SCHEME OF EXAMINATION FOR M.TECH. (COMPUTER SCIENCE)								
Paper Code	**Nomenclature**		**Time (hrs)**	**External marks**		**Internal marks**		**Total**
				Max.	**Pass**	**Max.**	**Pass**	
First Semester								
MT-CS-110	Advanced Data Structure using C++		3	100	40	50	20	150
MT-CS-120	Visual Programming & Web Technology		3	100	40	50	20	150
MT-CS-130	Advances in Databases		3	100	40	50	20	150
MT-CS-140	Advanced Computer Architecture		3	100	40	50	20	150
MT-CS-150	S/W Lab – I		3	50	20	50	20	100
MT-CS-160	S/W Lab – II		3	50	20	50	20	100
MT-CS-170	Seminar		½			50	20	50
						Total Marks		850
Second Semester								
MT-CS-210	Object Oriented Analysis & Design using UML		3	100	40	50	20	150
MT-CS-220	Distributed Systems		3	100	40	50	20	150
MT-CS-230	Elective-I		3	100	40	50	20	150
MT-CS-240	Elective-II		3	100	40	50	20	150
MT-CS-250	S/W Lab – I		3	50	20	50	20	100
MT-CS-260	S/W Lab – II		3	50	20	50	20	100
MT-CS-270	Seminar		½			50	20	50
						Total Marks		850
Elective Papers								
MT-CS-230(i)	Software Testing		MT-CS-240(i)	Digital Image Processing				
MT-CS-230(ii)	Dependable Systems		MT-CS-240(ii)	Biometrics				
MT-CS-230(iii)	Software Quality Management		MT-CS-240(iii)	Security in Computing				
Third Semester								
MT-CS-310	Advanced Optimization & Simulation Techniques		3	100	40	50	20	150
MT-CS-320	High Performance Networks		3	100	40	50	20	150
MT-CS-330	Elective-I		3	100	40	50	20	150
MT-CS-340	Elective-II		3	100	40	50	20	150
MT-CS-350	S/W Lab – I		3	50	20	50	20	100
MT-CS-360	S/W Lab – II		3	50	20	50	20	100
MT-CS-370	Seminar		½			50	20	50
						Total Marks		850
Elective Papers								
MT-CS-330(i)	Advanced Microprocessors		MT-CS-340(i)	Soft Computing				
MT-CS-330(ii)	Embedded Systems		MT-CS-340(ii)	Genetic Algorithm				
MT-CS-330(iii)	Mobile Computing		MT-CS-340(iii)	Neural Network & Fuzzy Logic				
Fourth Semester								
MT-CS-410	Dissertation	Evaluation		200	80			200
		Presentation and Viva-Voce		150	60			150
		Internal Assessment				100	40	100
						Total Marks		450

Seminar

Each student shall individually prepare and submit a seminar report on a topic of current relevance on stipulated time. A panel consisting of two teachers (internal) should evaluate the seminar report and the presentation. Marks should be distributed considering report writing, presentation, technical content, depth of knowledge, brevity and references and their participation in seminar. The time allotted for presentation is 30 minutes.

Dissertation

The supervisor for dissertation should be allocated to the student in the very beginning of the second semester facilitating the identification of dissertation topic, reviews of literature, etc. The one external examiner will evaluate dissertation and viva-voce will be conducted jointly by external examiner and the internal examiner (i.e. supervisor of the student).

MT-CS-110 ADVANCED DATA STRUCTURES USING C++

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction to C++: Object-Oriented features of C++, Class and Objects, Static data members and member functions, Pointers, Dynamic memory allocation and de-allocation, constructors and destructors, Dynamic objects, Array of pointers to object, local and global class, Console I/O, Operator Overloading , Friend Function and Type Conversion , Inheritance, Virtual Functions, Generic Programming & Exception Handling, and File Handling . Searching (Linear Search, Binary Search, Heuristic Binary Search) and sorting (Selection Sort, Bubble Sort, Insertion Sort, Shell Sort, Merge Sort, Quick Sort, Radix Sort, Heap Sort) techniques in C++.

UNIT – II

Abstract Data Types, Stack: operations, implementation and applications, polish notation & inter-conversions, evaluation of postfix expression, Queue: operations implementations and applications, Dequeue and circular queue implementation and applications, Linear Linked List implementation and applications, Circular Linked List implementation and applications, Recursive and Doubly Linked List implementation and applications, Dynamic Implementation of Stack, Queue, Dequeue, Priority queues , and Binomial queue, Recursion and Backtracking, Applications of Recursion.

UNIT – III

Binary Search Trees operations, implementation and applications, recursive and non-recursive traversals, Binary threaded Trees implementation and traversal, Balanced Trees: node balanced and height balanced (AVL) trees implementation, Converting general trees into binary tree, Complete Binary tree, B-tree, m-ary tree, Random Search trees

UNIT – IV

Graphs and its representation in computers: Adjacency matrix based, incidence matrix based, adjacency lists, linked representation, depth first search (DFS) and Breadth first search (BFS) traversal, shortest paths algorithms: Bellman Ford , Dijkstra's and Warshall's algorithms, Spanning trees algorithms: Kruskal and Prim's algorithms, Hashing and collision handling techniques.

Text Books:

1. Robert Lafore, "Object Oriented Programming in C++", SAMS Publishing Company.
2. Bjarne Stroustrup, " The C++ Programming Lenguage", Addison Wesley Publication, New York.
3. Seymour Lipschutz, "DATA STRUCTURERS", Tata McGraw- Hill Publishing Company Limited, Schaum's Outlines, New Delhi..
4. Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, "DATA STRUCTURES USING C and C++", Prentice- Hall of India Private Ltd., New Delhi.
5. Michael T. Goodrich, Roberto Tamassia, David M. Mount, "Data Structures and Algorithms in C++", John Wiley Publications, New York.
6. Sahni Sartaj, " Data Structures , Algorithms and Applications in C++", WCB McGrraw Hill, New York.

Reference Books:

1. Herbert Schildt, "C++ - The Complete Reference", Tata McGraw-Hill publishing Company Limited, New Delhi.
2. John Berry, The Waite group,s C++ Programming , Addison-Wesley Longman Publishing Co., Inc. Boston, MA, USA..
3. N.S. Kutti and P.Y. Padhye ,"Data Structures in C++" ,Prentice Hall of India Pvt., Ltd., New Delhi
4. D.S.Malik, "Data Structure using C++", Course Technology -Thomson Carrer & Professional Group, Boston, MA , USA.
5. Trembley, J.P. And Sorenson P.G., "An Introduction to Data Structures with Applications", McGraw-Hill International Student Edition, New York.
6. Vic Broquard , "Advanced Data Structure in C++", Broquard e Books, 2008.

MT-CS-120 VISUAL PROGRAMMING & WEB TECHNOLOGY

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction to Visual Basic: VB IDE, An overview of VB project types, VB as event-driven & object-based language, Default controls in Tool Box

Programming with VB: Variables, Constants, Data types, Arithmetic operators, String Operations, Built-in function, I/O in VB, Branching & Looping statements, Procedures, Arrays, collection.

UNIT – II

Menus and Dialog Boxes: Adding menus and manipulating, using Common Dialog Box

Working with Forms: Working with multiple forms, MDI form, loading, showing and hiding forms, drag and drop operation

Advanced Controls in VB: Scroll Bar, Slider Control, TreeView, List View, RichText Box Control, Toolbar, Status Bar, Progress Bar, Cool bar, Image List, Tab Strip.

UNIT – III

Working with Graphics: Using Paint, Line, Circle, RGB and other related method, manipulating graphics.

Using modules & class modules in VB

ActiveX: Creating & using ActiveX Controls, Creating & using ActiveX Documents, ActiveX EXE, and ActiveX DLL

VB & Databases: The Data Controls and Data-Bound Controls, Using DAO, RDO, ADO.

UNIT – IV

Introduction to the Web: Internet and web protocols, an overview of HTML

Dynamic Web Pages: The need of dynamic web pages; an overview of DHTML, cascading style sheet, Active Web Pages: Need of active web pages

Web-Enabled Applications: Creating & using a Web-Browser, Programming E-Mail, Using the Internet Transfer Control, an introduction to IIS.

Text Books:

1. Visual Basic 6 Programming: Black Book By Steven Holzner dreamtech PRESS
2. Mastering Visual Baisc 6 By Evangelos Petroutsos BPB
3. Programming in Visual Basic 6.0 By Julia Case Bradley & Anita C. Millspaugh Tata McGraw-Hill Edition

Reference Books:

1. Step by Step Microsoft Visual Basic 6.0 Professional By Michael Halvorson PHI
2. Visual basic 6 Complete BPB
3. Teach Yourself Visual basic 6 By Scott Warner Tata McGraw-Hill Edition
4. Using Visual Basic 6 Special Edition By Brian Siler and Jeff Spotts PHI
5. Internet & World Wide Web How to Program, Pearson education, 3rd edition, by: H.M. Deitel, P.J. Deitel, A.B. Goldberg.

MT-CS-130 ADVANCES IN DATABASES

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction: Database system concepts, Three-level Schema Model, Data Independence, Relational model concepts, Relational Database Design: Dependencies, Normalization

UNIT – II

The Enhanced Entity-Relationship Model and Object-Oriented Database: The ER model revisited, EER model: Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization; Object Model**:** Overview of Object-Oriented concepts, Object identity, Object structure, Type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Complex objects

UNIT – III

Parallel and Distributed Databases and Client-Server Architecture: Architecture for parallel database; Distributed database concepts, Data fragmentation, Replication, and allocation techniques, Overview of Client-Server Architecture

UNIT – IV

Enhanced Data Models for Advanced Applications: Active database concepts, Temporal database concepts, Spatial databases, Deductive databases; Emerging Database Technologies: Mobile databases, Multimedia Databases, Geographic information systems (GIS); XML and Internet Databases: Structured, Semi-structured and Unstructured Data, Introduction to web databases and XML, Structure of XML data.

Text Books:

1. Elmasri and Navathe, Fundamentals of Database Systems [5e], Pearson Education.
2. Korth, Silberchatz, Sudarshan, Database System Concepts[5e], McGraw-Hill.

Reference Books:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Peter Rob and Coronel, Database Systems, Design, Implementation and Management, Thomson Learning.
3. C.J.Date, Longman, Introduction to Database Systems, Pearson Education
4. Thomas Connolly,Carolyn Begg, Database Systems, [3e], Pearson Education

MT-CS-140 ADVANCED COMPUTER ARCHITECTURE

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Parallel Computer Models: The state of computing, Classification of parallel computers, Evolution of computer architecture, System attributes to performance, Multiprocessors and Multicomputers, Multivector and SIMD computers.

Program and Network Properties: Conditions of Parallelism - data and resource dependences, Bernstein's conditions, hardware and software parallelism. Program partitioning and scheduling - grain sizes and latency, grain packing and scheduling. Program Flow Mechanisms - control flow versus data flow, data flow architecture, demand driven mechanisms, comparison of flow mechanisms.

UNIT – II

System Interconnect Architectures: Network properties and routing, Static interconnection Networks – Linear Array, Ring & Chordal Ring, Barrel Shifter, Fat Tree, Mesh & Torus, Systolic Arrays, Hypercubes, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced Processors: Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

UNIT – III

Pipelining and Superscalar Techniques: Linear pipeline processor – asynchronous and synchronous model, clocking and timing control, speedup, efficiency and throughput. Nonlinear Pipeline Processor – reservation and latency analysis, collision free scheduling; Instruction Pipeline Design – principles & mechanisms; dynamic instruction scheduling, branch handling techniques, branch prediction. Arithmetic Pipeline Design - computer arithmetic principles, static Arithmetic pipeline.

Memory Hierarchy Design: Inclusion, coherence & locality; memory capacity planning; Cache basics & cache performance, cache addressing models & mapping, multilevel cache hierarchies, interleaved memory.

UNIT – IV

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence problem, Snoopy cache coherence protocol, directory-based protocols, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization,

Multicomputer Architectures: Message passing mechanisms – message routing schemes, deadlock and virtual channels, flow control strategies, multicast routing algorithms.

Text Books:

1. Kai Hwang, "Advanced computer architecture"; TMH, 1993.
2. D.Sima, T.Fountain, P.Kasuk, "Advanced Computer Architecture-A Design space Approach," Addison Wesley, 1997.

Reference Books:

1. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing, 1998
2. D. A. Patterson and J. L. Hennessey, "Computer organization and design," Morgan Kaufmann, 2002.
3. J.P.Hayes, "Computer Architecture and Organization"; MGH, 1998.
4. Harvey G. Cragon, "Memory System and Pipelined processors"; Narosa Publication, 1998.
5. V.Rajaraman & C.S.R.Murthy, "Parallel computer: Architecture & Programming", PHI, 2004.
6. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, MGH, 2002
7. Kai Hwang and Zu, "Scalable Parallel computing"; MGH, 1998.

MT-CS-210 OBJECT ORIENTED ANALYSIS & DESIGN USING UML

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Overview of Object-Oriented Methodologies: Concepts - abstraction, encapsulation, object, class, methods, message passing, inheritance, polymorphism, genericity, overriding, abstract class & methods, concurrency, persistence of objects. Methodologies - Object Modeling Technique (OMT) – object model, dynamic model, functional model.

Modeling with UML: Modeling Concepts – Systems, Models & Views; Event Classes, Events & Messages; Object-Oriented Modeling; Falsification & Prototyping; UML Diagrams – Use case diagram, class diagram, interaction diagram, statechart diagram, activity diagram.

UNIT – II

Requirements Elicitation: Functional and non functional requirements; Greenfield, reengineering and interface engineering; Activities – Identifying actors, scenarios and use cases; relationships among actors and use cases; identifying initial analysis objects and non-functional requirements.

Analysis: Analysis Object Models and Dynamic Models; entity, boundary and control objects; generalization and specialization; Activities - identifying entity, boundary and control objects; mapping use cases to objects with sequence diagrams; modeling interaction among objects; identifying associations, aggregates and attributes; modeling state dependent behavior of individual objects; modeling inheritance relationships between objects.

UNIT – III

System Design: Concepts – Subsystems & Classes; Coupling & Cohesion; Layers & Partition; Architectural Styles; Activities – identifying design goals and subsystems.

Addressing Design Goals: UML Deployment Diagram; Activities – Mapping subsystems to processors; identifying and storing persistent data, providing access control, designing the global control flow; identifying boundary conditions; reviewing system design.

UNIT – IV

Reusing Pattern Solutions: Reuse Concepts – Application and Solution Objects, Specification and Implementation Inheritance, Delegation, Liskov Substitution principle; Design Patterns - Elements of a design pattern, Reuse Activities - Selecting Design Patterns and Components –Heuristics for selecting Design Patterns; Identifying and Adjusting Application Frameworks.

Specifying Interfaces: Concepts - Class Implementer, Class Extender & Class User; Types, Signature & Visibility; Invariants, Preconditions & Post conditions; Object Constraint Language (OCL); OCL Collections; OCL Qualifiers; Identifying missing attributes and operations; Specifying type signatures, visibility, preconditions, post conditions & invariants; Inheriting contracts.

Text Books:

1. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Pearson Education, 2004
2. M. Blaha, J. Rumbaugh, Object-Oriented Modeling and Design with UML, Pearson Education-2007

Reference Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Pearson education, 2007
2. Satzinger, Jackson, Burd, Object-Oriented Analysis & Design with the Unified Process, Thomson-2007
3. Grady Booch, Object Oriented Analysis & Design, Addison Wesley-1994
4. Timothy C. Lethbridge, Robert Laganiere, Object Oriented Software Engineering, (Tata McGraw-Hill), 2004

MT-CS-220 DISTRIBUTED SYSTEMS

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction to Distributed Systems; Examples of Distributed Systems; Resource sharing and the Web; Challenges;

System Models: Introduction; Architectural models- Software layers, Client-server model, multiple servers, proxy servers and caches, peer processes; Variations on the client-server model; Design requirements for distributed architectures; Fundamental models- interaction model, failure model, security model;

UNIT – II

Networking and Internetworking: Introduction; Networking issues for Distributed systems; Types of Networks; Network principles- packet transmission, data streaming, switching schemes, protocols, ports, addressing, packet assembly and delivery, Routing, Congestion control, internetworking; TCP/IP architecture.

Interprocess communication: Introduction; The API for the Internet protocols, sockets, UDP datagram communication, TCP stream communication; Client-server communication

UNIT – III

Distributed Object Model: Introduction; Communication between distributed objects; Remote procedure call;

Security: Introduction; Overview of security techniques; Cryptographic algorithms; Digital signatures; certificates, firewalls; Case studies: Needham-Schroeder, Kerberos, SSL;

Distributed file systems: Introduction; Characteristics of file systems; Distributed file system requirements; File service architecture;

UNIT – IV

Name Services: Introduction; Domain name system, Name spaces, Name resolution, Caching, DNS queries, DNS name servers, DNS resource records;

Transactions and concurrency control: Introduction; Transactions, Concurrency control; Nested transactions; Locks, deadlocks; Timestamp ordering;

Introduction to distributed transactions; Flat and nested distributed transactions; Introduction to Replication; System model and group communication;

Text Book:

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems-Concepts and Design", Pearson Education

Reference Books:

1. Andrew S. Tanenbaum, Marten Van Steen, "Distributed Systems-Principles & Paradigms", Pearson Education.
2. S Mullender, "Distributed Systems", Addison Wesley.
3. Vijay K. Garg, "Elements of Distributed Computing", Wiley.
4. Behrouz A. Forouzan, "Data Communications and Networking", McGraw Hill.

MT-CS-230 (i) SOFTWARE TESTING

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Software testing principles: Need for testing, Psychology of testing, Testing economics, White box, Black box, Grey box testing – Software Development Life Cycle (SDLC) and Testing, Software Verification & Validation, Weyuker's adequacy axioms.

UNIT – II

Testing strategies: White box testing techniques: Control Flow based testing - Statement coverage, Branch Coverage, Path Coverage; Data flow based testing, Mutation testing, Automated code coverage analysis, Black box testing techniques: Boundary value analysis, Robustness testing, Equivalence partitioning, Cause-effect graphing, Syntax testing - Finite state testing; Levels of testing - Unit, Integration and System Testing; Acceptance testing: α, β, and γ testing.

UNIT – III

Testing object oriented software: Challenges, Differences from testing non-Object Oriented Software, Class testing strategies, Class Modality, State-based Testing, Message Sequence Specification.

Testability and related issues: Design for Testability - Observability & Controllability - Built-in Test - Design by Contract - Precondition, Post condition and Invariant - Impact on inheritance - Applying in the real world Regression Testing - Challenges – test optimization

UNIT – IV

Miscellaneous topics: Automated Tools for Testing - Static code analyzers, Test case generators, GUI Capture/Playback, Stress Testing, Testing Client-server applications, Testing compilers and language processors, Testing web-enabled applications, Ad hoc testing: Buddy testing, pair testing, Exploratory testing, Agile and extreme testing,

Text Books:

1. Glenford J.Myers, "The Art of Software Testing", 2/e, John Wiley & Sons, 2004.
2. Mathur P Aditya, Foundations of Software Testing, Pearson Education, 2008
3. D. Srinivasan & R. Gopalaswamy, Software Testing – Principles & Practices, Pearson Education, 2006.

Reference Books:

4. Robert V.Binder, "Testing Object-Oriented Systems: Models Patterns and Tools", Addison Wesley, 2000.
5. Patton Ron, Software Testing, 2/e, Pearson education, 2004.
6. Limaye G. M., Software Testing – Principles, Techniques, and Tools, Tata McGraw Hill, 2009.
7. Boris Beizer, Black-Box Testing: "Techniques for Functional Testing of Software and Systems", John Wiley & Sons, 1995.
8. P.C.Jorgensen, "Software Testing - A Craftman's Approach", CRC Press, 1995.
9. William E.Perry, "Effective Methods for Software Testing (2nd Edition)", John Wiley & Sons, 2000.
10. Boris Beizer, "Software Testing Techniques (2nd Edition)", Van Nostrand Reinhold, 1990.

MT-CS-230 (ii) DEPENDABLE SYSTEMS

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

System structure and reliability: Fault prevention and fault tolerance-Anticipated and unanticipated faults - Software / Hardware introduction- Interpreters and multilevel systems - Atomic actions - System Specification - Erroneous transition and states - Component and Design Failures - Errors and faults.

UNIT – II

Fault tolerance: Principles-Redundancy-Exception and exception handling - System Design-Software Implemented Fault Tolerance (SIFT) and Fault Tolerant Multiprocessor (FTMP) design Strategies.

UNIT – III

Error detection: Measures and mechanisms - Structuring error detections - Damage confinement and Assessment, protections - protection in multilevel systems.

UNIT – IV

Error recovery: State restoration - Forward and Backward error recovery checkpoints and audit trails - Recovery cache - Recovery in concurrent systems - Fault treatment - Fault location - System repair.

Software fault tolerance: Recovery block schemes - Acceptance tests - N Version programming - Software reliability and analysis.

Reference Books:

1. Kohlas, Jürg; Meyer, Bertrand; Schiper, André, Dependable Systems: Software, Computing, Networks, ISBN: 978-3-540-36821-2, Springer 2006.
2. Jean-claude Geffroy, Gilles Motet, J. C. Geffroy, Design of Dependable Computing Systems, Springer 2002.
3. Anderson and PA Lee, "Fault Tolerance Principles Practice", PHI, 1981.
4. Pradhan D.E. (Ed.), "Fault Tolerant Computing - Theory and Techniques", Vol.I and II, Prentice Hall, 1986.

MT-CS-230(iii) SOFTWARE QUALITY MANAGEMENT

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Concepts and Overview: Concepts of Software Quality, Quality Attributes, Software Quality Control and Software Quality Assurance, Evolution of SQA, Major SQA activities, Major SQA issues, Zero defect Software.

Software Quality Assurance: The Philosophy of Assurance, The Meaning of Quality, The Relationship of Assurance to the Software Life-Cycle, SQA Techniques.

UNIT – II

Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.

Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations.

Configuration Management: Maintaining Product Integrity, Components, configuration items, Change Management, Version Control, Configuration accounting.

UNIT – III

Defect Analysis: Analysis concepts, Identification of Defect, Analysis of Defect, reporting, Defect, repair, Implementation of Correction, Regression Testing, Classification of Defect.

Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.

UNIT – IV

Corrective Action: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the corrective Action, Periodic Review of Actions Taken, Traceability, Records, Software Quality Program Planning,

Social Factors: Accuracy, Authority, Benefit, Communication, Consistency, and Retaliation

Text Books:

1. John W. Horch, Practical Guide to Software Quality Management, Artech house publisher, 2003.
2. Robert Dunn, Software Quality Concepts and Plans, Prentice-Hall, 1990.
3. Alan Gillies, Software Quality, Theory and Management, Chapman and Hall, 1992.

Reference Books:

1. Tom Gilb, Principles of Software Engineering Management, Addison-Wesley, 1988.
2. Michael Dyer, The Cleanroom approach to Quality Software Engineering, Wiley & Sons, 1992.
3. Daniel Freedman, Gerald Weinberg, Handbook of Walkthroughs, Inspections and Technical Reviews, Dorset House Publishing, 1990.
4. Tom Gilb, Dorothy Graham, Software Inspection, Addison-Wesley, 1993.
5. Watts Humphrey, Managing the Software Process, Addison-Wesley, 1990.
6. Watts Humphrey, A Discipline for Software Engineering, Addison-Wesley, 1995.
7. Arthur Lowell, Improving Software Quality an Insiders guide to TQM, 1993, John Wiley & Sons.

MT-CS-240(i) DIGITAL IMAGE PROCESSING

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction to Digital Image Processing and its origins; Example fields using digital image processing; Fundamental steps in digital image processing; Components of an Image Processing system; Image sampling and Quantization; Relationships between pixels; Mathematical tools used in image processing;

UNIT – II

Image Enhancement: Intensity transformations and spatial filtering; Histogram processing; Fundamentals of spatial filtering; Smoothing and sharpening spatial filters; Filtering in frequency domain: Fourier Series and Transform; Sampling; Fourier Transform of Sampled Functions; Discrete Fourier Transform; Frequency Domain Filtering Fundamentals; Image smoothing and sharpening using Frequency Domain Filters; Homomorphic Filtering;

UNIT – III

Image Restoration: Model of Image Degradation/Restoration process; Noise models; Linear, Inverse filtering; Mean Square Error Restoration; Least Square Restoration; Singular value Decomposition;

Image Compression Fundamentals: Lossless and Lossy Compression; Basic Compression Methods: Huffman Coding; Run-Length Coding; LZW Coding; Bit-Plane Coding; Predictive Coding; Transform Coding; Wavelet Coding;

UNIT – IV

Image Segmentation: Fundamentals; Point, Line, and Edge Detection; Thresholding; Region-Based Segmentation; Motion-Based Segmentation;

Image Representation: Boundary Representation; Chain Codes; Polygonal Approximations; Signatures; Boundary Segments; Skeletons; Boundary Descriptors: Simple Descriptors; Shape Numbers; Fourier Descriptors; Regional Descriptors;; Topological Descriptors; Texture;

Text Book:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, PHI.

Reference Books:

1. William K. Pratt, Digital Image Processing, John Wiley &Sons.
2. B.Chanda, D. Dutta Majumder, Digital Image Processing and Analysis, PHI.
3. A.K. Jain, Fundamental of Digital Image Processing, PHI.
4. Millman Sonka, Vaclav Hlavac, Image Processing Analysis and Machine vision, Thompson Learning.

MT-CS- 240 (ii) BIOMETRICS

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Biometrics technology evolution, verification and identification, introduction to Biometrics, Fingerprint Recognition, Face Recognition, Iris Recognition, Hand Geometry Recognition, Gait Recognition, Voice Biometrics, On-Line Signature Verification, Face Recognition, comparison of various biometrics, biometric system errors, biometric deformations.

UNIT – II

False match rate, false non-match rate, biometric applications, biometric sensor interoperability, user psychology in biometric enrollment, Multi-biometrics and multimodal biometrics, Multi-spectral Face Recognition.

UNIT – III

Attacks against Biometric Systems, Biometric Cryptography, Fusion in biometrics, Liveness detection in biometrics, Fingerprint identification technology, scope of fingerprint biometric systems, how to improve the privacy and security of fingerprint biometric system. SFING (synthetic fingerprint generator).

UNIT – IV

Soft-biometric, Incorporating Ancillary Information in biometric Systems. Biometric System Security, Spoof Detection Schemes, Biometrics in Government Sector, Biometrics in the Commercial Sector, Biometric Standards, Biometrics Databases.

Text Books:

1. Davide Maltoni, Dario Maio, Anil K.Jain, and Salil Prabhakar, Handbook of Fingerprint Recognition, Springer.
2. Arun A. Ross, Karthik Nandakumar, and Anil K.Jain, Handbook of Multibiometrics (International Series on Biometrics), Springer.

Reference Books:

1. Anil K. Jain, Biometric Technology for Human Identification II (Proceedings of SPIE).
2. Anil K.Jain, Patrick Flynn, Arun A. Ross, Handbook of Biometrics, ISBN: 978-0-387-71040-2.
3. John Chirillo and, Scott Blaul, Implementing Biometric Security (Wiley Red Books).
4. Julian Ashbourn, Practical Biometrics: From Aspiration to Implementation, Springer Professional Computing.

MT-CS-240 (iii) SECURITY IN COMPUTING

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Computer security: Goal, Vulnerabilities, threats, attacks, and controls; Cryptography: Terminology and Background, Substitution Ciphers, Transpositions, Cryptanalysis, Data Encryption Standard, DES & AES Algorithms and comparison, Public Key Encryption

Program Security: Secure Programs, Non-malicious Program Errors, Viruses and Other Malicious Code, Controls against Program Threats

UNIT – II

Protection in General-Purpose Operating Systems: Security Methods of Operating Systems, Memory and Address Protection, Control of Access to General Objects, File Protection Mechanisms, User Authentication, Designing Trusted Operating Systems: Security Policies, Models of Security

UNIT – III

Database and Data Mining Security: Security Requirements, Reliability and Integrity, Sensitive data, Monitors, Multilevel Databases -Security Issues, Data Mining - Privacy and Sensitivity, Data Correctness and Integrity

UNIT – IV

Security in Networks: Threats in networks, Network security controls, Firewalls – design and types, Intrusion detection systems, security for email,

Legal and Ethical Issues in Computer Security: Copyrights, Patents, Trade Secrets, Information and the Law, Computer Crime

Text Books:

1. Charles. P. Pfleeger & Shari Lawrence Pfleeger, Security in Computing, fourth edition, Prentice Hall, 2006.

Reference Books:

1. William Stallings, Network Security Essentials, Applications and Standards, 3rd edition, Pearson Education, 2007.
2. William Stallings, Cryptography and Network Security Principles and practice. 4/e, Prentice Hall, 2006.
3. Michael. E. Whitman and Herbert J. Mattord, Principles of Information Security, Course Technology, 2002.

MT-CS- 310 ADVANCED OPTIMIZATION & SIMULATION TECHNIQUES

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its Algorithm, Two-phase Simplex method.
Duality: General Rules for converting any Primal into its Dual, Dual Simplex method.
Assignment models: Mathematical formulation of Assignment Problem, Hungarian algorithm for Assignment problems, Unbalanced Assignment problems.

UNIT – II

Integer Programming: Importance, Need and importance of Integer Programming, Gomory's All Integer Programming Problem technique and its algorithm.
CPM/PERT: Applications of CPM/PERT techniques, Network Diagram representation and rules for drawing Network Diagram, Time Estimation and Critical Path in Network Analysis.

UNIT – III

Modeling & Simulation Concepts: System Concepts**,** What is a Model?, Type of Models, Modeling & Simulation, Continuous vs. Discrete System Simulation, Numerical Integration vs. Continuous Simulation, Analog vs. Digital Simulation, Simulation vs. Monte- Carlo Simulation, Nature of Computer Modeling and Simulation, When to Use Simulation?, Limitations of Simulation, Validation**,** and Simulation Languages.
Random Numbers**:** Pseudo-random generators, Testing of Pseudo-random number generators, Generation of non-uniformly distributed random numbers.

UNIT – IV

Simulation Experiments: Run length of Static and Dynamic Stochastic Simulation Experiments, Minimizing variability in simulators without increasing Number of simulation Runs.
Design of Application Simulators – for Multi-server Queuing System, PERT, Optimizing Inventory Policy and Cost in Business environment.

Text Books:

1. Sharma, S.D., Operations Research, Kedar Nath and Ram Nath, Meerut.
2. Nar Singh Deo, "System Simulation with Digital computer", PHI, New Delhi.

Reference Books:

1. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York.
2. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.
3. Kanti Swarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi.
4. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi.
5. Gordon G., "System Simulation", PHI, New Delhi.
6. Payne James A. , " Introduction to Simulation : Programming Techniques and Methods of Analysis, McGraw Hill International Editions, Computer Science services, New York.
7. Jerry Banks, John S Carson II, Barry L Nelson and David M Nicol, Discrete Event Simulation, Pearson Education Asia, New Delhi.
8. Francis Neelamkavil, "Computer Modeling and Simulation", John Wiley & Sons, New York.

MT-CS- 320 HIGH PERFORMANCE NETWORKS

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

The Motivation for Internetworking; Need for Speed and Quality of Service; History of Networking and Internet; Advanced TCP/IP and ATM Networks; Internet Services; Internet Architecture; Interconnection through IP Routers; Standards; TCP Services; TCP format and connection management; Encapsulation in IP; UDP Services, Format and Encapsulation in IP; IP Services; Header format and addressing; Fragmentation and reassembly; classless and subnet address extensions; subnetting and supernetting; CIDR; IPv6;

UNIT – II

Congestion Control and Quality of Service: Data traffic; Network performance; Effects of Congestion; Congestion Control; Congestion control in TCP and Frame Relay; Link-Level Flow and Error Control; TCP flow control;

Quality of Service: Flow Characterstics, Flow Classes; Techniques to improve QoS; Traffic Engineering; Integrated Services; Differentiated Services; QoS in Frame Relay and ATM;

Protocols for QoS Support: Resource Reservation-RSVP; Multiprotocol Label Switching; Real-Time Transport Protocol;

UNIT – III

High Speed Networks: Packet Switching Networks; Frame Relay Networks; Asynchronous Transfer Mode (ATM); ATM protocol Architecture; ATM logical connections; ATM cells; ATM Service categories; ATM Adaptation Layer;

Optical Networks: SONET networks; SONET architecture;

High-Speed LANs: The Emergence of High-Speed LANs; Bridged and Switched Ethernet; Fast Ethernet; Gigabit Ethernet; Wireless LANs: IEEE 802.11, Bluetooth;

Connecting LANs: Devices, Backbone networks, Virtual LANs;

Wireless WANs: Cellular Telephony; Generations; Cellular Technologies in different generations; Satellite Networks;

UNIT – IV

Internet Routing: Interior and Exterior gateway Routing Protocols; Routers and core routers; RIP; OSPF; BGP; IDRP; Multicasting; IGMP; MOSPF; Routing in Ad Hoc Networks;

Routing in ATM: Private Network-Network Interface;

Private Network Interconnection: Private and Hybrid Networks; Virtual Private Network;

Error and Control Messages: ICMP; Error reporting vs Error Correction; ICMP message format and Delivery; Types of messages;

Address Resolution (ARP); BOOTP; DHCP; Remote Logging; File Transfer and Access; Network Management and SNMP; Comparison of SMTP and HTTP; Proxy Server; The Socket Interface;

Text Books:

1. William Stallings, "High-Speed Networks and Internets, Performance and Quality of Service", Pearson Education;
2. Douglas E. Comer, "Internetworking with TCP/IP Volume – I, Principles, Protocols, and Architectures", Fourth Edition, Pearson Education.

Reference Books:

1. B. Muthukumaran, "Introduction to High Performance Networks", Vijay Nicole Imprints.
2. Wayne Tomasi, "Introduction to Data Communications and Networking", Pearson Education.
3. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Pearson Education.
4. Andrew S. Tanenbaum, "Computer Networks", Pearson Education.
5. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, McGraw Hill.
6. Mahbub Hassan, Raj Jain, "High Performance TCP/IP Networking, Concepts, Issues, and Solutions", Pearson Education.

MT-CS-330 (i) ADVANCED MICROPROCESSORS

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Microprocessor & Its Architecture: Internal microprocessor architecture, real mode memory addressing, protected mode memory addressing, memory paging, flat mode memory.
Addressing Modes: Data addressing modes, program memory addressing modes, stack memory addressing modes.

UNIT – II

Memory Interface: Memory devices, address decoding, Pentium through Core2 (64-bit) memory interface, Dynamic RAM, EDO Memory, SDRAM, DDR, DRAM controllers.
Basic I/O Interface: I/O interface, I/O port address decoding, Programmable peripheral interface, 8254 programmable interval timer, 16550 programmable communications interface.

UNIT – III

Interrupts: Basic interrupts processing, hardware interrupts, expanding the interrupt structures, 8259A programmable interrupt controller.
Bus Interface: ISA bus, PCI bus, parallel printer interface, serial COM ports, USB, Accelerated Graphics Port (AGP).

UNIT – IV

Pentium & Pentium Pro Microprocessors: Pentium processor, special Pentium registers, Pentium memory management, new Pentium instructions, Pentium Pro microprocessor, special Pentium Pro features.
Pentium IV & Core2 Microprocessors: Memory interface, register set, hyper threading technology, multiple core technology, CPUID, model specific registers, performance monitoring registers, 64-bit extension technology.

Text Book:

1. Barry B. Brey, The Intel Microprocessors, Architecture, Programming and Interfacing, 8th Edition, Pearson Education, 2009.

Reference Books:

1. Daniel Tabak, Advanced Microprocessors, McGrawHill, 1995.
2. Rfiquzzaman, Microprocessors – Theory and Applications (Intel & Motorola), PHI, rev. edition.

MT-CS-330 (ii) EMBEDDED SYSTEMS

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Embedded Computing: Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Formalisms for System Design, Design Examples

The 8051 Architecture : Introduction, 8051 Micro controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

UNIT – II

Basic Assembly Language Programming Concepts: The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051.

Data Transfer and Logical Instructions.

Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Further Details on Interrupts.

UNIT – III

Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

Introduction to Real – Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

UNIT – IV

Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real- Time Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source); Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

Introduction to advanced architectures: ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

Text Books:

1. Wayne Wolf, Computers and Components, 2/e, Elseveir India Private Limited.
2. Kenneth J.Ayala, The 8051 Microcontroller, Third Edition, Thomson, 2004.
3. David E. Simon, An Embedded Software Primer, Pearson Education.

Reference Books:

1. Embedding system building blocks, Labrosse, via CMP publishers.
2. Raj Kamal, Embedded Systems, Tata McGraw Hill, 2003.
3. Ajay V Deshmukhi, Micro Controllers, Tata McGraw Hill.
4. Frank Vahid, Tony Givargis, Embedded System Design, John Wiley.
5. Raj Kamal, Microcontrollers, Pearson Education.

MT-CS-330 (iii) MOBILE COMPUTING

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Overview of Mobile Computing and its applications; Radio Communication; Mobile Computing Architecture; Mobile System Networks; Data Dissemination; Mobility Management;

Introduction to Cellular network: components, Architecture, Call set-up, Frequency Reuse and Co-channel cell, Cell Design, Interference, Channel assignment, Hand Off;

UNIT – II

Cellular Network Standards; Digital cellular communication; Multiple Access Techniques: FDMA, TDMA, CDMA;

GSM: System Architecture, Mobile services & features, Protocols, Radio interface, Handover, GSM Channels, Localization and calling, User validation; General Packet Radio Service;

Introduction to CDMA based systems; Spread spectrum in CDMA systems; coding methods in CDMA; IS-95;

UNIT – III

Wireless LAN: Wireless LAN (WiFi) Architecture and protocol layers;

WAP Architecture;

Bluetooth Architecture: Layers, Security in Bluetooth;

UNIT – IV

Mobile Ad-hoc and Sensor Networks: Introduction, MANET, Routing in MANET's Wireless Sensor Networks, Applications;

Mobile Devices: Mobile Agent, Application Server, Gateways, Portals, Service Discovery, Device Management, Mobile File Systems;

Mobile IP: Architecture, Packet delivery and Hand over Management, Location Management, Registration, Tunnelling and Encapsulation, Route optimization, DHCP.

Mobile Transport Layer: Conventional TCP/IP transport protocols, Indirect TCP, Snooping TCP, Mobile TCP

Text Books:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2004.
2. Raj Kamal, "Mobile Computing", Oxford Higher Education, 2008.

Reference Books:

1. Sipra DasBit, Biplab K. Sikdar, "Mobile Computing", PHI, 2009.
2. William C.Y.Lee, "Mobile Cellular Telecommunications", Second Edition, (Tata McGraw-Hill), 2006.
3. Theodore S. Rapparort, "Wireless Communications- Principles and Practice", Second Edition, Pearson Education, 2002.
4. Stomenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
5. W. Stallings, "Wireless Communications and Networks", Pearson Education, 2002.
6. Uwe Hansmann, Lothar Merk, Martin S. Nicklons, Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
7. Hazysztof Wesolowshi, "Mobile Communication Systems", John Wiley and Sons, 2002.

MT-CS-340 (i) SOFT COMPUTING

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Basic concepts of neuro-computing: Artificial Neural Network (ANN) and their biological roots and motivations, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Applications of Artificial Neural Networks, Competitive learning networks, Kohonen self organizing networks, Hebbian learning; Hopfield Networks, Associative Memories, The boltzman machine; Applications.

UNIT – II

Introduction to Fuzzy Logic: Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic.

UNIT – III

Genetic algorithms(GA), Evolution strategies(Ess), Evolutionary programming(EP), Genetic Programming(GP), Selecting, crossover, mutation, schema analysis, analysis of selection algorithms; convergence; Markov & other stochastic models.

Introduction to Genetic Algorithms: Robustness of traditional optimization and search methods, The Goals of optimization, Difference between GA and traditional methods, A simple genetic algorithm, Important Similarities, Similarity Templates (Schemata), Encodings.

UNIT – IV

Random Optimization, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Memetic Algorithms.

Text Books:

1. S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India, 2007.

Reference Books:

1. Jang, Sun, Mizutani, Neuro-Fuzzy and Soft computing, Pearson.
2. Haykin, Neural networks: a comprehensive foundation, Pearson.
3. Mitchell M., An Introduction to Genetic Algorithms, Prentice-Hall, 1998.
4. Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
5. Klir G.J. & Yuan B., Fuzzy Sets & Fuzzy Logic, PHI.

MT-CS-340 (ii) GENETIC ALGORITHM

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Introduction: Goal of optimization, local and global optima, Multi-objective optimization, Problems in global optimization like premature convergence to a local optimum, overfitting etc, A brief history of evolutionary computation, The appeal of evolution, Biological terminology, Search spaces and fitness landscapes, Conventional Optimization and Search Techniques - Gradient-Based Local Optimization Method, Random Search, Stochastic Hill Climbing, Simulated Annealing etc.

UNIT – II

Genetic algorithms(GA), Evolution strategies(Ess), Difference between Genetic Algorithm and traditional methods, Selection – elitism, rank selection, tournament selection, Boltzmann selection, steady state selection etc.; Crossover, mutation; Schema theorem – schemata and masks, Wildcards, Holland's schema theorem and criticism; convergence.

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UNIT – III

Computer Implementation of Genetic Algorithm: Data Structures, Reproduction, Crossover, and mutation, Mapping objective functions to fitness form, Fitness scaling, Different types of encodings - Binary Encoding, Octal Encoding, Hexadecimal Encoding, Permutation Encoding, Value Encoding, Tree Encoding etc.

UNIT – IV

Advanced operators and techniques in Genetic Search: Dominance, Diploidy, and Abeyance, Inversion and other reordering operators like partially matched crossover, order crossover and cycle crossover, Niche and speciations, Micro-operators, Knowledge based techniques, Genetic algorithm and parallel processors.
Classification of Genetic Algorithm: Simple Genetic Algorithm(SGA), Parallel and Distributed Genetic Algorithm (PGA and DGA), Hybrid Genetic Algorithm (HGA), Adaptive Genetic Algorithm(AGA), Fast Messy Genetic Algorithm (FmGA), Independent Sampling Genetic Algorithm(ISGA).

Text Books:

1. Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley.
2. Sivanandam S. N. & Deepa S. N., Introduction to Genetic Algorithms, Springer.

Reference Books:

1. Mitchell M., An Introduction to Genetic Algorithms, Prentice-Hall.
2. Weise Thomas, Global Optimization Algorithms – Theory and Application, http://www.it-weise.de/ projects/book.pdf.

MT-CS-340 (iii) NEURAL NETWORKS AND FUZZY LOGIC

Maximum marks: 150 (**External:** 100, **Internal:** 50) **Time:** 3 hours

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of total 7 parts (objective type/short-answer type questions) covering the entire syllabus and will carry 28 marks. In addition to the compulsory question there will be four units i.e. Unit-I to Unit-IV. Examiner will set two questions from each Unit of the syllabus and each question will carry 18 marks. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

UNIT – I

Fundamentals of ANN, Biological prototype, Neural Network Concepts, Definitions – Activation, Functions, single layer and multilayer networks, Training ANNs, perceptrons, Exclusive OR problem, Linear seperability, storage efficiency, perceptron learning - perceptron training algorithms, Hebbian learning rule - Delta rule, Kohonen learning law, problem with the perceptron training algorithm.

Back propagation neural network, Training algorithm, network configurations, Back propagation error surfaces, Back propagation learning laws, Network paralysis - Local minima, and temporal instability

UNIT – II

Counter propagation Networks, Kohonen layer, Training the Kohonen layer, preprocessing the input vectors, initializing the weight vectors.

Statistical properties, Training the Grossberg layer- Feed forward counter propagation Neural Networks, Applications.

Statistical methods simulated annealing, Bloltzman Training, Cauchy training - artificial specific heat methods, Application to general non-linear optimization problems, back propagation and cauchy training.

Hopfield network

UNIT – III

Fuzzy Logic: Classical and Fuzzy Sets, Overview of Classical Sets, Membership Function, a-cuts, Properties of a-cuts, Decomposition Theorems, Extension Principle, fuzzy operations, fuzziness in neural networks, neural trained fuzzy system, Bidirectional Associative Memory (BAM), Fuzzy Associative Memory (FAM), Operations on Fuzzy Sets: Complement, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT – IV

Fuzzy Relations: Crisp & Fuzzy Relations, Projections & Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations.

Possibility Theory: Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory.

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information: Information & Uncertainty, Non-specificity of Fuzzy & Crisp sets, Fuzziness of Fuzzy Sets.

Text Books:

1. Rao, Vallinu B.,and Rao, Hayagriva . Neural networks and fuzzy Logic, second edition, BPB Publication
2. Anderson J.A., An Introduction to Neural Networks, PHI.
3. G.J.Klir & B.Yuan, Fuzzy sets & Fuzzy logic, PHI.

Reference Books:

1. James A. Freeman and David M. Skapura, Neural Network Algorithms, Application and Programming Techniques, Addison – Wesley publishing company.
2. Freeman A. James, Skapura M. David, Neural networks algorithms, applications and programming Techniques, Pearson Education.
3. Philip D. Wasserman, Neural Computing – Theory and Practice, Van Nostrand and Reinhold,
4. Haykin S., Neural Networks-A Comprehensive Foundations, PHI, 1999.
5. Patterson D.W., Artificial Neural Networks: Theory and Applications, Prentice Hall, Singapore, 1995.
6. G.J.Klir & T.A. Folyger, Fuzzy Sets, Uncertainty & Information, PHI, 1988.
7. Kumar Satish, Neural Networks, Tata McGraw Hill, 2004.