1MIT1 COMPUTER GRAPHICS AND IMAGE PROCESSING

Review of Graphics Fundamentals
Basic raster graphical algorithm for 2D primitives, Line drawing algorithm, 2D and 3D transformations; Window, Viewport, Clipping algorithm; Circle drawing algorithm, Ellipse drawing algorithm, Bezier curve, b-spline curve, surfaces and Solid modeling. Parallel projection, Perspective projection and Computation of vanishing point; Z-buffer algorithm, Scan line algorithm. Area subdivision and Ray tracing algorithms

Shading
Illumination mode, Specular reflection model, Shading models for curve surfaces, Radiosity method, Rendering, Recursive ray tracing, Texture mapping

Image Manipulation & Storage
What is an Image, Elementary Image processing techniques; Multipass transformation, Image Compositing.

Advanced Modeling Techniques

Segmentation in 2D
Greedy and Local Methods – Watersheds and minimum spanning trees
Deformable Methods – Intelligent scissors/ livewires, active contours; DP snakes, region and boundary methods

Image Reconstruction
Anisotropic reconstruction, restoration, noise removal, high dynamic & range imaging and inpainting

Animation
3D animation, morphing and simulation of key frames

Reference:
1MIT2 OBJECT ORIENTED SOFTWARE ENGINEERING

Introduction to Software Engineering
Software Engineering Development, Software Life Cycle Models, Standards for developing life cycle models

Object Methodology & Requirement Elicitation
Introduction to Object Oriented Methodology, Overview of Requirements Elicitation, Requirement, Model-Action & Use cases, Requirements Elicitation Activities, Managing Requirements Elicitation

Architecture
Model Architecture, Requirements Model, Analysis Model, Design Model, Implementation Model, Test Model

Modeling with UML
Basic Building Blocks of UML, A Conceptual Model of UML, Basic Structural Modeling, UML Diagrams

System Analysis
Analysis Model, Dynamic Modeling & Testing

System Design
Design concepts & activities, Design models, Block design, Testing

Testing Object Oriented Systems

Reference:

Overview of Third Generation (3G) in wireless
Universal Mobile Telecommunication Service (UMTS), UMTS Service and Air interface, 3GPP network architectures, CDMA2000, TD-CDMA and TD-SCDMA Technologies.

Evolution of 2.5G
Enhancement over 2G, GPRS and EDGE network services and architectures, traffic dimensioning, CDMA2000 (1XRTT), WAP and SMS, migration path from 2G to 2.5G to 3G

UMTS
UMTS basics, WCDMA interface, UTRAN architecture, establishment of UMTS speech cells, UMTS packet data (R99), High speech packet data handover and UMTS core network evolution.

CDMA 2000
Radio components, Network structure packet data transport flow, Radio network (IS-2000 1XRTT), EVDO.

TD-SCDMA
Architecture and code network, Radio network, Interface Migration Technique RAN Traffic planning.

TD-CDMA
Generic TD-CDMA architecture, code networks, Radio Network, Interface migration technique RAN traffic planning.

VoIP Technology
Basis of IP transport, VoIP challenges, H-323, session invitation protocol, distributed architecture & media gateway control, VoIP and SS7 VoIP quality of service.

Broadband
Wifi 802.11, 802.16, bluetooth and cable system

Antenna System Selection
Base Station antenna, performance criteria, Diversity, cross pole antenna, dual band antenna dBi and dBd

References:
1MIT4.1 CLUSTER AND GRID COMPUTING

Cluster Computing
Parallel systems, Cluster Architecture, Parallel Paradigms, Parallel, Programming with MPI, Resource management and scheduling.

Grid Computing
Grids and Grid Technologies, Programming models and Parallelization Techniques, Standard application development tools and paradigms such as message-passing and parameter parallel programming, Grid Security Infrastructure, Data Management.

Application 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.

References:
5. Ahmad Abbas, “Grid Computing : A practical guide to technology and applications”.
1MIT4.2  ERROR CONTROL CODING

Coding for Reliable Digital Transmission and Storage, Introduction to Algebra, Linear Block Codes, Important Linear Block Codes, Cyclic Codes, Binary BCH Codes, Reed-Solomon Codes, Decoding Algorithms, Trellises for Linear Block Codes, Reliability-Based Soft-Decision Decoding Algorithms for Linear Block Codes, Convolutional Codes, Turbo Coding and codes for Burst–Error-Correcting.

References:

1MIT4.3 DESIGN PATTERNS

Introduction
Patterns in software engineering, definition and evolution, identifying patterns, representation, reflection, usage, refactoring and anti pattern.

J2EE & Design Pattern
Sum Java center J2EE patterns catalog, presentation Tier design considerations and Practices, Business Tier design considerations and Practices.

J2EE Refactoring
Presentation Tier Refactoring, Business and Integration Tier Refactoring, General refactoring.

Server side.com patterns
catalog, patterns applied to the web tier, patterns applied to a persistence framework, patterns to improve performance, seal ability and security, pattern for enterprise integration, patterns applied to enable reusability, maintainability & extensibility.

VB .NET & Design Pattern
Patterns in the Data Tier, Middle Tier, Presentation Tier, .NET remoting.

References:

1. E. Gamma et. al., “Design Pattern, Elements of reusable object oriented software”, AWL
2. C. A. Berry et. al., “J2EE design patterns applied”, Wror/Spd, 2000
3. Deepak Alur, John Crupi, Dan Malks, “Core J2EE Patterns “, Pearson Educations
2MIT1 ADVANCED COMPUTER NETWORKS

Networks, Queues and Performance Modeling
Introduction, Network types, Multiple-access protocols, Discrete-time queues, Performance measures

Probability, Random Variables and Distributions
Probability, Random variables, Distributions and Conditional distributions

Stochastic Process and Markov Chains
Poisson process and its properties, Markov chains and Markov chain models.

Discrete-Time Queues
Performance measures and Little’s result, Discrete-time queuing conventions, Discrete-time $M/M/1$ queue, Discrete-time $M/M/1/J$ queue, Discrete-time $M^{\text{etn}}/M/1$, Discrete-time $M^{\text{etn}}/M^{\text{em}}/\infty$ queue, S-queues

Discrete-Time Queuing Networks
Tandem S-queues, Network of S-queues, Discrete-time queuing network models for multiple access protocols, Equilibrium point analysis, Different customer classes.

Satellite Networks
Time-division multiple access, Slotted Aloha, Code division multiple access, Buffered slotted Aloha

Local Area Networks
Carrier sensing networks, Token passing networks, Slotted rings.

References:

2MIT2 ENTERPRISE COMPUTING IN JAVA

J2EE
Introduction to J2EE, Building J2EE Applications, JDBC, Servlets and Web Applications, Java Server Pages and Model/View/Controller, J2EE Web Services Overview, Introduction to EJB, Session EJBs, Entity EJBs, JMS and message driven Beans, Transactions and Security, Application Servers (Case Study of any one of IBM Websphere, BEA Weblogic, JBoss).

Hibernate

Spring

Web Services
Introduction to XML, Service-Oriented Architectures SOAP, SOAP message structure, handling errors WSDL, UDDI, Java Web Service implementations JAX-RPC, Web service clients in Java and Introduction to Ajax.

Reference:

2MIT3  ADVANCED DBMS

Review of traditional DBMS's
Relational algebra and relational calculus, design principles, normalization, transaction and concurrency control, recovery management.

Design Process
Design process, design evaluation, modeling process, E-R model, semantic data model, object oriented model, models and mapping normalization and denormalization. Data warehousing, OLAP and data mining.

Architecture
Architecture of DB2, SQL server and Oracle. DB2 sever tuning, SQL server tuning, Oracle server tuning, OS tuning (Microsoft OS's)

Distributed Database Management Systems
Components, levels of data & process distribution, transparency features, data fragmentation, data replication.

Client Server Systems
Principles, components, ODBC, ADO, JDBC and JSQL overview.

Reference:
3. DB2, “Oracle & SQL Server Documentation”.
2MIT4.1 SOFTWARE TESTING

Introduction
Need for software testing, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing, No absolute proof of correctness, Overview of Graph Theory.

Functional Testing
Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Structural Testing
Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

Reducing the number of test cases
Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing

Testing Activities

Object Oriented Testing
Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing.

Testing Tools

Reference:
2MIT4.2 EMBEDDED SYSTEMS DESIGN

Introduction
Embedded systems overview, Design challenge - optimizing design metrics, Common design metrics, time-to-market design metric, NRE and unit cost design metric, performance design metric,

Processor Technology
General-purpose processors - software, Single-purpose processors – hardware, Application-specific processors
IC technology - Full-custom/VLSI, Semi-custom ASIC, PLD, Trends
Design Technology - Compilation/Synthesis, Libraries/IP, Test/Verification
Tradeoffs - Design productivity gap

Custom Single-Purpose Processors Hardware
Combinational Logic, Transistors and logic gates, Basic combinational logic design, RT-level combinational components

Sequential Logic
Flip-flops, RT-level sequential components, Sequential logic design,
Custom single-purpose processor design, RT-level custom single-purpose processor design - Optimizing original program, FSM, datapath and FSM

General-purpose processors: Software
Basic architecture - Datapath, Control unit, Memory
Operation - Instruction execution, Pipelining, Superscalar and VLIW architectures, Programmer's view - Instruction set, Program and data memory space, Registers, I/O and Interrupts
Operating Systems and Development environment - Design flow and tools, Testing and debugging

Application-specific instruction-set processors (ASIP's)
Microcontrollers, Digital signal processors (DSP), Less-general ASIP environments, Selecting a microprocessor, General-purpose processor design

Memory
Memory write ability vs storage permanence, Common memory types - ROM, Mask-programmed ROM, OTP ROM - one-time programmable ROM, EPROM, EEPROM and Flash memory RAM - SRAM - Static RAM, DRAM - Dynamic RAM, PSRAM - Pseudo-static RAM, NVRAM - Non-volatile RAM,

Interfacing
Communication terminology and protocol concepts, Microprocessor interfacing - I/O addressing,
Port and bus-based I/O, interfacing interrupts and Direct memory access
Arbitration - Priority arbiter, Daisy-chain arbitration, Networked-oriented arbitration methods.
Digital camera example
Introduction to Digital camera - User’s perspective and Designer’s perspective
Specification - Informal functional specification, Non-functional specification, Executable specification
Design - Implementation 1: 8051-based design, Implementation 2: fixed point FDCT, Implementation 3: hardware FDCT

Reuse
intellectual property cores
Hard, soft and firm cores, New challenges posed by cores to processor providers as well as by cores to processor users

References:
Introduction to Wireless Sensor Networks (WSN)
Types of applications, challenges for WSN, Enabling Technologies for WSN

Single Node Architecture of WSN
Hardware Component, Energy Consumption issues, operating system and execution environment, case study – Tiny OS and nisc, example nodes – Mica Mote, Eyes nodes

Network Architecture
Sensor Network Scenarios – Single hop vs multi hop networks, multiple sinks and sources, optimization goals and figure of merit. Design Principles of WSN, Service interface of WSN, Gateway concept

Localization & Positioning
Properties of localization and positioning procedures and approaches, mathematical basis for lateral problems, single loop localization, positioning in multi-hop environment

Topology Control
Motivation and basic idea, controlling topology in flat networks, hierarchical networks by domain set hierarchical network by clustering

Routing Protocols
Many faces of forwarding & routing, gossiping and agent based multi casting energy efficient market, broadcast & multicast geographical routing, mobile nodes

Data Centric and content based networking, Data Centric routing and Data aggregation

References:
Introduction
Concept of Multimedia, Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation

Components of multimedia
Text, Graphics, Audio, Video and their representation

Design & Authoring Tools
Categories of Authority Tools, Types of products

Animation
Introduction, Basic Terminology techniques, Motion Graphics 2D & 3D animation

Animating Tool
Fundamentals of MAYA, Modeling- NURBS, Polygon, Organic, animation, paths & boxes, deformers, Working with MEL - Basics & Programming

Rendering & Special Effects
Shading & Texturing Surfaces, Lighting, Special effects

References:
3MIT2.1 SECURITY ANALYSIS OF SOFTWARE

Overview of Computer Security
Threats, risks, vulnerabilities, safeguards, attacks, exploits, Information states, Security at the various states of information processing, storage and transmission; Definition of security based on current state and reachable states, Comprehensive model of security, Confidentiality, integrity and availability, Risk management, corrective action, risk assessment and physical security.

Access Control
Access control matrix, Access control lists, Capabilities, Role-based access, control and Application dependence.

Security Policies
Types of policies, Role of trust, Information states and procedures, Types of access control, Separation of duties, Application dependence, Importance for automated information systems (AIS) and Security planning
Confidentiality Policies - Goals and definitions, Bell-LaPadula model and Multi-level security.
Integrity Policies - Goals and definitions, Information states and procedures, Operating system integrity, Biba model and Clark-Wilson model
Hybrid Policies - Chinese Wall model and Role-Based Access Control

Authentication
Passwords, Challenge-response, Biometrics, Location, Combinations and Application to access control/authorization

Malicious Logic
Trojan horses, Computer viruses, Computer worms, Logic bombs, Defenses and countermeasures

Auditing
Auditing mechanisms, Auditing system design, Privacy issues, Trails and logs, Access control issues, Application dependence

Intrusion Detection
Principles, Models, Architecture, Organization and Intrusion response

Network Security
Policy development, Network organization, Firewalls, Availability, Access control issues, Attacks anticipation, Traffic analysis, Public vs private
Administrative policies
Purposes, Back-up policies, E-mail security and privacy policies, Wireless policies, FAX security policies, Internet security policies, Incident response policies, Testing and validation policies, Application development control, Facilities management, Copyright management, Licensing management, Biometrics access management, Software piracy, Law enforcement issues, assisting investigations, Media destruction/sanitization/protection, Security planning, Resources misuse or abuse, Documentation and auditing.

References:


Additional material:

3MIT2.2 SERVICE ORIENTED ARCHITECTURE

SOA Fundamentals
Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment

Web services Technologies
XML technologies – XML, DTD, XSD, XSLT, XQuery, XPath
Web services technologies - Web services and SOA, WSDL, SOAP, UDDI

SOA Planning and Analysis
Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, non-runtime qualities), business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA)

SOA Design and implementation
service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance

Managing SOA Environment
Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrics), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle

References
SOA and Web services resources on IBM’s website.
3MIT2.3 INFORMATION STORAGE & MANAGEMENT

Complexity of Information Management
Proliferation of Data, Data Center Evolution, Managing Complexity, I/O and the five pillars of technology, Storage Infrastructure, Evolution of Storage

Storage Systems Architecture

Introduction to Networked Storage
Storage Networking Overview, Direct Attached Storage, Storage Area Networks, Case study – Applying SAN concepts, Network Attached Storage, Case study - Applying NAS concepts, IP SAN, CAS, Hybrid Network Storage Based Solutions/ Emerging Technologies, Case study - Applying SAN, NAS, IPSAN concepts

Introduction to Information Availability
Business Continuity Overview, Data Availability, Business Continuity – Local, Case study – Applying local information availability strategies, Business Continuity – Remote, Case study – Applying remote information availability strategies

Disaster Recovery Managing and Monitoring
Monitoring in the Data Center, Case study – Monitoring exercise, Management in the Data Center, Case study – Managing exercise

References: