Shell design, Space considerations, Structural Specifications.
2.6. Applicable Standards – including fire resistance, fire suppression and security, etc.
2.7 Codes & Regulations – including legislative requirements across different countries
2.8. Other types of data centre design – covering modular data centres, scalable data centres, container based systems, fast provisioning, pre-fabricated data centres etc.

UNIT-3: IT HARDWARE
The purpose of this unit is to help candidates understand the terminology and technology of the IT hardware to be housed in a data centre. Specifically, candidates must be able to:
3.1. Identify the roles and terminologies of servers.
3.2. Understand the issues surrounding low server utilisation and the benefits of virtualisation.
3.3. Understand the various types of storage equipment.
3.4. Understand the various types of communications equipment.
3.5. Be aware of technology developments, today’s challenges and the associated standards & regulations around IT hardware
3.6. Understand provisioning guidelines associated with IT, and how they affect managing data centre capacity.
3.7. Case study of innovative designs – Google, Facebook, Yahoo, Deutsche Bank, Kyoto cooling, eBay.

UNIT-4: COOLING SYSTEM OPTIONS & ELECTRICAL POWER SYSTEMS
The purpose of this unit is to help the candidate to comprehend cooling in the context of the data centre and about electrical power systems. Specifically, candidates must be able to:
4.1. Demonstrate knowledge of the fundamentals of cooling.
4.2. Understand what cooling options are available and the advantages/disadvantages of each method, especially with respect to risk management.
4.3. Understand different monitoring and control strategies including associated benefits.
4.4. Understand how to make cooling systems more efficient – understand CoP/EER and operational efficiency across the whole lifecycle of the data centre including apart load efficiency.
4.5. Identify what is meant by power quality for the ICT load and understand the ITIC/CBEMA Power Quality Curve.
4.6. Explain the term ‘grid power supply’.
4.7. Identify the various types of UPS including scalable & modular designs for energy efficiency and eco-mode operation.
4.8. Identify the various forms of energy storage, particularly battery and flywheel, and understand the limitations of each. Understand how power can be distributed in the data centre.
4.9. Explain standby/backup power and understand emerging technologies in this area – including fuel cell technologies.
4.10. Renewable power – low carbon generation and its applicability to the modern data centre.

UNIT-5: ROOM LAYOUT & FIRE PROTECTION AND SECURITY SYSTEMS

The purpose of this unit is to explain the importance of a room layout and fire protection in the context of the data centre.
5.1 Identify IT cabinet types and their installation – including rack mount and blade configurations.
5.2. Explain what is a hot aisle/cold aisle configuration and understand the benefits of air management.
5.3. Future considerations aligned to IT roadmap, including liquid cooled servers.
5.4. Explain the importance of fire regulations, how to prevent fire and identify the prime reasons for a fire suppression strategy.
5.5. Understand the various systems for fire detection, warning and fire suppression; including water, water-mist & gaseous suppressants.
5.6. Understand the elements of a security plan.
5.7. Understand the difference between physical security and electronic security.
5.8. Be aware of surveillance policy and procedures along with associated regulations and standards.

REFERENCES:
2. Hwaiyu Geng, Data Centre Handbook, Wiley.
UNIT-I:
Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating
digital evidence potential- Device handling: seizure issues, device identification, networked
devices and contamination. Overview of Types of computer forensics i.e. Media Forensics,
Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and
investigations)

UNIT-II:
Digital forensics examination principles: Previewing, imaging, continuity, hashing and
evidence locations- Seven element security model- developmental model of digital systems-
audit and logs- Evidence interpretation: Data content and context.

UNIT-III:
Live Data collection and investigating windows environment: windows Registry analysis,
Gathering Tools to create a response toolkit (Built in tools like netstat, cmd.exe, nbtstat, arp,
md5sum, regdmp etc and tools available as freeware like Fport, Pslist etc), Obtaining volatile
Data (tools like coffee, Helix can be used) Computer forensics in windows environment, Log
analysis and event viewer, File auditing, identifying rogue machines, hidden files and
unauthorized access points

UNIT-IV:
Live Data collection and investigating Unix/Linux environment: /Proc file system overview,
Gathering Tools to create a response toolkit (Built in tools like losetup, Vnode, netstat, df,
md5sum, strace etc and tools available as freeware like Encase, Carbonite etc). Handling
Investigations in Unix/Linux Environment: Log Analysis (Network, host, user logging details),
Recording incident time/date stamps, Identifying rogue processes, unauthorized access points,
unauthorized user/group accounts,

UNIT-V:
Forensic Tools and Report Generation: Recovery of Deleted files in windows and Unix,
Analyzing network traffic, sniffers, Ethical Hacking, Hardware forensic tools like Port scanning
and vulnerability assessment tools like Nmap, Netscan etc. Password recovery (tools like John
the ripper, L0phtcrack, and THC-Hydra), Mobile forensic tools and analysis of called data record
Template for computer forensic reports

REFERENCES:
1. Incident Response & Computer Forensics. Mandia, k, Prosise, c, Pepe, m. 2nd edition. Tata-
Frank Enfinger, and Chris Steuart, Thomson Learning
System Forensic Analysis by Brian Carrier , addition Wesley
4. Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Harlan Carvey, syngress
Publication
sybex Publication
ELECTIVE-V

OPTIMIZATION TECHNIQUES (MTCS051)

UNIT-I:
Introduction: Introduction to OR Modeling Approach and Various Real Life Situations Linear Programming Problems (LPP) : Basic LPP and Applications ; Various Components of LP Problem Formulation Solving Linear Programming Problems : Solving LPP : Using Simultaneous Equations and Graphical Method ; Simplex Method ; Duality Theory ; Charnes’ Big – M Method . Transportation Problems and Assignment Problems.

UNIT-II:
Network Analysis: Shortest Path : Dijkstra Algorithm ; Floyd Algorithm ; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

UNIT-III:
Inventory Control: Introduction ; EOQ Models ; Deterministic and probabilistic Models ; Safety Stock ; Buffer Stock.

UNIT-IV:
Game Theory: Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and 6L Maxi-Min Theorems (statement only); Games without saddle point ; Graphical Method ; Principle of Dominance.

UNIT-V:
Queuing Theory: Introduction ; Basic Definitions and Notations ; Axiomatic Derivation of the 7L Arrival & Departure (Poisson Queue ). Pure Birth and Death Models; Poisson Queue Models : M/M/1 : \( \infty \)/FIFO and M/M/1: N/ FIFO.

REFERENCES:

DIGITAL IMAGE PROCESSING (MTCS052)

UNIT-I:
Introduction: Fundamental steps of image processing, components of an image processing of system, the image model and image acquisition, sampling and quantization, station ship between pixels, distance functions, scanner

UNIT-II:
Statistical and spatial operations: Grey level transformations, histogram equalization, smoothing & sharpening-spatial filters, frequency domain filters, homomorphic filtering, image filtering & restoration. Inverse and weiner filtering. FIR weiner filter, Filtering using image transforms, smoothing splines and interpolation.
UNIT-III:
**Morphological and other area operations:** basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms, extension to grey scale images. Segmentation and Edge detection region operations, basic edge detection, second order detection, crack edge detection, gradient operators, compass and laplace operators, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds.

UNIT-IV:
**Image compression:** Types and requirements, statistical compression, spatial compression, contour coding, quantizing compression, image data compression-predictive technique, pixel coding, transfer coding theory, lossy and lossless predictive type coding. Basics of color image processing, pseudocolor image processing, color transformation, color smoothing and sharpening, color segmentation, color image compression, compression standards

UNIT-V:
**Image Transforms** - Fourier, DFT, DCT, DST, Haar, Hotelling, Karhunen -Loeve, Walsh, Hadamard, Slant. Representation and Description - Chain codes, Polygonal approximation, Signatures Boundary Segments, Skeltons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, PCA.

REFERENCES:

**PROFESSIONAL ASPECTS IN SOFTWARE ENGINEERING** (MTCS053)

UNIT-I:
**Intellectual Property rights**
Confidential Information, Copyright, Infringement of Copyright, Acts permitted in Relation to Copyright Works, Licensing and Assignment of Copyright, Moral Rights, Designs, Trademarks, The tort of passing off, Domain Names, Patents.

UNIT-II:
**Software Licenses**
Copyright, Contract, Patent, Free Software and Open Source Software, MIT License, BSD License, GNU General Public License, GNU Lesser General Public License, Q Public License, Proprietary License, Sun Community License.

UNIT-III:
**Software Contracts**
Basics of Software Contracts, Extent of liability, Contract for the supply of custom-built software at a fixed price, other types of software service Contract, Liability for defective software.
UNIT-IV:

**Software Crime Prevention**
Computing and criminal Activity, Reforms of Criminal Law, Categories of Misuse, Computer Fraud, Obtaining Unauthorized Access to Computer, Unauthorized Alteration or Destruction of Information, Denying Access to an Authorized user, Unauthorized Removal of Information Stored in a Computer.

UNIT-V:

**Data Protection Regulations**
Data Protection and Privacy, The impact of the Internet, Factors Influencing the Regulation of Data Processing, Convergence of Data Protection Practice, Defamation and the protection of Reputation.

REFERENCES:

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**STORAGE AREA NETWORK** (MTCS054)

UNIT–I:
Introduction to Storage Technology Information storage, evolution of storage technology and architecture, data center infrastructure, key challenges in Managing information, information lifecycle. Storage system Environments: components of storage system environment, Disk Drive components, Disk Drive Performance, fundamental laws governing disk performance, logical components of the host, application requirements and disk performance.

UNIT-II:

UNIT-III:
Direct – Attached Storage and Introduction to SCSI :Types of DAS, DAS benefits and limitations, disk drive interfaces, introduction to parallel SCSI, SCSI command model. Storage Area Networks: fibre channel, The SAN and Its evolution, components of SAN, FC connectivity, Fibre channel ports, fibre channel architecture, zoning, fiber channel login types, concepts in practice: EMC Connectrix.

UNIT–IV:
UNIT-V:

REFERENCES:

OPTICAL NETWORKS (MTCS055)

UNIT-I:
OPTICAL SYSTEM COMPONENTS: Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT-II:
OPTICAL NETWORK ARCHITECTURES: Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

UNIT-III:
WAVELENGTH ROUTING NETWORKS: The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

UNIT-IV:

UNIT-V:
NETWORK DESIGN AND MANAGEMENT: Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization; Overall design considerations; Control and Management – Network
management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

REFERENCES:

ADVANCED DATA MODELING (MTCS056)

UNIT-I:

UNIT-II:
Mathematical Foundation of the Relational Model, Keys and Referential Integrity, Functional dependencies and normalization, Relational Algebra, Relational Mappings.

UNIT-III:
Object Oriented Databases – Introduction, Weakness of RDBMS, Object Oriented Concepts Storing Objects in Relational Databases, Next Generation Database Systems, Object Oriented Data models, OODBMS Perspect, Issues in OODBMS, Advantages and Disadvantages of OODBMS.

UNIT-IV:
Object Oriented Database Design, OODBMS Standards and Systems, Object Management Group, Object Database Standard ODMG, Object Relational DBMS, Comparison of ORDBMS and OODBMS.

UNIT-V:
XML Fundamentals, XML Schema and DTD document definitions, XSLT transformations and programming, Parsing XML.

REFERENCES: