Scheme and Syllabus of

M.Tech. (Computer Science & Engineering)

With effect from September 2008

Visvesvaraya Technological University
'Jnana Sangama',
Belgaum – 590 014, Karnataka

VARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER SCIENCE & ENGINEERING

I Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment		I.A.	Exam	
08SCS11	Operating Systems	4	2	3	50	100	150
08SCS12	Data Structures & Algorithms	4	2	3	50	100	150
08SCS13	Database Management Systems	4	2	3	50	100	150
08SCS14	Computer Systems Performance Analysis	4	2	3	50	100	150
08SCS15	Elective – I	4	2	3	50	100	150
08SCS16	Seminar	--	3	3	50	--	50
Total		**20**	**13**	**15**	**300**	**500**	**800**

Elective – I	
08SCS151	Theoretical Foundations of Computer Science
08SCS152	Computer Graphics & Visualization
08SCS153	Digital Image Processing

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II Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment		I.A.	Exam	
08SCS21	Computer Architecture	4	2	3	50	100	150
08SCS22	Software Engineering	4	2	3	50	100	150
08SCS23	Computer Networks	4	2	3	50	100	150
08SCS24	Embedded Computing Systems	4	2	3	50	100	150
08SCS25	Elective – II	4	2	3	50	100	150
08SCS26	Project Phase – I*	--	--	--	--	--	--
08SCS27	Seminar	--	3	3	50	--	50
Total		**20**	**13**	**15**	**300**	**500**	**800**

* 6 Weeks Duration; Carried out between Semesters II and III after availing a vacation of 2 weeks

Elective – II
08SCS251 OOAD & Design Patterns
08SCS252 Artificial Intelligence
08SCS253 Digital Signal Processing

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III Semester

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work		I.A.	Exam	
08SCS31	Information & Network Security	4	2	3	50	100	150
08SCS32	Elective III	4	2	3	50	100	150
08SCS33	Elective IV	4	2	3	50	100	150
08SCS34	Project Work – Phase II	--	*	--	--	--	--
08SCS35	Seminar on Project Phase - I	--	3	--	50	--	50
Total		**12**	**09**	**09**	**200**	**300**	**500**

* 3 days for Course Work and 3 days for Project Work

Elective – III		**Elective – IV**	
08SCS321	Storage Area Networks	08SCS331	Mobile Computing
08SCS322	Pattern Classification	08SCS332	Compiler Design
08SCS323	Topics in Algorithms	08SCS333	Distributed Systems

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IV Semester

Course Code	Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work		I.A.	Exam	
08SCS41	Seminar on Project Phase – II	--	3	--	50	--	50
08SCS42	Seminar on Project Phase - III	--	3	--	50	--	50
05SCS43	Project Work	--	6	--	--	100+100	200
Total		**--**	**12**	**--**	**100**	**200**	**300**
Grand Total (I to IV Semester) : 2400							

Note:

1. The hours/week shown in the column of Practical/Field work are the contact hours for students, no load to be shown to the teachers. The teachers should provide guidance.
2. Project Work – Phase - I: 6 weeks of compulsory work to be undertaken by the students after availing 2 weeks of vacation at the end of II semester examinations. An extensive report on this work is to be submitted by the students and further a seminar on this work must be presented during Semester III. This is to be evaluated for 50 Marks by the department committee constituted for the purpose. This is to be included in the Marks Card of III semester.
3. Project Work Phase – II: This is carried out for 3 days per week during Semester III (Effective Total Time: 5 Weeks). A report on this work must be submitted and a Seminar on the same must be presented during Semester IV. This is to be evaluated for 50 marks by the department committee constituted for the purpose and is to be included in the Marks Card of Semester IV.
4. Project Work Phase – III: This is carried out during Semester IV. A Seminar on this work must be presented at the end of Semester IV. This is to be evaluated for 50 marks by the department committee constituted for the purpose and is to be included in the Marks Card of Semester IV.
5. During the final viva, students have to submit all the reports.
6. The Project Valuation and Vive-Voice will be conducted by a committee consisting of the following:
   a) Head of the Department (Chairman)
   b) Guide
   c) Two Examiners appointed by the University. (Out of two external examiners at least one should be present)

SEMESTER I

Operating Systems

Subject Code: 08SCS11	**I.A. Marks : 50**
Hours/Week : 04	**Exam Hours: 03**
Total Hours : 52	**Exam Marks: 100**

1. **Introduction to Operating Systems, System structures**
   What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments.
   Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

2. **Process Management**
   Process concept; Process scheduling; Operations on processes; Inter-process communication.
   Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.
   Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling.

3. **Process Synchronization**
   Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

4. **Deadlocks**
   Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

5. **Memory Management**
   Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
   Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

6. **File System, Implementation of File System**
   File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection.
   Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

7. **Secondary Storage Structures, Protection**
   Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management.
   Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix , Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

8. **Case Study: The Linux Operating System**
   Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication.

Text book:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 7th Edition, Wiley-India, 2006.

References:

1. D.M Dhamdhere: Operating systems - A concept based Approach, Tata Mcgrawhill 2002.
2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006.
3. Harvey M Deital: Operating systems, Addison Wesley, 1990.

Data Structures & Algorithms

Sub Code : 08SCS12	**IA Marks : 50**
Hrs/Week : 04	**Exam Hours: 03**
Total Hrs : 52	**Exam Marks: 100**

1. **Algorithm Analysis**
   Mathematical Background, Model, What to Analyze, Running Time Calculations,

2. **List , Stacks, and Queues**
   Abstract Data Types (ADTs),2 The List ADT, vector and list in the STL, Implementation of vector, Implementation of list, The Stack ADT, The Queue ADT.

3. **Trees**
   Preliminaries, Binary Trees, The Search Tree ADT – Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals (Revisited), B-Trees, Sets and Maps in the Standard Library.

4. **Hashing**
   General Idea, Hash Function, Separate Chaining , Hash Tables Without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing.

5. **Priority Queues (Heaps)**
   Model, Simple Implementation, Binary Heap, Applications of priority Queues, d-Heaps, Leftist Heaps, Skew Heaps, Binomial Queues, Priority Queues in the standard Library.

6. **Sorting**
   Preliminaries, Insertion Sort, A Lower Bound for simple Sorting Algorithms, Shellsort, Heaposrt, Mergesort, Quicksort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting,

7. **Graph Algorithms**
   Definitions, Topological Sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, Introduction to NP-Completeness.

8. **Algorithm Design Techniques**
   Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms, The Turnpike Reconstruction Problem, Games.

Text Books:

1 Marks Allen Wesis: Data Structures and algorithm analysis in C++. Pearson Education, 3rd Edition, 2007.

References:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, PHI, 2005.
2. Sartaj Sahni: Data Structures, Algorithms and Applications in C++, McGraw-Hill, 2005.

Database Management Systems

Subject Code: 008SCS13	**I.A. Marks : 50**
Hours/Week : 04	**Exam Hours: 03**
Total Hours : 52	**Exam Marks: 100**

1. Introduction

Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS.

Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

2. Entity-Relationship Model

Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

3. Relational Model and Relational Algebra

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

4. SQL

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

5. Database Design

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form.

6. Transaction Management

The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2007
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

Reference Book:

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, 5th Edition, Mc-GrawHill, 2006

Computer Systems Performance Analysis

Subject Code: 08SCS14	**IA Marks : 50**
Hrs/Week: 04	**Exam Hours: 03**
Total Hrs: 52	**Exam Marks: 100**

1. **Introduction**

   The art of Performance Evaluation; Common mistakes in Performance Evaluation; A systematic approach to Performance Evaluation; Selecting an evaluation technique; Selecting performance metrics; Commonly used performance metrics; Utility classification of performance metrics; Setting performance requirements.

2. **Workloads, Workload Selection and Characterization**
   Types of work loads: addition instructions; Instruction mixes; Kernels; Synthetic programs; Application benchmarks; Popular benchmarks.
   Work load selection: Services exercised; Level of detail; Representativeness; Timeliness; Other considerations in workload selection.
   Work load characterization techniques: Terminology; Averaging; Specifying dispersion; Single-parameter histograms; Multi-parameter histograms; Principle-component analysis; Markov models; Clustering.

3. **Monitors, Program Execution Monitors, and Accounting Logs**
   Monitors: Terminology and classification; Software and hardware monitors; Software versus hardware monitors; Firmware and hybrid monitors; Distributed system monitors.
   Program execution monitors and accounting logs: Program execution monitors; Techniques for improving program performance; Accounting logs; Analysis and interpretation of accounting log data; Using accounting logs to answer commonly asked questions.

4. **Capacity Planning and Benchmarking**
   Steps in capacity planning and management; Problems in capacity planning; Common mistakes in benchmarking; Benchmarking games; Load drivers; Remote-terminal emulation; Components of an RTE; Limitations of RTEs.
5. **Experimental Design and Analysis**
   Introduction: Terminology; Common mistakes in experiments; Types of experimental designs.
   2^k Factorial Designs: Concepts; Computation of effects; Sign table method for computing effects; Allocation of variance; General 2^k Factorial Designs.
   General full factorial designs with k factors: Model; Analysis of a general design; Informal methods.
6. **Queuing Models**
   Introduction: Queuing notation; Rules for all Queues; Little's law; Types of stochastic processes.
   Analysis of Single Queue: Birth-Death processes; M / M / 1 Queue; M / M / m Queue; M / M / m / B Queue with finite buffers; Results for other M / M / 1 Queuing Systems.
   Queuing Networks: Open and closed Queuing Networks; Product form networks; Queuing Network models of Computer Systems.
   Operational Laws: Utilization law; Forced flow law; Little's law; General response time law; Interactive response time law; Bottleneck analysis.
   Mean Value analysis and related techniques: Analysis of open queuing networks; Mean value analysis; Approximate MVA; Balanced job bounds.
   Convolution Algorithm: Distribution of jobs in a system; Convolution algorithm for computing G(N); Computing performance using G(N); Timesharing systems.
   Hierarchical decomposition of Large Queuing Networks: Load-dependent service centers; Hierarchical decomposition; Limitations of Queuing Theory.

Text Books:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 1991.

Reference Books:

1. Paul J. Fortier, Howard E. Michel: Computer Systems Performance Evaluation and Prediction, Elsevier, 2003.
2. Trivedi, KS, Probability and Statistics with Reliability, Queueing and computer science Applications Prentice Hall of India Reprinted in 1990

Theoretical Foundations of Computer Science

Subject Code: 08SCS151	**I.A. Marks : 50**
Hours/Week : 04	**Exam Hours: 03**
Total Hours : 52	**Exam Marks: 100**

1. Introduction to Finite Automata

Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata; An application of finite automata; Finite automata with Epsilon-transitions.

2. Regular Expressions

Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions.

3. Regular Languages, Properties of Regular Languages

Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata.

4. Context-Free Grammars and Languages

Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages.

5. Pushdown Automata

Definition of the Pushdown automata; The languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

6. Properties of Context-Free Languages

Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs.

7. Introduction To Turing Machine

Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines; Turing Machine and Computers.

8. Undecidability

A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.

9. Intractable problems

The Classes P and NP; Additional NP-Complete Problems; Complements of Languages in NP; Problems solvable in Polynomial Space.

Text Books:

1. John E.. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson education, 2007.

Reference Books:

1. Raymond Greenlaw, H.James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
2. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
3. Daniel I.A. Cohen: Introduction to Computer Theory, 2nd Edition, John Wiley & Sons, 2004.

Computer Graphics and Visualization

Subject Code: 08SCS152	**I.A. Marks : 50**
Hours/Week : 04	**Exam Hours: 03**
Total Hours : 52	**Exam Marks: 100**

1. **INTRODUCTION**
   Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics.
   Graphics Programming: The Sierpinski gasket; Programming two-dimensional applications.

2. **The OpenGL**
   The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting implicit functions.

3. **Input and Interaction**
   Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

4. **Geometric Objects and Transformations - 1**
   Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling.
   Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications; Quaternions.

5. **Viewing**
   Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel-projection matrices; Perspective-projection matrices; Projections and shadows.

6. **Lighting and Shading**
   Light and matter; Light sources; The Phong lighting model; Computation of vectors; Polygonal shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

7. **Implementation**
   Basic implementation strategies; The major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Addison-Wesley, 2008. (Chapters 1, 2, 3, 4, 5, 6, 7)

Reference Books:

1. F.S. Hill,Jr.: Computer Graphics Using OpenGL, 2nd Edition, Pearson education, 2001.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison-wesley 1997.
3. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 2nd Edition,Pearson Education, 2003.

Digital Image Processing

Sub Code: 08SCS153	**IA Marks: 50**
Hours/Week: 4	**Exam Hours: 3**
Total Hours: 52	**Exam Marks: 100**

1. Fundamentals

Basic concepts, Examples of fields that use Digital Image processing, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Basic relationships between pixels

2. Image Enhancement in Digital Spatial Domain

Some basic gray level transformations, Histogram Processing, Enhancement using Arithmetic/Logic Operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial enhancement methods

3. Image Enhancement in the Frequency Domain

Background, Introduction to the Fourier transform and the frequency domain, Smoothing frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering, Implementation

4. Image Restoration

A model of the image degradation/restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, Periodic noise reduction by frequency domain filtering, Linear, position-invariant degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error filtering, Constrained least squares filtering, Geometric mean filter, Geometric transformations

5. Image Compression

Fundamentals, Image compression models, Elements of information theory, Error-free compression, Lossy compression and image compression standards.

6. Image Segmentation

Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region-based segmentation, Segmentation by morphological watersheds and the use of motion in segmentation.

7. **Object Recognition**

Pattern and pattern classes, Recognition based on Decision-Theoretic Methods and Structural Methods.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods: Digital Image Processing, 2nd Edition, Pearson Education, 2002.

Reference Books:

1. Anil K. Jain: Fundamentals of Digital Image Processing, Prentice-Hall of India Pvt. Ltd.,1997.
2. B. Chanda , Dutta Majumdeer: Digital Image Processing and Analysis, Prentice-Hall of India Pvt. Ltd.,2002.

SEMESTER II

Computer Architecture

Sub Code: 08SCS21	**IA Marks: 50**
Hrs/Week: 04	**Exam Hours : 03**
Total Hrs: 52	**Exam Marks :100**

1. **Fundamentals Of Computer Design.**
   Introduction; Classes computers; Defining computer architecture; Trends in Technology; Trends in power in Integrated Circuits; Trends in cost; Dependability, Measuring, reporting and summarizing Performance; Quantitative Principles of computer design; Performance and Price-Performance; Fallacies and pitfalls.

2. **Pipelining: Basic and Intermediate concepts**
   Introduction; Pipeline hazards; How is pipelining implemented? What makes pipelining hard to implement?

3. **Instruction –Level Parallelism, Its Exploitation and Limits on ILP**
   Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with prediction; Overcoming Data hazards with Dynamic scheduling; Dynami scheduling: Examples and Algorithms; Hardware-based Speculation; Exploiting ILP using Multiple issue and Static scheduling; Exploiting ILP using Multiple issue and Dynamic Scheduling; Advanced Techniques for instruction delivery and Speculation; Fallacies and pitfalls.
   Limits in ILP: Introduction; Studies of the limitations of ILP; Limitations on ILP for realizable processors; Cross-Cutting issues: Hardware versus software speculation; Using ILP to exploit thread-level parallelism.

4. **Multiprocessors and Thread –Level Parallelism**
   Introduction; Symmetric Shared-Memory Architectures; Performance of Symmetric Shared-Memory Multiprocessors; Distributed Shared Memory and Directory-based Coherence; Synchronization: The Basics; Models of Memory Consistency.

5. **Memory Hierarchy**
   Review: Introduction; Cache performance; Cache Optimizations.
   Memory Hierarchy design: Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations.

6. **Data Flow Architecture:**
   Data Flow and Hybrid architecture; Case study: VLIW architecture, Superscalar and RISC architecture.

Text Books:

1. Hennessey and Patterson: Computer Architecture A Quantitative Approach, 4th Edition, Elsevier, 2007.
2. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programmability, Tata McGraw-Hill, 2003.

Software Engineering

Sub Code: 08SCS22	**IA Marks: 50**
Hours/Week: 4	**Exam Hours : 3**
Total Hours: 52	**Exam Marks : 100**

1. **Introduction and Review of Software Process Models** **7 Hrs**
   FAQs about Software Engineering; Professional and ethical responsibility; Software process models; Process iteration; Process activities; Computer-Aided Software Engineering.

2. **Rapid Software Development, Software Reuse** **8 Hrs**
   Agile methods; Extreme programming; Rapid application development.
   Reuse landscape; Design patterns; Generator-based reuse; Application frameworks; Application system reuse

3. **CBSE, Software Evolution** **8 Hrs**
   Components and component models; Component-Based Software Engineering (CBSE).
   Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

4. **Verification and Validation** **7 Hrs**
   Planning verification and validation; Software inspections;
   System testing; Component testing; Test case design; Test automation.

5. **Critical Systems, Specifications of Critical Systems** **8 Hrs**
   What are critical systems? Examples; System dependability, availability and reliability.
   Risk-driven specification; Safety specification; Security specification; Software reliability specification.

6. **Critical Systems Development, Validation** **8 Hrs**
   Dependable processes; Dependable programming; Fault tolerance and fault-tolerant architectures.
   Reliability validation; Safety assurance; Security assessment; Safety and dependability cases.

7. **Distributed Systems Architecture** **7 Hrs**
   Multiprocessor architectures; Client-Server architectures; Distributed object architectures; Inter-Organizational distributed computing.

8. **Real-Time Software Design** **7 Hrs**
   Real-time systems; System design; Monitoring and control systems; Data acquisition systems.

Text Books:

1. Ian Sommerville: Software Engineering, 8th Edition, Addison-Wesley, 2007.

Reference Books:

1. Roger S. Pressman: Software Engineering: A Practitioner's Approach, 7th Edition, Mc Graw-Hill Publications, 2007.
2. Pfleeger: Software Engineering Theory and Practice, 2nd Edition, Pearson Education, 2001.
3. Waman S Jawadekar: Software Engineering Principles and Practice, Tata McGraw Hill, 2004.

Computer Networks

Sub Code: 08SCS23	**IA Marks :50**
Hrs/Week: 04	**Exam Hours:03**
Total Hrs : 52	**Exam Marks: 100**

1. **Foundation**
   Building a Network; Applications; Requirements; Network Architecture; Implementing Network software; Performance.

2. **Direct Link Networks**
   Physically connecting hosts; Hardware building blocks; Encoding; Framing; Error detection; Reliable transmission; Ethernet (802.3); Ring; (802.5, FDDI, 802.17); Wireless (802.15.1, 802.11, 802.16, Cell Phone Technologies).

4. **Packet Switching**
   Switching and forwarding; Bridges and LAN Switches; Cell Switching; Implementation and Performance.

5. **Internetworking**
   Simple internetworking (IP); Routing; Global Internet; Multicast; MPLS.

6. **End –to-End Protocols**
   Simple demultiplexer (UDP); Reliable byte stream (TCP).

7. **Congestion Control and Resource Allocation**
   Issues in resource allocation; Queuing discipline; TCP Congestion Control; Congestion-Avoidance mechanisms; Quality of Service.

8. **Applications**
   Traditional applications; Web services; Multimedia applications; Overlay Networks.

Text Books:

1. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

Reference Books:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.

Embedded Computing Systems

Subject Code: 08SCS24	**I.A. Marks : 50**
Hours/Week : 04	**Exam Hours: 03**
Total Hours : 52	**Exam Marks: 100**

1. Introduction to Embedded Systems

Embedded systems; Processor embedded into a system; Embedded hardware units and devices in a system; Embedded software in a system; Examples of embedded systems; Embedded System-on-Chip (SoC) and use of VLSI circuit design technology; Complex systems design and processors; Design process in embedded system. Formalization of system design; Design process and design examples; Classification of embedded systems; Skills required for an embedded system designer.

2. Devices

I/O types and examples; Serial communication devices; Parallel device ports; Sophisticated interfacing features in device ports. Wireless devices; Timer and counting devices; Watchdog timer; Real time clock.

3. Communication Buses for Device Networks

Networked embedded systems; Serial bus communication protocols; Parallel bus device protocols; Internet enabled systems; Wireless and mobile system protocols.

4. Device Drivers and Interrupts Service Mechanism

Device access without interrupts; ISR concept; Interrupt sources; Interrupt servicing mechanism; Multiple interrupts; Context and the periods for context-switching, interrupt latency and deadline; Classification of processors' interrupt service mechanism from context-saving angle; Direct memory access; Device drivers programming.

5. Program Modeling Concepts, Processes, Threads, and Tasks

Program models; DFG models; State machine programming models for event controlled program flow; Modeling of multiprocessor systems.

Multiple processes in an application; Multiple threads in an application; Tasks and task states; Task and data; Distinctions between functions, ISRs and tasks.

6. Real-time Operating systems

Operating System services; Process management; Timer functions; Event functions; Memory management; Device, file and I/O sub-systems management; Interrupt routines in RTOS environment and handling of interrupt source calls.
Real-Time Operating Systems; Basic design using an RTOS; RTOS task scheduling models, interrupt latency and response times of the tasks as performance metrics; OS security issues.

7. Embedded Software Development, Tools

Introduction; Host and target machines; Linking and locating software; Getting embedded software in to the target system; Issues in hardware-software design and co-design; Testing on host machine; Simulators; Laboratory tools.

Text Books:

1. Rajkamal: Embedded Systems Architecture, Programming and Design, 2nd Edition, Tata McGraw Hill, 2008.

Reference Books:

1. Wayne Wolf: Computers as Components Principles of Embedded Computer System Design, Elsevier, 2005.
2. Tammy Noergaard: Embedded Systems Architecture, Elsevier, 2005.
3. Steve Heath: Embedded Systems Design, 2nd Edition, Elsevier, 2003.
4. Dr. K.V.K.K. Prasad: Embedded/Real-Time Systems: Concepts, Design and Programming – The Ultimate Reference", Dreamtech. Press, 2004.
5. Michael J.Point: Embedded C, Pearson Education, 2002.

OOAD & Design Patterns

Subject Code: 08SCS251	**I.A. Marks: 50**
Hours/Week: 4	**Exam Marks: 100**
Total Hours: 52	**Exam Hours: 3**

1. Introduction, Modeling Concepts

What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history.

Modeling as Design Technique: Modeling; abstraction; The three models.

2. Class Modeling

Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models.

Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages.

3. State Modeling

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.

4. Interaction Modeling

Interaction Modeling: Use case models; Sequence models; Activity models; Use case relationships; Procedural sequence models; Special constructs for activity models.

5. Process Overview, System Conception,

Process Overview: Development stages; Development life cycle.

System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.

6. Domain Analysis, Application Analysis

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

7. System Design

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

8. Class Design, Implementation Modeling

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example.

Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations.

9. Design Patterns

What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description.

Structural Decomposition: Whole-Part; Organization of Work: Master-Slave; Management : Command processor; View handler; Communication: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

Text Books:

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2006.

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson, 2007.
2. Mark Priestley: Practical Object-Oriented Design with UML, 2nd Edition, Tata McGraw-Hill, 2003.
3. K. Barclay, J. Savage: Object-Oriented Design with UML and JAVA, Elsevier, 2008.
4. Booch, G., Rumbaugh, J., and Jacobson, I.: The Unified Modeling Language User Guide, 2nd Edition, Pearson, 2005.
5. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns- Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
6. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 2002.

Artificial Intelligence

Subject Code: 08SCS252	**I.A. Marks: 50**
Hours/Week: 4	**Exam Marks: 100**
Total Hours: 52	**Exam Hours: 3**

1. Introduction

What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

2. Informed Search, Exploration, Constraint Satisfaction, Adversial Search

Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction problems; Backtracking search for CSPs. Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning.

3. Logical Agents

Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

4. First-Order Logic, Inference in First-Order Logic

Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting; Forward chaining; Backward chaining; Resolution.

5. Knowledge Representation

Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.

7. Planning

The planning problem; Planning with state-space approach; Planning graphs; Planning with propositional logic.

8. Uncertainty, Probabilistic Reasoning

Uncertainty: Acting under certainty; Inference using full joint distributions; Independence; Bayes' rule and its use; The Wumpus world revisted.

Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantics of Bayesian networks; Efficient representation of conditional distributions; Exact inference in Bayesian networks; Approximate inference in Bayesian Networks; Extending probability to first-order representations; Other approaches to Uncertain Reasoning.

9. Learning, AI: Present and Future

Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory.

AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.

Reference Books:

1. Elaine Rich, Kevin Knight: Artificial Intelligence, 2nd Edition, Tata McGraw Hill, 1991.
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.

Digital Signal Processing

Subject Code: 08SCS253	**I.A. Marks: 50**
Hours/Week: 4	**Exam Hours: 03**
Total Hours: 52	**Exam Marks: 100**

1. The Discrete Fourier Transform : Its Properties and Applications

Frequency Domain Sampling: The Discrete Fourier Transform: Frequency Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to other Transforms. Properties of the DFT: Periodicity, Linearity and Symmetry Properties, Multiplication of Two DFT's and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT.

2. Efficient Computation of the DFT: Fast Fourier Transform Algorithms

Efficient Computation of the DFT: FFT Algorithms : Direct Computation of the DFT, Divide-and-Conquer Approach to Computation of the DFT, Radix-2 FFT Algorithms, Radix-4 FFT Algorithms, Split-Radix FFT Algorithms, Implementation of FFT Algorithms.

Applications of FFT Algorithms: Efficient computation of the DFT of Two Real Sequences, Efficient computation of the DFT of a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear filtering and Correlation.

A Linear filtering approach to Computation of the DFT: The Goertzel Algorithm, The Chirp-Z Transform Algorithm.

Quantization Effects in the Computation of the DFT: Quantization Errors in the Direct Computation of the DFT, Quantization Errors in FFT Algorithms.

3. Implementation of Discrete-Time Systems

Structures for the Realization of Discrete-Time Systems.

Structures for FIR Systems: Direct-Form Structures, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.

Structures for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Lattice and Lattice-Ladder Structures for IIR Systems.

State-Space System Analysis and Structures: State-Space Descriptions of Systems Characterized by Difference Equations, Solution of the State-Space Equations, Relationships between Input-Output and State-Space Descriptions, State-Space Analysis in the Z-Domain, Additional State-Space Structures.

Representation of Numbers: Fixed-Point Representation of Numbers, Binary Floating-Point Representation of Numbers, Errors Resulting from Rounding and Truncation.

Quantization of Filter Coefficients: Analysis of Sensuitivity to Quantizatior of Filter Coefficients, Quantization of Coefficients in FIR Filters.

Round-Off Effects in Digital Filters: Limit-Cycle Oscillations in Recursive Systems, Scaling to Prevent Overflow, Statistical Characterization of Quantization effects in Fixed-Point Realizations of Digital Filters.

4. Design of Digital Filters

General Considerations: Causality and its Implications, Characteristics of Practical Frequency-Selective Filters.

Design of FIR Filters: Symmetric And Antisymetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method, Design of Optimum Equiripple Linear-Phase FIR Filters, Design of FIR Differentiators, Design of Hilbert Transformers, Comparison of Design Methods for Linear-Phase FIR filters.

Design of IIR Filters from Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, The Matched-Z Transformation, Characteristics of commonly used Analog Filters, Some examples of Digital Filters Designs based on the Bilinear Transformation.

Frequency Transformations: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.

Design of Digital Filters based on Least-Squares method: Padé Approximations method, Least-Square design methods, FIR least-Squares Inverse (Wiener) Filters, Design of IIR Filters in the Frequency domain.

Text Books:

1. John G. Proakis and Dimitris G. Manolakis: Digital Signal Processing, 3rd Edition, Pearson Education, 2003. (Chapters 5, 6, 7 and 8)

Reference Books:

1. Paulo S. R. Diniz, Eduardo A. B. da Silva And Sergio L. Netto: Digital Signal Processing: System Analysis and Design, Cambridge University Press, 2002.
2. Sanjit K. Mitra: Digital Signal Processing: A Computer Based Approach, Tata Mcgraw-Hill, 2001.
3. Alan V.Oppenheim and Ronald W.Schafer: Digital Signal Processing, Pearson Education, 2003.

SEMESTER III

Information and Network Security

Subject Code: 08SCS31	**IA Marks : 50**
Hrs/Week: 04	**Exam Hours: 03**
Total Hrs: 52	**Exam Marks:100**

1. **Introduction to Information Security**
   Introduction; What is security? Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology.

2. **Planning for Security**
   Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print

3. **Security Technology**
   Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections.
   Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices.

4. **Information Security maintenance**
   Introduction; Security Management Models; The Maintenance Model.

5. **Introduction to Network Security**
   Attacks , Services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs.

6. **Cryptography**
   Conventional Encryption Principles and Algorithms; Cipher Block Modes of Operation; Location of encryption devices; Key distribution; Approaches to message authentication; Secure Hash functions and HMAC; Public Key Cryptography Principles and Algorithms; Digital Signatures; Key management.

7. **Authentication Applications**
   Kerberos, X.509 Directory Authentication Service

8. **Electronic Mail Security**
   Pretty Good Privacy (PGP), S/MIME

9. **IP Security**
   IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.

10. **Web Security**
    Web security requirements, Secure Socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET)

11. **Network Management Security**
    Basic concepts of SNMP, SNMPv1 community facility, SNMPv3

Text Books:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Thomson, 2005.
2. William Stallings: Network Security Essentials Applications and Standards, Person Education, 2000.

Reference Books:

1. Behrouz A. Forouzan: Cryptography and Network Security, Tata McGraw-Hill, 2007.

Storage Area Networks

Sub Code: 08SCS321	**IA Marks: 50**
Hrs/Week: 04	**Exam Hours : 03**
Total Hrs: 52	**Exam Marks: 100**

1. **Introduction**
   Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks
   The Data Storage and Data Access problem; The Battle for size and access

2. **Intelligent Disk Subsystems**
   Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

3. **I/O Techniques**
   The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage

4. **Network Attached Storage**
   The NAS Architecture, The NAS hardware Architecture, The NAS Sotfware Architecture, Network connectivity, NAS as a storage system.

5. **File System and NAS**
   Local File Systems; Network file Systems and file servers; Shared Disk file systems;
   Comparison of fibre Channel and NAS.

6. **Storage Virtualization**
   Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network

7. **SAN Architecture and Hardware devices**
   Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

8. **Software Components of SAN**
   The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

9. **Management** Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Text Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2007
2. Robert Spalding: Storage Networks The Complete Reference, Tata McGraw-Hill, 2003.

Reference Books:

1. Richard Barker and Paul Massiglia: Storage Area Network Essentials A CompleteGuide to understanding and Implementing SANs, John Wiley India, 2002

Pattern Classification

Subject Code: 08SCS322	**I.A. Marks: 50**
Hours/Week: 4	**Exam Hours: 03**
Total Hours: 52	**Exam Marks: 100**

1. Introduction
Machine perception, Pattern Recognition Systems, The Design Cycle; Learning and Adaptation.

2. Bayesian Decision Theory
Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, Classification, Classifiers, Discriminant Functions, and Decision Surfaces; The Normal Density; Discriminant Functions for the Normal Density, Error Probabilities and Integrals, Error Bounds for Normal Densities, Bayes Decision Theory: Discrete Features.

3. Maximum-Likelihood and Bayesian Parameter Estimation
Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian Parameter Estimation: Gaussian Case, general theory; Sufficient Statistics; Problems of Dimensionality; Component Analysis and Discriminants.

4. Non-Parametric Techniques
Introduction; Density Estimation; Parzen Windows; k_n – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

5. Linear Discriminant Functions
Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

6. Stochastic Methods
Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

7. Unsupervised Learning and Clustering
Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Discrimination and Clustering; Criterion Functions for Clustering; Iterative Optimization; Hierrchical Clustring; The Problem of Validity; On-Line Clustering; Graph Theoritic Methods; Low-Dimensional Representation and Multi-Dimensional Scaling.

8. Introduction to Biometric Recognition
Biometric Methodologies: Finger Prints; Hand Geometry; Facial Recognition; Iris Scanning; Retina Scanning; Identification versus Verification; Performance Criteria.

Text Books:

1. Richard O. Duda, Peter E. Hart, and David G.Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.
2. K. Jain, R. Bolle, S. Pankanti: Biometrics: Personal Identification in Networked Society, Kluwer Academic, 1999.

Reference Books:

1. Earl Gose, Richard Johnsonbaugh, Steve Jost : Pattern Recognition and Image Analysis, Pearson Education, 2007.

Topics In Algorithms

Sub Code: 08SCS323	**IA Marks: 50**
Hours/Week: 4	**Exam Hours: 3**
Total Hours: 52	**Exam Marks: 100**

1. Analysis Techniques:
Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

2. Graph Algorithms
Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.

3. Polynomials and the FFT
Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

4. Number -Theoretic Algorithms
Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

5. String-Matching Algorithms
Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm Boyer – Moore algorithms.

6. Approximation Algorithms The vertex-cover problem; The traveling-sales-person problem; The set-covering problem; The subset-sum problem.

Text Books:
1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 2nd Edition, Prentice-Hall of India, 2002.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, University Press, 2007.
2. Alfred V. Aho,John E. Hopcroft, J.D.Ullman: The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974.

Mobile Computing

Subject Code: 08SCS331	**IA Marks : 50**
Hours/Week : 04	**Exam Hours: 03**
Total Hours: 52	**Exam Marks: 100**

1. Overview

Mobile communications; Mobile computing; Mobile computing architecture; Mobile devices; Mobile system networks; Data dissemination; Mobility management; Mobile phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices, Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.

2. GSM and Similar Architectures

GSM – Services and System Architectures, Radio Interfaces, Protocols, Localization, Calling, Handover, General Packet Radio Service, High-speed circuit-switched data, DECT.

3. Wireless Medium Access Control and CDMA – based Communication

Medium Access Control, Introduction to CDMA – based Systems, OFDM

4. Mobile IP Network Layer

IP and Mobile IP Network Layers Packet Delivery and Handover Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol.

5. Mobile Transport Layer

Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP – layer Transmission for Mobile Networks.

6. Databases

Database Hoarding Techniques, Data Caching, Client – Server Computing and Adaptation, Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service.

7. Data Dissemination and Broadcasting Systems

Communication Asymmetry, Classification of Data – Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques, Digital Audio Broadcasting, Digital video Broadcasting.

8. Data Synchronization in Mobile Computing Systems

Synchronization, Synchronization Protocols, SyncML – Synchronization Language for Mobile Computing, Synchronized Multimedia Markup Language (SMIL).

9. Mobile Devices, Server and Management

Mobile agent, Application Server, Gateways, Portals, Service Discovery, Device Management, Mobile File Systems, Security

10. Wireless LAN, Mobile Internet Connectivity and Personal Area Network

Wireless LAN (WiFi) Architecture and Protocol Layers, WAP 1.1 and WAP 2.0 Architectures, Bluetooth – enabled Devices Network, Zigbee.

11. Mobile Application languages – XML, Java, J2ME and JavaCard

Introduction, XML, JAVA, Java 2 Micro Edition (J2ME), JavaCard.

12. Mobile Operating Systems

Operating System, PalmOS, Windows CE, Symbian OS, Linux for Mobile Devices.

TEXT BOOK:

1. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007.

REFERENCES:

1. Asoke Talkukder, Roopa R Yavagal, “Mobile Computing – Technology, Applications and Service Creation”, Tata McGraw Hill, 2007
2. Reza B’Far, “Mobile Computing Principles – Designing and Developing Mobile Applications with UML and XML”, Cambridge University press, 5th Edition, 2006.
3. Uwe Hansmann, Lothat Merk, Martin S Nicklous and Thomas Stober, Principles of Mobile Computing”, Springer International Edition, Second Edition, 2005
4. Schiller, “Mobile Communication”, Pearson Publication, 2004.

Compiler Design

Subject Code: 08SCS332	**I.A. Marks : 50**
Hours/Week: 04	**Exam Hours: 03**
Total Hours : 52	**Exam Marks: 100**

1. Introduction

Language processors; The structure of a Compilers; The evolution of programming languages; The science of building a compiler; Applications of Compiler technology; Programming language basics;

2. Lexical Analysis

Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

3. Syntax Analysis

Introduction; Context-free Grammars; Writing a Grammar; Top-down Parsing.
Bottom-up Parsing; Introduction to LR Parsing: Simple LR.
More powerful LR parsers; Using ambiguous grammars; Parser Generators.

4. Syntax-Directed Translation

Syntax-Directed definitions; Evaluation order for SDDs; Applications of Syntax-directed translation; Syntax-directed translation schemes.

5. Intermediate Code Generation

Variants of syntax trees; Three-address code; Types and declarations; Translation of expressions; Type checking; Control flow; Back patching; Switch statements; Intermediate code for procedures.

6. Run-Time Environments

Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

7. Code Generation

Issues in the design of Code Generator; The Target language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator.

Text Books:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2007.

Reference Books:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997.
3. Kenneth C Louden: Compiler Construction Principles & Practice, Thomson Education, 1997.

Distributed Systems

Subject Code: 08SCS333	**IA Marks: 50**
Hours/Week: 04	**Exam Hours : 03**
Total Hours: 52	**Exam Marks : 100**

1. Characterization of Distributed Systems and System Models

Introduction, Examples of distributed systems, Resource sharing and the Web, Challenges, Architectural models, Fundamental models.

2. Networking and Internetworking

Types of Networks, Networks principles, Internet protocols, Network case studies(Ethernet, wireless LAN and ATM).

3. Interprocess Communication

Introduction, The API for the Internet protocols, External data representation and marshalling, Client -Server communication, Group communication, Case study: Interprocess communication in UNIX

4. Distributed Objects and Remote Invocation

Communication between distributed objects, Remote procedure call, events and notifications, JAVA RMI case study.

5. Operating System Support and Security

The Operating system layer, protection, processes and threads, communication and invocation , operating system architecture, overview of security techniques, cryptographic algorithms, digital signatures, cryptography pragmatics, case studies: Needham-Schroeder, Kerberos, SSL and Millicent.

6. Distributed File Systems

File service architecture, Sun Network file system, Andrew file system, Recent advances

7. Transactions and Concurrency Control

Transactions, nested transactions, locks, optimistic concurrency control, timestamp ordering, comparison of methods for concurrency control

8. Distributed Transactions

Flat and nested distributed transactions, atomic commit protocols, concurrency control in distributed transactions, distributed deadlocks, transaction recovery.

9. Distributed Shared Memory

Design and Implementation issues, sequential consistency and Ivy, Release consistency and Munin, other consistency models

10. CASE Studies

Corba , Mach

Text Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems, Concept and Design, 3rd edition, Pearson Education, 2005.