MANGALORE UNIVERSITY

Scheme of Examination and Syllabus for

Master of Science (Computer Science) Degree

Choice Based Credit System(CBCS)
(2011-12 onwards)

DEPARTMENT OF POST-GRADUATE STUDIES AND RESEARCH IN COMPUTER SCIENCE
MANGALAGANGOTRI-574 199
SEPTEMBER 2010

I SEMESTER M.Sc(Computer Science)

Subject Code	Subject	Theory Hours/ Week	Practical Hours/ Week	Duration of exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
CS-401	Foundations of Computer Science	4	-	3	30	70	100	4
CS-402	Data Structures and Algorithms	4	-	3	30	70	100	4
CS-403	JAVA Technology	4	-	3	30	70	100	4
CS-404	Data Communications and Computer Networks	4	-	3	30	70	100	4
CS-405	Computer Organization and Architecture	4	-	3	30	70	100	4
CS-406	Data Structures Lab	-	6	4	25	50	75	3
CS-407	Java Technology Lab	-	6	4	25	50	75	3
	Total Semester	**20**	**12**	**23**	**200**	**450**	**650**	**26**

II SEMESTER M.Sc(Computer Science)

Subject Code	Subject	Theory Hours/ Week	Practical Hours/ Week	Duration of exams(Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
CS-451	Operating Systems Concepts	4	-	3	30	70	100	4
CS-452	System Software	4	-	3	30	70	100	4
CS-453	Database Management Systems	4	-	3	30	70	100	4
CS-454	Computer Graphics and Multimedia	4	-	3	30	70	100	4
CS-455	Elective-I(E1-E5)	4	-	3	30	70	100	4
CS-456	Operating Systems Lab	-	6	4	25	50	75	3
CS-457	DBMS Lab	-	6	4	25	50	75	3
	Total Semester	**20**	**12**	**23**	**200**	**450**	**650**	**26**

III SEMESTER M.Sc(Computer Science)

Subject Code	Subject	Theory Hours / Week	Practical Hours / Week	Duration of exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
CS-501	Fundamentals of Information Technology	4	-	3	30	70	100	4
CS-502	Software Engineering	4	-	3	30	70	100	4
CS-503	Analysis and Design of Algorithm	4	-	3	30	70	100	4
CS-504	.NET Technology	4	-	3	30	70	100	4
CS-505	Elective II(E1-E5)	4	-	3	30	70	100	4
CS-506	.NET Programming Lab	-	6	4	25	50	75	3
CS-507	Mini Project & Domain Knowledge Seminar	-	6	--	75	--	75	3
	Total	**20**	**12**	**23**	**250**	**400**	**650**	**26**

Elective Subjects in II and III Semesters					
CS-455	:	**Elective-I**	**CS-505**	**:**	**Elective-II**
E1	:	Embedded Systems	E1	:	Object-Oriented Data Modeling Using UML
E2	:	Soft Computing Paradigms	E2	:	Image Processing
E3	:	Mobile and Wireless Communications	E3	:	Bioinformatics
E4	:	Linux Environment Systems	E4	:	Data Mining Techniques
E5	:	Molecular Modeling and Simulation	E5	:	Advanced Computer Networks

IV SEMESTER M.Sc(Computer Science)								
Subject Code	Subject	Theoretical Explanation /Demonstration/Week	Practical Hours/ Week	Duration of exams (Hrs)	Marks & Credits			
					IA	Dissertation+ Viva Exam	Total	Credits
CS-551	Project Work and Internal Assessment Either at Company / University	4	36	-	150	300 + 100	550	22
Grand Total Marks Of All The Four Semesters							**2500**	
Grand Total Credits Of All The Four Semesters								**100**

	I SEMESTER M.Sc(Computer Science)							
Subject Code	Subject	Theory Hours/ Week	Practical Hours/ Week	Duration of exams (Hrs)	Marks & Credits			
					IA	Exam	Total	Credits
CS-401	Foundations of Computer Science	4	-	3	30	70	100	4
CS-402	Data Structures and Algorithms	4	-	3	30	70	100	4
CS-403	JAVA Technology	4	-	3	30	70	100	4
CS-404	Data Communications and Computer Networks	4	-	3	30	70	100	4
CS-405	Computer Organization and Architecture	4	-	3	30	70	100	4
CS-406	Data Structures Lab	-	6	4	25	50	75	3
CS-407	Java Technology Lab	-	6	4	25	50	75	3
	Total Semester	**20**	**12**	**23**	**200**	**450**	**650**	**26**

CS-401: FOUNDATIONS OF COMPUTER SCIENCE

Hours/Week: 4   **I.A.   Marks: 30**
 Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Review of Sets, Propositions, Relations, Functions, Graphs, *Introduction to Probability theory:* Introduction, Sample space-random variables - probability distributions, expected values, joint distributions, variance, covariance

UNIT - II   12 Hours

Theory of Computation: Introduction: Strings and their properties, Formal Languages, Types of Grammars and Languages, Chomsky classification of Languages, Recursive and recursively enumerable sets, Operations.

Theory of Automata: Finite State Models, Minimization, Regular sets and Regular Grammars, Pumping Lemma, Closure properties, Applications of Finite automata

UNIT - III   12 Hours

*Context Free Languages***:** Context Free Grammar and Push Down Automata, equivalence of PDA and CFG, Deterministic PDA, Normal forms, Applications of CFG

UNIT - IV   12 Hours

Turing machines and Linear Bounded Automata: TM model, Representation and Design of TM, Halting problem, Universal TM and modifications, Linear bounded automata.

Text Books:
1. Introduction to Automata Theory, Languages and Computation- JD Ullman et al.
2. Elements of Discrete Mathematics – C L Liu, McGraw-Hill
3. Probability and Statistics with Reliability, Queuing and Computer Science   applications, K. S. Trivedi, Prentice Hall of India.

Reference Books:
1. Gems of Theoretical Computer Science - U.Schoninz, R J Pruim
2. Elements of the Theory of Computation - Hary R Lewis, Christor H Papadi metrion.
3. Theory of Computer Science- KLP Mishra and N Chandrashekar, PHI

CS-402: DATA STRUCTURES AND ALGORITHMS

Hours/Week: 4   **I A   Marks: 30**
 Credits : 4   **Exam. Marks: 70**

UNIT-I   *12 Hrs.*

Review of Abstract Data Types: Arrays, Polynomial, Sparse Matrices, Strings, Stacks & Queues, Multiple Stacks & Queues –Application of Stacks-Postfix, Prefix representation and Evaluation, Application of Queue- Priority Queue, Simulation

Linked Lists: Singly Linked Lists, Reusable Linked List Class, Circular Lists, Linked Stacks & Queues, Polynomials, Equivalence Classes, Sparse Matrices, Doubly   Linked   Lists, Generalized Lists.

UNIT-II   *12 Hrs.*

Trees: Introduction - Binary Trees - Binary Tree Traversal & Tree Iterators- Additional Binary Tree Operations - Threaded binary Trees - Binary Search Trees - Selection Trees - Forests - Set Representation - An Object-Oriented System of Tree Data Structures - Counting Binary Trees Graphs

UNIT-III   *12 Hrs.*

Graphs: Elementary Graph Operations - Minimum Cost Spanning Trees - Shortest Paths & Transitive Closure.
Sorting: Motivation - Insertion Sort - Quick Sort -Merge Sort - Heap Sort - Sorting on Several Keys - List & Table Sort - Summary of Internal Sorting - External Sorting Hashing

UNIT-IV   *12 Hrs.*

Symbol Table: Static Hashing - Dynamic Hashing, Heap Structures - Min-Max Heaps, Binomial Heaps.
Introduction to advanced data structures: Optimal Binary Search Trees-AVL Trees - 2-3 Trees - 2-3-4 Trees - Red-Black Trees - B-Trees

Text Book:
[1] Fundamentals of Data Structures in C, ELLIS HOROWITZ, SARTAJ SAHNI and DINESH MEHTA, 1995

Reference Books:
[1] Data structures and Algorithms, AHO, HOPCROFT and ULLMAN, Addison Wesley, 1983.
[2] Data structures using C and C++ - Langsam, Augenstein, Tanenbaum, PHI

CS-403: JAVA TECHNOLOGY

Hours/Week: 4   **I A   Marks: 30**

Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

INTRODUCTION TO JAVA: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens; Creating and destroying objects; Access specifies; Operators and Expressions; Control Statements: Selection statements, iteration statements, Jump Statements.

UNIT - II   12 Hours

CLASSES, INHERITANCE, EXCEPTIONS, APPLETS: Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading. Exception handling**:** Exception handling in Java. The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console.

UNIT - III   12 Hours

MULTI THREADED PROGRAMMING, EVENT HANDLING: Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

UNIT - IV   12 Hours

SWINGS: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

JAVA 2 ENTERPRISE EDITION OVERVIEW, DATABASE ACCESS: Overview of J2EE and J2SE. The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

TEXT BOOKS:

1. **Java - The Complete Reference** – Herbert Schildt, 7th Edition, Tata McGraw Hill, 2007.
2. **J2EE - The Complete Reference** – Jim Keogh, Tata McGraw Hill, 2007.

REFERENCE BOOKS:

1. **Introduction to JAVA Programming** – Y. Daniel Liang, 6th Edition, Pearson Education, 2007.
2. **The J2EE Tutorial** – Stephanie Bodoff et al, 2nd Edition, Pearson Education, 2004.

CS-404: DATA COMMUNICATIONS AND COMPUTER NETWORKS

Hours/Week: 4   **I A   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT – I   12 - Hrs

Introduction : Data communications fundamentals, Communication model, computer communications architecture, Data Communication tasks, Data Communication Systems Applications , Data Communication System Characteristics features, Data Communication Network criteria, Protocols and standards, Standards Organizations, Line Configuration, Topology, Transmission mode, Categories of Networks. Signals: Analog / Digital data and Signals, Periodic and A periodic Signals, Time and Frequency Domains, Composite Signals. Transmission rate, Bit rate, Baud rate and signal levels, Channel capacity using Nyquist and Shannon's relation .

UNIT – II   12 - Hrs

Encoding and Modulating : Digital to Dogital Conversion, Analog to Digital Conversion, Analog to Analog Conversion, Digital to Analog Conversion, Modulation and Demodulation: Data modulation methods: ASK, FSK, PSK, QAM, PCM, PAM, POLAR, BIPOLAR, NRZ, RZ. Transmission of Digital data : Interfaces and Modems: Digital Data transmission, DTE-DCE interface, Other Interface Standards , Modem features , Types of Modem and functions of MODEM. Transmission media, Guided media, Unguided media, Transmission impairments and Performance. Multiplexing Techniques.

UNIT – III   12 - Hrs

Definition of Computer Networks, Goals and Applications. ISO-OSI Architecture, Functions and Services of Physical, Data link, Network, Transport, Session, Presentation and Application Layers. Classifications of Computer Networks: Local Area Network (LAN), Wide Area Network WAN, Metropolitan Area Network, Storage Area Network (SAN), Public and Private Networks, Value Added Network (VAN), Internetworks, TCP /IP reference Model, Novell Netware Reference Model. Standards of Networks. Distributed Applications

UNIT – IV   12 - Hrs

Physical Layer Services, Data Link Layer Services and Network Layer Services: Point – to – Point Protocol (PPP), Networking and Internetworking Technology Devices, Repeaters, Bridges, Routers, Gateways, TCP/IP Protocol Suit: Overview of TCP/IP, Classes of IP, Addressing, Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Internet Control MESSAGE Protocol (ICMP), Internet Group Message Protocol (IGMP). Upper OSI Layers: Transport Layer, Session Layer, Presentation and Application Layer services. BOOTP, Dynamic Host Configuration Protocol(DHCP), Domain Name System (DNS), Telnet, Fle transfer Protocol (FTP), Trivial File Transfer Protocol (TFTP),Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP), Simple Network Management Protocol (SNMP), Hyper Text Transfer Protocol (HTTP) , World Wide Web (WWW).

TEXT BOOKS:

1.   William Stallings – Data & Computer Communications, PHI (6th ed.).
2.   Behrouz A Forouzan - Data Communication & Networking, McGraw Hill, 2nd ed., 2000.

Reference Books:

1.   W. Tomasi – Advanced Electronic Communication Systems.

2. Forouzan, B.A., "TCP/IP Protocol", TMH
3. Laura Chappell (ed), "Introduction to Cisco Router Configuration", Techmedia, 1999.
4. Tananbaum A.S., "Computer Networks", 3rd Ed, PHI, 1999.
5. Black U., "Computer Networks-Protocols, Standards and Interfaces", PHI, 1996.
6. Stallings W., "SNMP, SNMPv2, SNMPv3, RMON 1&2", 3rd Ed., Addison Wesley, 1999.
7. James Martin – Telecommunications & the Computer, PHI, 3rd ed.

CS-405: COMPUTER ORGANIZATION AND ARCHITECTURE

Hours/Week: 4   **I A   Marks: 30**

Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance − Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

UNIT - II   12 Hours

Input/output Organization: Accessing I/O Devices, Interrupts − Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses; Interface Circuits, Standard I/O Interfaces − PCI Bus, SCSI Bus, USB

UNIT - III   12 Hours

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories − Mapping Functions, Replacement Algorithms, Performance Considerations; Virtual Memories, Secondary Storages;

UNIT - IV   12 Hours

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders; Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro-programmed Control

Text Book

1. **Computer Organization**, Carl V Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, TMH, 2002.

Reference Books

1. **Computer Organization & Architecture**, William Stallings, 7th Edition, PHI, 2006.
2. **Computer Systems Design and Architecture**, Vincent P. Heuring & Harry F. Jordan, 2nd Edition, Pearson Education, 2004.

CS-406: DATA STRCUTRES LAB

CS-407: JAVA TECHNOLOGY LAB

	II SEMESTER M.Sc(Computer Science)							
Subject Code	**Subject**	**Theory Hours/ Week**	**Practical Hours/ Week**	**Duration of exams(Hrs)**	**Marks & Credits**			
					IA	**Exam**	**Total**	**Credits**
CS-451	Operating Systems: Principles and Programming	4	-	3	30	70	100	4
CS-452	System Software	4	-	3	30	70	100	4
CS-453	Database Management Systems	4	-	3	30	70	100	4
CS-454	Computer Graphics and Multimedia	4	-	3	30	70	100	4
CS-455	Elective Subjects-I(E1-E5)	4	-	3	30	70	100	4
CS-456	Operating Systems Lab	-	6	4	25	50	75	3
CS-457	DBMS Lab	-	6	4	25	50	75	3
	Total Semester	**20**	**12**	**23**	**200**	**450**	**650**	**26**

CS-455	:	**Elective Subjects-I**
E1	:	Embedded Systems
E2	:	Soft Computing Paradigms
E3	:	Mobile and Wireless Communications
E4	:	Linux Environment Systems
E5	:	Molecular Modeling and Simulation
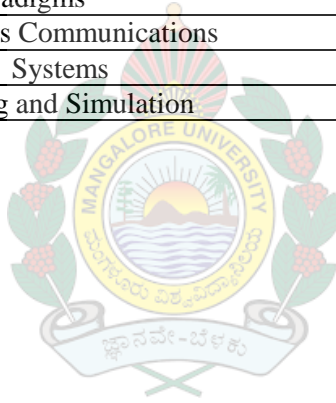
CS-451:   OPERATING SYSTEM: PRINCIPLES AND PROGRAMMING

Hours/Week: 4   **I. A.   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Review of Operating System: *Functions, Process, I/O, Memory and File Management aspects, Process management, CPU Scheduling.*

UNIT - II   12 Hours

Process synchronization: *Critical sections, Classical synchronization problems, Semaphores, Critical regions.*

Process Management in UNIX/Windows Operating Systems: *Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, waited, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times.*

Process Relationships: *Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp, tcsetpgrp, and tcgetsid Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.*

UNIT - II   12 Hours

Deadlocks: *Handling deadlocks, Detection and Resolution, Avoidance*
Inter process communication: *Inter process messages, Implementation issues.*
Introduction to IPC mechanisms in UNIX/Windows Operating Systems: *Pipes; FIFOs; Message Queues; Shared Memories; Semaphores.*

UNIT - II   12 Hours

Internals of UNIX/LINUX operating system, Internals of WINDOWS operating system; Introduction to Socket Programming: Introduction; Socket Descriptors; Addressing; Connection establishment; Data transfer; Socket options; Out-of-band data; Non-blocking and asynchronous I/O.

Text Books:
1. Operating System Concepts - Peterson J.L. And Silberschatz A, Addison Wesley.
2. The Design Of The Unix Operating System - Maurice J Bach.
3. Terrence Chan: Unix System Programming Using C++, Prentice-Hall of India / Pearson Education, 1999..(Chapters 1, 5, 6, 7, 8, 9)
4. W.Richard Stevens, Stephen A. Rago: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education / Prentice-Hall of India, 2005. (Chapters 7, 8, 9, 13, 15, 16)
5. Inside Microsoft Windows 2000 (Microsoft Programming Series)   David A. Solomon, Mark Russinovich

Reference Books:
1. Operating System – Dietel And Dietel
2. Operating System – Milan Kovic
3. Operating System Internals - William Stallings

Hours/Week: 4   **I. A.   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   **12 Hours**

Introduction to Language Processing: Language processing   activities - Fundamentals of language processing - Fundamentals   of language specification - Language processor development tools, Data structures for Language processing
Assemblers: Assembly scheme, Pass structure of assemblers, Design of two pass assembler

UNIT - II   **12 Hours**

Macros and Macro processors: Macro Definition and Call, Expansion, Design of Macro Processors
Linkers: Relocation and Linking, Design of Linker, Linker for MS-DOS and WINDOWS

UNIT - II   **12 Hours**

Compilers:
Lexical Analysis: Input buffering, Specification and Recognition of tokens, Design of Lexical analyzer generators, Usage of LEX utility.

Syntax Analysis: Role of Parser, Top-down parsing:- Predictive parsing, Bottom-up parsing:- LR-parser:- SLR, LR(1), LALR, Usage of YACC utility.

UNIT - IV   **12 Hours**

Intermediate Code Generation: Semantic actions and Syntax directed translations, Intermediate representations, Bottom-up translations.

Code Optimization Techniques: Machine independent optimization aspects, Symbol table and Code generation issues.

Text Books:
1. Compilers - Principles, Techniques & Tools by Aho A.V., R. Sethi & Ullmann, Addison Wesley
2. Systems Programming & Operating Systems, D.M. Dhamdhere, Tata - McGraw Hill Publications.

Reference Books:
1. Introduction to Compiler Construction by Thomas W. Parsons, Computer Science Press.

2. Compiler Construction, DHAMDHERE D.M Wiley, 1986.

CS0-453:DATABASE MANAGEMENT SYSTEMS

Hours/Week: 4   I A Marks: 30

Credits : 4   Exam. Marks: 70

UNIT - I   12 Hours

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; 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.

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; Extended ER model

UNIT - II   12 Hours

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.

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.

UNIT - III   12 Hours

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; Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms.

UNIT - IV   12 Hours

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.

Introduction on more recent applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. **Data Base System Concepts** – Silberschatz, Korth and Sudharshan, 5th Edition, Mc-GrawHill, 2006.
2. **An Introduction to Database Systems** – C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.

CS-454: COMPUTER GRAPHICS AND MULTIMEDIA

Hours/Week: 4   **I A   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

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.

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.

UNIT - II   12 Hours

INPUT AND INTERACTION: Interaction; Input devices; Clients and servers; Display lists; Display lists and modelling; Programming event-driven input; Menus; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

GEOMETRIC OBJECTS AND TRANSFORMATIONS: Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modelling a colored cube; Affine transformations; Rotation, translation and scaling; Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications;

UNIT - III   12 Hours

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.

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.

UNIT - IV   12 Hours

INTRODUCTION, MEDIA AND DATA STREAMS, AUDIO TECHNOLOGY: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; Multimedia Databases; Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases;

TEXT BOOKS:

1. **Interactive Computer Graphics A Top-Down Approach with OpenGL** -Edward Angel, 5th Edition, Addison-Wesley, 2008.

2. **Multimedia Fundamentals: Vol 1-Media Coding and Content Processing –** Ralf Steinmetz, Klara Narstedt, 2nd Edition, Pearson Education / PHI, 2003.

3. **Multimedia Systems Design** – Prabhat K. Andleigh, Kiran Thakrar, PHI, 2003.

REFERENCE BOOKS:

1. **Computer Graphics Using OpenGL** – F.S. Hill,Jr. 2nd Edition, Pearson Education, 2001.
2. **Computer Graphics - OpenGL Version** – Donald Hearn and Pauline Baker, 2nd Edition, Pearson Education, 2003.

CS-455(E1-E5): ELECTIVE SUBJECTS

CS-456: Operating Systems Lab

CS-457: Database Management Systems Lab

CS-455(E1): EMBEDDED SYSTEMS

Hours/Week: 4   **I. A.   Marks: 30**

Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

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; I/O types and examples; Serial communication devices; Parallel device ports

UNIT - II   12 Hours

COMMUNICATION BUSES FOR DEVICE NETWORKS: Wireless devices; Timer and counting devices; Watchdog timer; Real time clock; Networked embedded systems; Serial bus communication protocols; Parallel bus device protocols; Internet enabled systems; Wireless and mobile system protocols; 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.

UNIT - III   12 Hours

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.

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.

UNIT - IV   12 Hours

REAL-TIME OPERATING SYSTEMS – 2: 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.

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 BOOK:

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

REFERENCE BOOKS:

1. **Computers as Components: Principles of Embedded Computer System Design** – Wayne Wolf, Elsevier, 2005.

2. **Embedded Systems Architecture** – Tammy Noergaard, Elsevier, 2005.

3. **Embedded Systems Design** – Steve Heath, 2nd Edition, Elsevier, 2003.

4. **Embedded/Real-Time Systems: Concepts, Design and Programming: The Ultimate Reference** – Dr. K.V.K.K. Prasad, Dreamtech Press, 2004.

5. **Embedded C** – Michael J.Point, Pearson Education, 2002.

CS-455(E2): SOFT COMPUTING PARADIGMS

Hours/Week: 4   **I. A.   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Basics of soft computing: Bbiological and artificial neural network, fuzzy sets, fuzzy logic systems, and rough sets
Applications: Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing.

UNIT - II   12 Hours

Introduction to Artificial Neural Network-Architecture, Activation Functions, Training Neural Net, McCulloch-Pitts Neuron model, Applications of Neural Networks. Amari's learning rule, Hebb's learning rule, DELTA rule, ADALINE, MADALINE system network, Perceptron Layer network. Associative Memory - Autoassociative, Iterative & Heteroassociative net, BAM. Self Organizing Maps- Fixed Weight Compitive Nets, Kohonen Self-Organizing Maps, Counter propagation, Learning Vector Quantization. Radial Basis Functions and applications.

UNIT - III   12 Hours

Fuzzy vs Crisp, Crisp sets, Crisp Relations, Fuzzy systems– Crisp Logic, Predicate logic, Fuzzy Logic, fuzzy sets; fuzzy reasoning; fuzzy inference systems; fuzzy control; fuzzy clustering; Fuzzy rule based system, deffuzzification methods applications of fuzzy systems. Rough sets and approximations, reducts, reasoning with rough sets, applications of rough sets

UNIT - IV   12 Hours

Neuro-fuzzy systems: neuro-fuzzy modeling; neuro-fuzzy control. Genetic Algorithms: Simple GA, crossover and mutation, genetic algorithms in search and optimization.

Text Books
1. D.K.Prathihar, Soft Computing, Narosa Publications.
2. S. Rajasekaran, G.A Vijayalakshmi Pai, " Neural Networks, Fuzzy Logic, Genetic Algorithms", Prentice Hall of India Publishers, 2003

Reference Books
1. M. Friedman and Abraham Kandal, Introduction to Pattern Recognition- Statistical, Structural, Neural and Fuzzy Logic Approaches, World Scientific, 2005
2. Timothy J Ross, Fuzzy Logic with Engineering Applications, MCH, 1997
3. Kishan Mehrotra, Chilukuri K. Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram, Mumbai,1997
4. Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, J.S.R. Jang, C.T. Sun, E. Mizutani, Prentice Hall, 1996
5. Mitchell, Melanie, An Introduction to Genetic Algorithms, PHI, 2004

CS-455(E3): MOBILE & WIRELESS COMMUNICATION

Hours/Week: 4   **I. A.   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signaling.
Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.

UNIT - II   12 Hours

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. **Mobile Data Communication**: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

UNIT - III   12 Hours

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). **Third Generation (3G) Mobile Services**: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

UNIT - IV   12 Hours

Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. **Global Mobile Satellite Systems**; case studies of the IRIDIUM and GLOBALSTAR systems. **Wireless Enterprise Networks**: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. PAN, HAN, WPAN.

Text / Reference Books:

1. Wireless and Mobile Networks Architectures, by Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.

2. Mobile and Personal Communication systems and services, by Raj Pandya, Prentice Hall of India, 2001.

3. Mobile Cellular Telecommunications; 2nd ed.; William, C Y Lee McGraw Hill

4. Wireless and Digital Communications; Dr. Kamilo Feher (PHI).

Reference Books

1. Guide to Designing and Implementing wireless LANs, by Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.

2. Wireless Web Development, Ray Rischpater, Springer Publishing, 2000.

3. "The Wireless Application Protocol", by Sandeep Singhal, Pearson Education Asia, 2000.

4. Third Generation Mobile Telecommunication systems, by P.Stavronlakis, Springer Publishers, 2001, Mobile Communication Hand Book; 2nd Ed.; IEEE Press

5. Mobile Communication Engineering – Theory & Applications; TMH.

6. ''Mobile Communications'', Jochen Schiller ; Pearson Education

CS-455(E4): LINUX ENVIRONMENT SYSTEMS

Hours/Week: 4   **I. A.   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Introduction to Unix & Networking: History & Origin of Unix, Features of Linux , Linux architecture and Concepts, Popular flavors and Comparison between various flavors of Linux, Basic Commands and Introduction to Networking. File manipulation Under Linux : Copy, rename, delete & move , File & directory listing, File handling & I/O redirection, File systems and their types, Names & contents of important, Linux file directories, Compatibility of file Systems, Fsck & Disk check Commands, Log files

UNIT - II   12 Hours

Command Line Interface : Text Manipulation Commands,   e.g. cut, grep, egrep, split, paste, Vi editor,   su,ps,find,make,df/du,   Introduction to Regular expression,   awk, sed, passwd, wc, Antivirs, utilities, tar, gzip/ gunzip, accessing, pen drive, C.D., gdb
Installation: Basic hardware requirements, File system planning, OS Components, Types of Installation. Text VS Graphics, Partitioning & Disk management, Package management, GUI Configuration, Concept of users & groups, Owner creator, Primary and Secondary group, Types of file and directory permission, Configuring users, groups and peripherals, Adding softwares, mkdev, stty, inittab command in detail, Kernel rebuild.

UNIT - III   12 Hours

***Network Management*:** Networking, Internetworking with windows(samba),   Ping Telnet, ftp, ssh program, NIS, NFS, Tomcat web server Changing network configuration and files, Commands to configure network.
Security: Levels of Security, User Security, Data Security, Network Security. *Disaster Recovery:* Concepts, Importance of Backup, Backup strategy levels and devices, Commands for backup, Tools for backup.

UNIT - IV   12 Hours

Maintenance and Troubleshooting: Responsibilities of a System Administrator, Troubleshooting techniques. *Performance Tuning:* Importance of Tuning, Activities, Files to keep track of necessary. tuning parameters, mpstat, iostat, sar etc.

Text Books:
1.   Red Hat Linux - The Complete Reference by Richard Petersen, Second Edition McGraw-Hill.
2.   Essential System Administration   - Frisch

Reference Books:
3.   Essential System Administration   - Frisch
4.   TCP/IP Network Administration   - Hunt
5.   Unix in a nutshell   - Alhir
6.   Unix system administration handbook   - Evi Nemeth et. Al
7.   Matt Welsh, Matthias Kalle Dalheimer, Terry Dawson, and Lar Kaufman, Running
8.   Linux, Fourth Edition, O'Reilly Publishers, 2002.

CS-455(E5): MOLECULAR MODELLING AND SIMULATION

Hours/Week: 4   **I. A.   Marks: 30**

Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Introductions to Simulation, Introduction to Simulation, Advantages and Disadvantages of Simulation, Areas of Applications, Systems and system environment, Components of a system, Discrete and continuous systems, Model of a system, Types of Model, Discrete-event system simulation, Steps in a simulation study. **Statistical Models in Simulation,** Review of terminology and concepts, Useful Statistical models, Discrete distributions, Continuous Distributions, Poisson process, Empirical distributions.

UNIT - I   12 Hours

Useful Concepts in Molecular Modelling, Introduction, Coordinate System, Potential Energy Surfaces, Molecular Graphics, Surfaces, Computer Hardware and Software, Units of Length and Energy, The Molecular Modelling Literature, The Internet, Mathematical Concepts.

An Introduction to Computational Quantum Mechanics, Introduction, One-electron atoms, Polyelectronic Atoms and Molecules, Molecular Orbital Calculations, The Hartree-Fock Equations, Basis Sets, The Calculation of Molecular Properties Using *ab into*Quantum Mechanics, Approximate Molecular Orbital Theories, Semi-Empirical Methods, Hückel Theory,   Performance of Semi-Empirical.

UNIT - I   12 Hours

Empirical Force Field Models: Molecular Mechanics. Introduction, Some General Features of Molecular Mechanics Force Fields, Bond stretching, Angle bending, Torsional terms, Improper Torsions and Out-of-plane Bending Motions, Cross Terms: Class 1,2 and 3 Force Fields, Introduction to Non-bonded Interactions, Electrostatic Interactions, Van der Waals Interactions, Many-body Effects in Empirical Potentials, Effective Pair Potentials, Hydrogen bonding in molecular mechanics, Force field models for the simulation of liquid water, United atom force fields and reduced representations, Derivatives of the molecular mechanics energy function, Calculating thermodynamic properties using a force field, Force field Parameterisation, Transferability of force field parameters, The treatment of delocalised [Pi]systems, Force fields for inorganic Molecules, Force fields for Solid-State Systems, Empirical Potentials for Metals and Semiconductors.

UNIT - I   12 Hours

Computer Simulation Methods: Introduction, Calculation of simple thermodynamic properties, Phase space, Practical aspects of computer simulation, Boundaries, Monitoring the equilibration, Truncating the potential and the minimum image convention, Long-range forces, Analysing the results of a simulation and estimating errors.

Application of Molecular Modelling and Chemoinformatics to Discover and Design New Molecules: Molecular modelling in drug discovery, Computer Representations of Molecules, chemical Databases and 2D substructure searching, 3D Database searching , Deriving and Using Three-dimensional Pharmacophores, Sources of Data for 3D Databases, Molecular docking, Application of 3D Database searching and docking , Molecular similarity and similarity searching, Molecular descriptor , Selecting 'Diverse' Sets of Compounds, Structure-based De Novo Ligand Design, Quantitative Structure-Activity Relationships, Partial least Squares, Combinatorial Libraries.

Text Books:
1. Jerry Banks, Discrete-Event System Simulation, Prentice Hall, 2007.
2. Andrew R. Leach, Molecular Modelling Principles and Applications, 2nd ed. 2010.

References :
1. Johann Gasteiger, Dr. Thomas Engel, Chemoinformatics-A Text Book, Wiley-VCH Verlag GmbH & Co, 2003.
2. Jurgen Bojorath, Chemo informatics , Concepts, Methods, and tools for Drug Discovery, Humana Press Incorporation, 2004.

				III SEMESTER M.Sc(Computer Science)					
Subject Code	**Subject**	**Theory Hours / Week**	**Practical Hours / Week**	**Duration of exams (Hrs)**	**Marks & Credits**				
					IA	**Exam**	**Total**	**Credits**	
CS-501	Fundamentals of Information Technology	4	-	3	30	70	100	4	
CS-502	Software Engineering	4	-	3	30	70	100	4	
CS-503	Analysis and Design of Algorithm	4	-	3	30	70	100	4	
CS-504	.NET Technology	4	-	3	30	70	100	4	
CS-505	Elective Subjects-II(E1-E5)	4	-	3	30	70	100	4	
CS-506	.NET Programming Lab	-	6	4	25	50	75	3	
CS-507	Mini Project & Domain Knowledge Seminar	-	6	--	75	--	75	3	
	Total	**20**	**12**	**23**	**250**	**400**	**650**	**26**	

CS-505	**:**	**Elective Subjects-II**
E1	:	Object-Oriented Modeling Using UML
E2	:	Image Processing
E3	:	Bioinformatics
E4	:	Data Mining Techniques
E5	:	Advanced Computer Networks
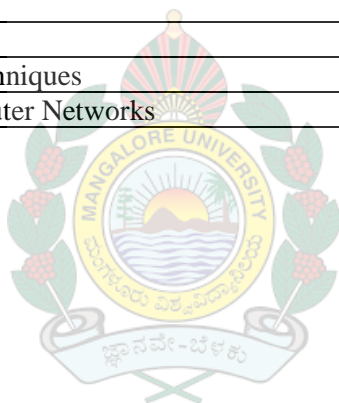
CS-501: FUNDAMENTALS OF INFORMATION TECHNOLOGY
(CHOICE BASED CREDIT SYSTEM SUBJECT)

Hours/Week: 4   I A   Marks: 30

Credits : 4   Exam. Marks: 70

UNIT - I   12 Hours

Introduction to computers: Characteristics of computers, advantages & disadvantages of Computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Supercomputers.

Anatomy of Computer: Introduction, Functions & Components of a Computer, Central Processing Unit, Memory- RAM, ROM, PROM, EPROM, EEPROM, Flash Memory. Secondary Storage Devices.

Input and output Devices: Introduction, Keyboard, Mouse, Trackball, Joystick, Digitizing Tablet, Scanners, Digital Camera, Bar Code Reader, Speech Input Devices, Touch Screen, Touch pad, Light Pen, Monitor, Printers, Plotters, Sound Cards & Speakers.

Application of Computers: In Home, Education & Training, Business & Industry, Entertainment, Science, Medicine & Engineering.

UNIT - II   12 Hours

Computer Software: Fundamentals, Introduction, Operating System, Utilities, Compilers & interpreters, word processors, spreadsheets, presentation graphics, database management systems.

Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems-Batch Operating System, Multiprogramming Operating System, Time Sharing Operating System, Personal Computer Operating System, The Unix Operating System, Microkernel Based Operating System, On-Line and Real Time Systems.

Programming Languages: Introduction, machine language, assembly language, high level language, types of high level languages.

UNIT - III   12 Hours

Introduction to Office Automation

Word Processing: Introduction, Basic Capabilities of Word Processors, Advanced Features of Word Processors.

Electronic spreadsheets: Fundamentals, Electronic Spreadsheets, Characteristics of a Spreadsheet, Spreadsheet Packages

Presentation software: Introduction, Presentation Basics, The ingredients of a Good Presentation, Presentation Packages.

Database base Tools: Fundamenatls, Information, Quality of Information, Information Processing, DBMS, Types of DBMS, RDBMS, Relational data structure, integrity & manipulation

UNIT - IV   12 Hours

Internet: Introduction, Features of Internet, Milestones of Internet, Internet application, Services of Internet, Configurations of Internet, ISP, URL, Web Browsers, Various Browsers, Features of Browsers, Search Engine.

Text Books:
1. Introduction to Computers, Peter Norton, VI Edition, TATA McGRAW Hill Publication.
2. Alexis Leon & Mathews Leon – Computers Today
3. Fundamentals of Computers, V Rajaraman, V Edition, PHI Publications. 2010.

Reference Book:
1. Peter Norton's Introduction to Computers –Second Edition
2. Cisco Systems Networking Academy: First Year Companion Guide – Vitp Amato – Techmedia Publication.
3. Internet for everyone – Alexis Leon and Mathews Leon – Leon TechWorld Publication
4. Internet in a Nutshell – Valerie Quercia – O'Reilly Publication

CS-502: SOFTWARE ENGINEERING

Hours/Week: 4   **I A   Marks: 30**
 Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Introduction to s/w Engineering:The s/w problem, S/w engineering problem, s/w engineering approach.S/w processes:S/w process, characteristics of a s/w process, s/w development process, project mgt process, s/w configuration management process.

UNIT - II   12 Hours

Software requirements analysis and specifications:s/w requirements, problem analysis, requiremnet specification, validation, metrics.Planning a s/w project:Cost estimation, project scheduling, staffing & personnel planning, quality assurance plans, project monitoring plans, risk management .

UNIT - III   12 Hours

System & detailed design:Design principles, module level concepts, design methodologies, structured design methodology & object oriented design, verification and metrics.Coding:Programming practise, verification, metrics.

UNIT - I   12 Hours

Testing:Fundamentals, functional & structural testing, testing process, metrics.Software Engineering tools and environment:Process models, 4th generation techniques, technical metrics for Software .

Text Books:

1. R. S. Pressman, "Software Engineering: A practioner's Approach", McGraw Hill.

2. Ian Sommerville, ,''Software Engineering'', Seventh Edition, Person Education, 2005.

Reference Books:

1. Ali Behforooz and Freedrick J. Hudson, "Software Engineering Fundamentals", Oxford University Press, 2004.
2. Pankaj Jalote, "An Integrated Approach to Software Engineering, Narosa Publishing House.
3. Fundamentals of s/w Engineering – Carlo Ghezze, Mehde Jazayeri, Dino Mandrioli
4. Software engineering – shooman
5. Software engineering – Wattmanh.

CS-503: DESIGN AND ANALYSIS OF ALGORITHMS

Hours/Week: 4   **I A   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

Introduction: Algorithm specification and Characteristics, Performance Analysis
Strategies:
Divide and Conquer: General method, Binary search, Maximum and Minimum, Merge sort, Quick sort, Selection sort, Strassen's Matrix multiplication

UNIT - II   12 Hours

Greedy: General method, Knapsack problem, Job sequencing with dead lines, MST, Optimal storage on tapes, Optimal merge pattern, Single source shortest path.

UNIT - III   12 Hours

Dynamic Programming: General method, Multistage graph, All Pair Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack.

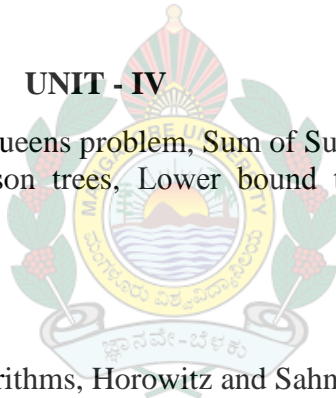## UNIT - IV   12 Hours

Backtracking: General method, 8-Queens problem, Sum of Subsets, Graph Coloring.
Lower Bound Theory: Comparison trees, Lower bound thro' reduction, NP-hard and NP-complete problems.

TEXT BOOKS:

1. Fundamentals of Computer Algorithms, Horowitz and Sahni, Galgotia Publications

2. The Design and Analysis of Computer Algorithms, Aho, Hop croft & Ullman   - Addison Wesley Publishing Company.

CS-504: .NET TECHNOLOGY

Hours/Week: 4   **I A**   **Marks: 30**

Credits : 4   **Exam. Marks: 70**

UNIT - I   12 Hours

THE PHILOSOPHY OF .NET: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, An Overview of .NET Binaries, The Role of the Common Intermediate Language, The Role of .NET Type Metadata, The Role of the Assembly Manifast, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.

UNIT - II   12 Hours

BUILDING C# APPLICATIONS: The Role of the Command Line Complier (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET IDE, Other Key Aspects of the VS.NET IDE, C# "Preprocessor:" Directives.

C# LANGUAGE FUNDAMENTALS: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.

UNIT - III   12 Hours

OBJECT- ORIENTED PROGRAMMING WITH C#: Forms Defining of the C# Class, Definition the "Default Public Interface" of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The "Protected" Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between.

EXCEPTIONS AND OBJECT LIFETIME: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception), Custom Application-Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of "new', The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

UNIT - IV   12 Hours

INTERFACES AND COLLECTIONS: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementation Interfaces Using .NET, understanding the IConvertible Interface.

Callback Interfaces, Delegates, and Events, Advanced Techniques: Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, Understanding Asynchronous Delegates, Understanding (and Using) Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines.

UNDERSTANDING .NET ASSEMBLES: An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly.

Text Books:

1. **Pro C# with .NET 3.0** – Andrew Troelsen, Special Edition, Dream tech Press, India, 2007.

2. **Programming in C#** – E. Balagurusamy, 5th Reprint, Tata McGraw Hill, 2004. (For Programming Examples)

REFERENCE BOOKS:

1. **Inside C#** – Tom Archer, WP Publishers, 2001.

2. **C#: The Complete Reference** – Herbert Schildt, Tata McGraw Hill, 2004.
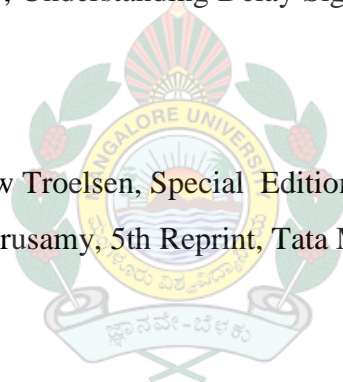
CS-505(E1-E5): ELECTIVE SUBJECTS-II

CS-506: .NET Programming Lab

CS-507: Mini Project & Domain Knowledge Seminar

CS-505(E1) OBJECT-ORIENTED ANALYSIS DESIGN WITH UML

Hours/Week: 4   **I A   Marks: 30**
 Credits : 4   **Exam. Marks: 70**

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UNIT - I   **12 Hours**
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Introduction, Modeling Concepts, class Modeling
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.
Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

<div align="center">

UNIT - II   **12 Hours**
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Advanced Class Modeling, State Modeling : Advanced object and class concepts; Association ends; N-ary associations; **Aggregation;** Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.

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

Advanced State Modeling, Interaction Modeling:
Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.
Interaction Modeling: Use case models; Sequence models; Activity models.
Use case relationships; Procedural sequence models; Special constructs for activity models.

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UNIT - III   **12 Hours**
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Process Overview, System Conception, Domain Analysis
Process Overview: Development stages; Development life cycle. **System Conception:** Devising a system concept; Elaborating a concept; Preparing a problem statement.
Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

Application Analysis, System Design
Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

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.

UNIT - IV   12 Hours

Class Design, Implementation Modeling, Legacy Systems   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; Testing.

Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

Design Patterns, Idioms

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

Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

Management Patterns: Command processor; View handler.

Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example.

Text Books:
1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
   (Chapters 1 to 17, 23)
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.
   (Chapters 1, 3.5, 3.6, 4)

Reference Books:
1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson, 2007.
2. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley-Dreamtech India, 2004.
4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 2002.

CS-505(E2) : DIGITAL IMAGE PROCESSING

Hours/Week: 4   **I A   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - 1   12 Hours

Digitized image and its properties: Basic concepts, Image digitization, Digital image properties. Image Preprocessing: Image pre-processing; Histogram processing, Enhancement using arithmetic / logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Brightness and geometric transformations, local preprocessing.

UNIT - II   12 Hours

SEGMENTATION: Thresholding, Edge-based segmentation, Region based segmentation, Matching.

UNIT - III   12 Hours

IMAGE ENHANCEMENT: 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.

IMAGE COMPRESSION: Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT - IV   12 Hours

SHAPE REPRESENTATION: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

MORPHOLOGY: Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds.

TEXT BOOKS:

1. **Image Processing, Analysis and Machine Vision** – Milan Sonka, Vaclav Hlavac and Roger Boyle, 2nd Edition, Thomson Learning, 2001.
2. **Digital Image Processing –** Rafel C Gonzalez and Richard E Woods, 2nd Edition, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Fundamentals of Digital Image Processing** – Anil K Jain, Pearson Education/Prentice-Hall of India Pvt. Ltd., 1997.

2. **Digital Image Processing and Analysis** – B.Chanda, D Dutta Majumder, Prentice-Hall India, 2002.

CS-505(E3) : BIOINFORMATICS

Hours/Week: 4   **I A   Marks: 30**

Credits : 4   **Exam. Marks: 70**

UNIT - 1   12 Hours

Introduction to Genes and Proteins: Central Dogma of molecular biology, Genome Sequences, ORFs, Genes, Intones, Exons, Splice Variants DNA/ RNA Secondary Structure, Triplet Coding Protein Sequences, Problems in molecular biology and their bioinformatics approach.
Biological databases: PUBMED, NCBI, EMBL, GENBANK, Entrez, Unigene, PDB, SwissProt, And TrEMBL, Bioinformatics tools

UNIT - II   12 Hours

Sequence alignment and database searching: Alignment of pairs of sequence: Introduction to sequence analysis, Sequence analysis of biological data, models for sequence analysis and their biological motivation, methods of alignment, Application of dot matrix, Methods of optimal alignment, Using gap penalty and score matrices, Multiple alignment tools and its Application, Hidden Markov Models - Viterbi algorithm HHM based multiple-sequence alignment SAM, Tools for sequence analysis : BLAST, FASTA

UNIT - III   12 Hours

Structure prediction methods for gene and protein: Protein Structure: Secondary, Tertiary, Quaternary, protein Folding, protein function, protein structure databases and visualization tools, protein prediction tools, Method of protein prediction for known fold and unknown fold, protein function prediction, Accuracy of prediction. Using pattern to predict genes, Method of gene prediction, prediction tools.

UNIT - IV   12 Hours

Introduction to Data Generating Techniques: Restriction Enzymes, Gel Electrophoresis, Chromatograms Blots, PCR, Micro arrays, Mass Spectrometry, DNA sequencing, Gene mapping application of Mapping, introduction to proteomics and metabolic pathways.

Text Books
1. S.C. Rastogi, Namita Mendirata, Parag Rastogi "Bioinformatics concepts Skills and application", CBS publisher
2. D. Baxevanis and F. Oulette, (2002), "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley
3. Arthur M. Lesk, (2002), "Introduction to Bioinformatics" Oxford University
4. David W. Mount, "Bioinformatics: Sequence and Genome Analysis." Cold Spring Harbor, Laboratory Press.

CS-505(E4) : DATA MINING TECHNIQUES

Hours/Week: 4　　　　　　　　　　　　　　　　　　　　　**I A　　Marks: 30**
Credits : 4　　　　　　　　　　　　　　　　　　　　　　　**Exam. Marks: 70**

UNIT - I　　　　　　　　　　　　　12 Hours

Introduction: Motivations, Data Mining Databases-Relational Data Bases, Data warehouse, Transactional Databases, Advanced Database systems and advanced Database applications. Data Mining Functionalities- Concept/Class Discrimination; characterizations and Discrimination, Association Analysis, Classification and Prediction, Cluster Analysis, Outlier Analysis and Evolution Analysis. Classifications of Data Mining Systems, Major issues in Data Mining.
Data Preprocessing: Introduction, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation Discretization.

UNIT - II　　　　　　　　　　　　　12 Hours

Data Warehouse and OLAP Technology: An Overview, Introduction to Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining.

Data Cube Computation and Data Generalization: Data Cube Computation and Data Generalization: Efficient Method for Data Cube Computations, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

UNIT - III　　　　　　　　　　　　12 Hours

Data Cube Computation and Data Generalization: Data Cube Computation and Data Generalization: Efficient Method for Data Cube Computations, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.
Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and a Road Map, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

UNIT - IV　　　　　　　　　　　　12 Hours

Classification and Prediction: Introduction, Issues regarding classification and prediction, classification by decision tree Induction, Bayesian classification, Rule based Classification, Classification by back propagation and advanced classification methods, prediction, classification accuracy.

Cluster Analysis: Introduction, Types of data in cluster analysis, A categorization of major cluster Methods, Partitioning methods, Hierarchical methods, Density-Base Methods, Grid-based methods, Model based Methods, Clustering High Dimensional Data, Outlier analysis. Introduction to Advanced Data Mining and their applications.

Text Book:
1. Jaiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann/Elsevier Science publisher, 2nd Edition. Indian Reprint 2009.

Reference Books:
1. Arun K Pujari, Data Mining Techniques, University Press (INDIA) Pvt., 2003.
2. Krzysztof J Cios; Witold Pedrycz and Roman W Swiniarski and Lukasz A. Kurgan, Data Mining A Knowledge Discovery Approach, Springer International Edition: first Indian Reprint 2010.

CS-505(E5): ADVANCED COMPUTER NETWORKS

Hours/Week: 4   **I A   Marks: 30**
Credits : 4   **Exam. Marks: 70**

UNIT - I   **12 Hours**

Introduction: Introduction to Computer Networks. Understanding Network architecture. Introduction to TCP/IP Architecture, TCP/IP addressing, services, FTP, SMTP, TFTP, SNMP, Network file system, domain name system, transport layer protocols, user datagram protocol, transmission control protocol, Class addresses, ARP, RARP.

UNIT - II   **12 Hours**

Inter process communications: File and record locking, pipes, FIFO's, stream and messages, message queues, semaphores.

UNIT - III   **12 Hours**

Sockets: Sockets system calls, reserved ports, stream pipes, socket option, asynchronous I/O, Sockets and signals. Understanding the Internet Protocols SLIP versus PPP. Understanding the Socket interface. Concepts of the Windows sockets API. Importance of Raw Sockets. Internet Application Services, E-Mail, File Transfer Protocols, Characteristic Features of the Firewall.

UNIT - IV   **12 Hours**

Transport Layer Interface: Elementary TLI functions, stream and stream pipes, asynchronous I/O multiplexing. **Remote Procedure calls:** Remote login, remote command execution, external data representation. UUCP.

Text Books:

1.   A. Stevens, "TCP/IP Illustrated", Vol. 1-3, Addison Wesley, 1998.
2.   R. Stevens, "Unix Network Programming", PHI 1998
3.   J. Martin, "TCP/IP Networking – Architecture, Administration and programming", Prentice Hall, 1994.

Reference Books

1.   D.E. Comer, "Internetworking with TCP/IP, Vol. 1, Principles, Protocols, and architecture, PHI, 2000.
2.   Internet Programming by Kris Jamsa, Galgotia publishers, 1997.