

**DETAILED SYLLABUS
FOR
MASTER OF SCIENCE [INFORMATION TECHNOLOGY] (MSc[IT])
(FOR BATCH 2002-2004)**



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MSC(IT) SYLLABUS (2002-2004 BATCH)**THEORY PAPERS
SEMESTER - I**

SUBJECT CODE	SUBJECT NAME	MARKS	THEORY (INTERNAL)	TOTAL
1MSC(IT)1	COMPUTER ORGANIZATION & ARCHITECTURE	100	40	140
1MSC(IT)2	NETWORKING	100	40	140
1MSC(IT)3	DATA STRUCTURES AND ALGORITHMS USING C	100	40	140
1MSC(IT)4	OPERATING SYSTEMS	100	40	140
1MSC(IT)5	GUI PROGRAMMING IN VISUAL BASIC	100	40	140

**PRACTICALS AND PROJECTS
SEMESTER - I**

SUBJECT CODE	SUBJECT NAME	PRACTICAL (EXTERNAL & VIVA)	PRACTICAL (INTERNAL)	TOTAL
1MSC(IT)6	C & DATA STRUCTURES	60	40	100
1MSC(IT)7	VISUAL BASIC	60	40	100

SEMESTER - II

SUBJECT CODE	SUBJECT NAME	MARKS	INTERNAL MARKS	TOTAL
2MSC(IT)1	DATABASE MANAGEMENT SYSTEM & ORACLE	100	40	140
2MSC(IT)2	OBJECT ORIENTED PROGRAMMING IN C++	100	40	140
2MSC(IT)3	SOFTWARE ENGINEERING	100	40	140
2MSC(IT)4	WINDOWS SERVER ADMINISTRATION	100	40	140
2MSC(IT)5	ELECTIVE I	100	40	140

**PRACTICALS AND PROJECTS
SEMESTER - II**

SUBJECT CODE	SUBJECT NAME	EXTERNAL MARKS	INTERNAL MARKS	TOTAL
2MSC(IT)6	C++	60	40	100
2MSC(IT)7	ORACLE & WINDOWS SERVER ADMINISTRATION	60	40	100
2MSC(IT)8	MINOR SUMMER PROJECT	60	40	100

**THEORY PAPERS
SEMESTER - III**

SUBJECT CODE	SUBJECT NAME	MARKS	THEORY (INTERNAL)	TOTAL
3MSC(IT)1	CURRENT TRENDS & TECHNOLOGIES	100	40	140
3MSC(IT)2	PROGRAMMING IN JAVA	100	40	140
3MSC(IT)3	INTERNET & E-COMMERCE	100	40	140
3MSC(IT)4	LINUX & WEB SERVER ADMINISTRATION	100	40	140
3MSC(IT)5	ELECTIVE –II	100	40	140

**PRACTICALS AND PROJECTS
SEMESTER - III**

SUBJECT CODE	SUBJECT NAME	PRACTICAL (EXTERNAL & VIVA)	PRACTICAL (INTERNAL)	TOTAL
3MSC(IT)6	JAVA	60	40	100
3MSC(IT)7	INTERNET & E-COMMERCE AND LINUX	60	40	100

**THEORY PAPERS
SEMESTER - IV**

SUBJECT CODE	SUBJECT NAME	MARKS	THEORY (INTERNAL)	TOTAL
4MSC(IT)1	VISUAL C++	100	40	140
4MSC(IT)2	COM/DOM	100	40	140
4MSC(IT)3	ELECTIVE III	100	40	140

**PRACTICALS AND PROJECTS
SEMESTER-IV**

SUBJECT CODE	SUBJECT NAME	PRACTICAL (EXTERNAL & VIVA)	PRACTICAL (INTERNAL)	TOTAL
4MSC(IT)4	VISUAL C++	60	40	100
4MSC(IT)5	COM/DCOM	60	40	100

MAJOR PROJECT

SUBJECT CODE	SUBJECT NAME	PRACTICAL (EXTERNAL & VIVA)	PRACTICAL (INTERNAL)	TOTAL
4MSC(IT)6	MAJOR PROJECT	250	130	380

**INTERNAL SCHEME FOR MSC(IT)
THE MARKING SCHEME FOR M.SC(IT)**

Theory paper	100 marks
Theory (Internal)	40 marks
Practical papers (External and Viva)	60 marks
Practical paper (internal)	40 marks
Minor summer project (External and Viva)	60 marks
Minor summer project (Internal)	40 marks
Major project (Viva)	250 marks
Major Project (Internal)	130 marks
Grand total	
Odd semester	900 marks
Even semester	1000 marks

ELECTIVE STREAM NAME

STREAM NAME	Papers
1.OPERATING SYSTEM	A1) System Programming A2) Distributed Operating System A3) O.S-Design Approach
2.COMPIILER DESGIN	B1) Theory of Computation B2) System Software B3) Compiler Designing
3.NETWORK TECHNOLOGIES	C1) Data Communication C2) Networking Techniques C3) Advance Networking
4.DIGITAL SIGNAL PROCESSING	D1) Mathematical Prerequisites D2) Numerical Techniques D3) Digital Signal Processing
5. SOFTWARE ENGINEERING	E1) Fundamental of Software Engineering E2) Business System and MIS E3) Advance Features of Software Engineering
6.ARTIFICAL INTELLIGENCE	F1) Introduction to AI F2) Practical aspects of AI F3) Advanced Topics in AI

Three Papers from one of the above stream:

Students can choose only one stream for all three elective papers.

Note:- Study centers can propose their own stream, based on the Expertise of their

Faculty, along with detailed syllabi for three elective papers.

These stream may be included in the course after the approval of the University.

1MSC(IT)1-COMPUTER ORGANIZATION AND ARCHITECTURE**UNIT-I**

Introduction to Organization and Architecture : System Buses : Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, PCI , Input/Output : External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors, The External Interface

UNIT-II

Internal Memory: Computer Memory System Overview, Semiconductor Main Memory, Cache Memory, Advanced DRAM Organization, External Memory - Magnetic Disk, RAID, Optical Memory, Magnetic Tape

Computer Arithmetic - The Arithmetic and Logic Unit (ALU), Integer Representation, Integer Arithmetic, Floating – Point Representation, Floating-Point Arithmetic .

UNIT-III

Instruction Sets: Characteristics and Functions, Machine Instruction Characteristics, Types of Operands, Types of Operations, Assembly Language, Instruction Sets : Addressing Modes and Formats, Addressing, Instruction Formats

UNIT-IV

CPU Structure and function : Processor Organization, Register Organization, The Instruction Cycle, Instruction Pipelining,

The Pentium Processor, The PowerPC Processor

UNIT-V

Reduced Instruction set Computers (RISCs) :Instruction Execution Characteristics, Reduced Instruction Set Architecture, Control Unit Operation - Micro - operations, Control of the CPU, Hardwired Implementation

TEXTS & REFERENCE BOOKS :

- ❑ COMPUTER ORGANIZATION AND ARCHITECTURE BY WILLIAM STALLINGS, TMH PUBLICATION
- ❑ COMPUTER SYSTEM ARCHITECTURE: BY M. MORRIS MANO,
- ❑ DIGITAL LOGIC AND COMPUTER DESIGN: BY M. MORRIS MANO

1MSC(IT)2-NETWORKING**UNIT-I**

The importance of Networking, Types of Networking, Transmission, Media, Signal Transmission, Digital Signaling, Analog signaling, Baseband and Broadband Transmission, Network adapters card, Multiplexer (FDM, TDM, STDM), Hub, repeater server based, peer based network, Network Topology, Physical topology, logical Topology.

UNIT-II

Switching Technique, Message switching, circuit Switching, Packet Switching, Virtual Circuit Switching, Datagram Switching, layered Architecture of LAN, OSI reference Model, IEEE Standards, Study of IEEE 802.3, IEEE 802.4 IEEE 802.5 LLC & MAC Sublayer of OSI Model, ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Bit Map protocol, CCITT X 25 Network.

UNIT-III

Sliding Window protocol, FDDI Token ring, ATM Network, FST Ethernet, Bridges, Transparent Bridge, Source routing, Bridge, Routers, Routing, Algorithm, Short path algorithm, flooding etc., congestion control Algorithm.

UNIT-IV

Internet basics, Transport layer protocol, TCP/IP, IP addresses, IPV6, UDP, FTP, (Electronic Mail) SMTP, MIME, HTTP, Network security, Data Encryption, Transposition ciphers, Substitution cipher

UNIT-V

Gateway, Modem, Modulation Technique, Basics of ISDN Channel, Tx carrier, Broad Band ISDN, Function of Networking operating system, Client O.S. Server O.S.

TEXT & REFERENCE BOOKS :

- ❑ NETWORKING ESSENTIALS:MCSE BY JAMES CHELLING, CHARLES PERKINS
- ❑ DATA & COMPUTER COMMUNICATION BY WILLIAM STALLINGS
- ❑ DATA COMMUNICATIONS BY PRAKASH G GUPTA
- ❑ LOCAL AREA NETWORK BY GERD E KEISER
- ❑ LOCAL AREA NETWORK BY S K BASANDRA S JAISWAL, GALGOTIA PUBLICATIONS

1MSC(IT)3-DATA STRUCTURES AND ALGORITHMS USING C**UNIT-I**

Introduction to Data Structure : Concept of data structure , abstract data structure, time & space analysis of algorithms. Memory representation of Array

Stacks and Queues : Introduction to stack & operation on stack, Multiple Stack, Stacks application: Infix, postfix, Prefix and Recursion, Introduction to queues & Operations on the Queues, , Circular queue, Dequeue, Priority queue.

UNIT-II

Linked list : Introduction to the Linked List as Stacks & Queues, Header nodes, Doubly Linked List, Circular Linked List, Operation on Linked list like Insertion, Deletion, Traversing, Merging, Copying, Comparing, Reversing, Inverting, Concatenating, etc., Application of Linked List.

UNIT-III

Trees : Basic Terminology of trees, Binary Trees, Tree Representations as Array & Linked List, Binary tree representation, Traversal of binary trees: In order, Preorder & postorder, Application of Binary trees, Threaded binary tree, B-tree & Height balanced tree, representation of B+ & B* trees, Conversion of General Tree to Binary tree, Counting binary trees, 2-3 Trees.

UNIT-IV

Searching & Sorting : Sequential searching, Binary search, Sorting : External & Internal, Insertion sort, Selection sort, Quick sort, Bubble sort, Heap sort, Merge Sort, Radix sort, Comparison of sorting methods, Algorithms of sorting and searching in Linked List and Arrays.

UNIT-V

Tables & Graphs : Hash table, Collision resolution Techniques, Introduction to graphs: Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversals – Depth first & Breadth first search, Spanning Trees, Minimum Spanning Trees, The basic Greedy Strategy for computing Algorithm of Kruskal

and Prim, Application of Graphs: Shortest path and Longest Path Problems, Topological sorting of nodes of an acyclic graph.

TEXTS & REFERENCE BOOKS:

- ❑ **FUNDAMENTALS OF DATA STRUCTURE** : BY S. SAWHNEY & E. HOROWITCH
- ❑ **DATA STRUCTURE** : BY TREMBLAY & SORRENSON
- ❑ **DATA STRUCTURE USING PASCAL**: BY TANNENBAUM & AUGENSTEIN
- ❑ **DATA STRUCTURE** : BY LIPSCHUISTS (SCHAUM'S OUTLINE SERIES, MCGRAW HILL PUBLICATION)

1MSC(IT)4 - OPERATING SYSTEMS

UNIT-I

Operating System basics : Definitions- Simple Batch System , Multi programmed Batched System, Time-sharing system, Personal Computer System, Parallel System, distributed system, Real-time system, System components, Operating system Services, System Calls, System programs, System structure, System Design and Implementation, System Generations .

Process Management: Process concepts, process state & process control block, Process Scheduling, Scheduling criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real Time Scheduling.

UNIT- II

Process Synchronization: The Critical Section Problem, Semaphores, Classical Problem of Synchronization, Monitors, Atomic Transactions, System Model, Deadlock Characterizations, Method for Handling Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined approach to Deadlock.

UNIT-III

Storage Management: Logical versus physical address space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing, Other Consideration, Demand Segmentation .

UNIT-IV

File System Interface : File concept, Access methods, Directory structure, Protections, Consistency, Semantics, File system structure, Allocation methods, Free space management, Directory implementations, efficiency and performance, Recovery

I/O System : Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Performance, Disk Structure, Disk Scheduling, Disk Management, Swap Space Management, Disk reliability, Stable Storage Implementation.

UNIT-V

Case Studies- UNIX - Design principles, Programmer interface, User interface, Process management, Memory management, File system, I/O system.

TEXTS & REFERENCE BOOKS :

- ❑ **OPERATING SYSTEM CONCEPTS** BY SILBERSCHATZ & GALVIN, ADDISON WESLEY PUBLICATION
- ❑ **OPERATING SYSTEM CONCEPTS & DESIGN** BY MILAN MILEN KOVIC, TMH PUBLICATION.

1MSC(IT)5-GUI PROGRAMMING IN VISUAL BASIC**UNIT-I**

Integrated Development Environment of VB, User Interface Designing, Basics of Event driven programming. Form- Designing, Showing & Hiding

Data Types, Variables & Constant, Arrays, Dynamic Arrays, Array as function, Collections, Procedures, Arguments passing, Functions Return Values.

Control flow Statements: if-then, if-then-else, Select case, looping statement: Do-Loop,

For-Next, While-Wend, Nested Control Structure, Exit statement.

UNIT-II

Basic Active X Control & Their Use - Text box, List box, combo box, Scroll bar, Slider & Fire Controls. Advance Active X Control - Common Dialog controls, Color, Font, File open, file save, print help, Tree view & List view Controls.

Graphics controls, Image Handling in VB, Coordinate System, Graphics methods- Text Drawing, Lines & Shape, Filling Shapes, Grid methods Menu editor: Pull-down, Pop-up and Dynamic menus

UNIT-III

Multiple Document interface- Parent & Child Forms & Methods. OLE-Basics OLE at Runtime, OLE control Properties & Methods developing applications with OLE control Error handling: Types of Errors, Error handling methods and functions

UNIT-IV

Database programming with VB -- DATA Control- methods, Properties, Visual data manage, Connectivity with database, DATA bound controls.

ADO data control creating & using database, Attaching Queries with database

RDO creating & using database.

DATA report

UNIT-V

Visual Basic & Internet programming - HTML Pages, Server Client Interactions, DHTML, Web browser control its basic properties.

TEXTS & REFERENCE BOOKS:

- ❑ **MASTERING VISUAL BASIC 6** BY EVANGELOS PETROUTSOS, BPB PUBLICATIONS
- ❑ **BEGINNER'S GUIDE TO VISUAL BASIC 6** BY REETA SAHOO & G.B. SAHOO, KHANNA PUBLISHING HOUSE
- ❑ **PETER NORTON'S GUIDE TO VISUAL BASIC 6**
- ❑ **BEGINNING VISUAL BASIC 6** BY PETER WRIGHT, SHROFF PUBLISHERS
- ❑ **VISUAL BASIC 6 SUPER BIBLE** BY DAVID JUNG, BOUTAIN, PARDUM, TECHMEDIA PUBLICATIONS

2MSC(IT)1-DATABASE MANAGEMENT SYSTEM & ORACLE**UNIT-I**

INTRODUCTION TO DATABASE SYSTEMS : Operational Data, File management Vs Data management, Characteristics of database approach, An Architecture for a Database System, Advantages and Disadvantages of DBMS, Data associations - Entities, Attributes and Associations, Relationship among Entities, Representation of Associations and Relationship, Data Model classification, Entity Relationship model.

RELATIONAL DATA STRUCTURE : A review of set theory, Relations, Domains and Attributes, Tuples, keys, Extensions and Intensions, Relational Algebra and Operations, Retrieval Operations

UNIT-II

RELATIONAL DATABASE DESIGN : Universal Relation, Anomalies in a Database, Normalization Theory, Functional Dependencies. Closure of a set of F.D Covers, Non redundant and minimum cover, Canonical cover, First, Second and Third Normal Forms, Relations with more than one candidate key, Good and bad decompositions, Boyce Codd Normal form, Multivalued dependencies and Fourth Normal Form, Join dependencies and Fifth Normal Form.

UNIT-III

QUERY PROCESSING: Query processing stages, Query interpretation, Equivalence of Expression, Query Execution statistics. Query Execution plan, Query Estimation, Query Evaluation,

THE DISTRIBUTED DATABASES : Distributed Database concepts, Architecture of Distributed Databases, The design of Distributed Databases, Distributed Query processing, Recovery in Distributed systems, Commit protocols for Distributed Databases, Multi database System

UNIT-IV

DDL & DML : Data Definition Language (DDL) - Creating, Altering & Dropping tables, Integrity Constant, Data Manipulation Language (DML) - Select Insert, Update, Delete Commands, Transaction Control using SQL - Commit, Rollback, Save point command, Data Controlling using SQL - Grant, Revoke, Set Role, SQL functions,

UNIT-V

PL/SQL : Introduction to PL/SQL Execution environment, Oracle transaction, Cursor, Parameterized, Implementation of concurrency control in oracle using locks, Stored procedure, Function, Package, Overloading procedure and function, Database triggers.

TEXTS AND REFERENCE BOOKS:

- ❑ AN INTRODUCTION TO DATABASE SYSTEM (3RD ED.) : BY C. J. DATE
- ❑ DATABASE SYSTEM CONCEPTS : BY HENRY F. KORTH
- ❑ DATABASE MANAGEMENT SYSTEMS BY LEON & LEON, VIKAS PUBLICATIONS.
- ❑ AN INTRODUCTION TO DATABASE SYSTEM BY BIPIN C. DESAI
- ❑ THE ORACLE COOK BOOK BY LIEBSCHUTYZ, BPB PUBLICATIONS
- ❑ ORACLE A BEGINNERS GUIDE BY MICHAEL ABBEY & MICHAEL J. COREY, TMH PUBLICATIONS
- ❑ ORACLE & CLIENT SERVER BY BOBROSKI
- ❑ SQL PL/SQL THE PROGRAMMING LANGUAGE OF ORACLE BY IVAN BAYROSS

2MSC(IT)2-OBJECT ORIENTED PROGRAMMING IN C++**UNIT-I**

C++ a nearly superset of C, Hello World in C++, New style comments, New style i/o Insertion and extraction operators (absence of format specifiers and implicit overloading) cascading, Implicit operator overloading with bit shift operators, And precedence New style i/o manipulators, New style declarations: placement, Dynamic initialisation, Scope resolution operator, Const type qualifier, Reference variables, Type-cast operator, Strong typing and automatic type-conversion.

Functions: Main function in C++, Meaning of empty argument list, Function prototyping, Inline functions, Call by reference and return by reference, Default arguments, Overloaded functions, And argument matching.

User defined data types: Enumerated types, Use of tag names, Anonymous unions, Scope of tag names

UNIT - II

Classes and Objects : C-structures, Putting functions in a C++ structure: Recap of typedef and pointer to a function, C++ structures:Data members and member functions Access specifiers, C++ classes, Objects, More on classes and objects, Friend functions Pointers to class members, Object memory model and static member variables static member functions, This pointer, Principles of object oriented programming

Constructors and Destructors : Using objects like primitive data types: When Constructors and Destructors are called. Default Constructor, Access specifiers for constructors, and instantiation parameterized constructors, Conversion constructors, And initialization of constants destructors, Dynamic memory allocation: New and delete, Allocating memory for arrays copy constructor,

UNIT-III

Inheritance : Public derivation, Private derivation, The protected access specifier, Access specifier and modes of derivation (summary), Multilevel inheritance, Multiple inheritance: Advantages and

disadvantages Dreaded Diamond derivation (DDD), Resolving DDD through the virtual keyword Hybrid inheritance, Hierarchical inheritance

Polymorphism: Overloading as polymorphism, Dynamic polymorphism, Function overriding, Virtual functions, Virtual function tables and late binding, References and virtual functions, Pure virtual functions and abstract base classes.

UNIT-IV

Operator Overloading: Operator overloading as another form of polymorphism examples, Use of friend functions, Restrictions on operator overloading, prefix and postfix forms of ++ and --, Overloading the subscript operator overloading other operators.

I/O : C I/O basics, streams, Text and binary streams, Recapitulation of formatted I/O in C, C++ stream classes, Using format flags, Object I/O, Overloading inserters and extractors, I/O functions, Creating manipulators, File classes, Detecting eof, various file i/o functions, Obtaining the current file position, I/O status and customized I/O files.

UNIT-V

Exception handling: Exception handling in C: Signal/raise and setjmp/ longjmp, Object memory model and problems with C-style exception handling in C++, try, Throw, Catch sequence multiple catch blocks, uncaught exceptions, Catch- all exception handler.

Templates and Namespaces: Reason for templates: Compactness and flexibility, function template examples, Explicit specialization, overloading a function template, Class templates, Out of class definition of member functions, Explicit specialization of class templates, Default arguments, Namespaces, Global namespace and namespace std Nested namespaces.

TEXTS AND REFERENCE BOOKS :-

- ❑ C++ COMPLETE REFERENCE BY HERBERT SCHILDT
- ❑ OBJECT ORIENTED PROGRAMMING WITH C++ BY BALAGURASAMY:
- ❑ C++ PROGRAMMING LANGUAGE BY STROUSTRUP
- ❑ TURBO C++ BY ROBERT LAFORE

2MSC(IT)3-SOFTWARE ENGINEERING

UNIT-I

Software : Software characteristics, Components & applications, Software Engineering - a layered technology, Software process models - Linear sequential model, Prototype & RAD Model., Evolutionary software process model – Incremental model and spiral model.

Software project management : Project Management Concepts – people problem and process .

S/w process and project metrics :Metrics in the process and project domains . software measurement –size oriented, Function oriented metrics, Extended function, Logical metrics

UNIT-II

Software project planning : Objectives, Scope, Project Estimation, Decomposition Techniques, Empirical Estimation Models.

Analysis concept and principles : Requirement analysis, Communication Techniques, Analysis principles, Software prototyping, Specifications.

Analysis modelling : Elements of the analysis modeling, Data modeling . Functional modeling and information flow, Behavioral modeling, Data Dictionary.

UNIT-III

Design Concepts and principles : Design Process, Design concepts, Design principles, Effective modular design .

Design methods : Architectural design process, Transform mapping and transaction mapping, Interface design, - Internal and external design, Human computer interface design, Interface design guidelines, procedural design,

UNIT-IV

S/w Quality Assurance: Quality concepts, Matrix for software Quality, Quality movement, S/W quality assurance, S/W Review, Formal Technical reviews, Formal approaches to SQA, S/W Reliability, ISO 9000 Quality Standards

S/w testing models: S/W testing fundamentals, Test case Design, White and Black Box Testing, Basic path testing, Control structure

S/w testing strategies: Strategic Approach to S/W testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging

UNIT-V

S/w reuse : Reuse process, Building reuse components, Classified and retrieving components, Economics of S/W reuse

Computer aided s/w engineering: Introducing of CASE, Building Block for CASE, Taxonomy of case tools, Integrating CASE environment, Integrating Architecture, CASE repository

TEXTS AND REFERENCE BOOKS :

- ❑ SOFTWARE ENGINEERING BY R.S.PRESSMAN
- ❑ AN APPROACH TO SOFTWARE ENGINEERING BY PANKAJ JALOTE
- ❑ SOFTWARE ENGINEERING - A PRACTITIONER'S APPROACH, FIFTH EDITION BY ROGER S. PRESSMAN, McGraw-Hills

2MSC(IT)4-WINDOWS SERVER ADMINISTRATION

UNIT-I

Introduction to Windows NT, Various Features, Differences with other Windows Environment and other O.S.s., Windows NT workstations Versus Server. Kernel and its Subsystems: Kernel/User Mode, Win32 Subsystem.

Security Models: System level restrictions, Server application security, Domain group access, Right and privilege verification, Application Support- Windows and Non Windows applications.

Installation: Requirement Analysis, Basic Hardware required, Workgroup and Domain concepts: PDC, BDC.

Network Configuration: Selecting NIC, Installing NIC driver, Choosing protocols and services

UNIT-II

NT Administration: User manager for domain, Disk administration, Backup, System policy editor, Remote access administration, Network clients administration.

Control panel- Start and stops services from control Panel, Adding/ Removing Hardware and Software with control panel.

Windows NT File systems: Physical file organisation, Basic File systems: FAT, NTFS, CDFS, HPFS, The FAT file systems, The NTFS file systems, File systems Integrity and recoverability, File compression.

UNIT-III

Networking with TCP/IP: TCP/IP services in NT, Advantages of using TCP/IP in NT, TCP/IP installation and configuring DHCP and WINE services.

Remote Access Service: Remote access clients and servers, Installing and configuring Remote Access Server, Administration of RAS.

UNIT-IV

Setting and running up a web server – Windows NT web server - Internet Information Server, IIS setup, setting up a web site, Virtual

directories, Virtual Web Sites. Administration of Web Server with ISM.

Windows NT Registry – Registry working, Necessity of registry, Registry Database layout, Registry Editor and its working.

Diagnosis and troubleshooting NT hardware and software installation problems, Startup problems, problems with Logon, Accounts & password, Network HW and SW problems, Performance problems. NT diagnostic tools: WINMSD, Network Monitor.

UNIT-V

HAL, Kernel and Executive: Hardware Abstraction Layer (HAL), Kernel – Kernel objects and Threads, NT Executives – I/O Manager and Device Drivers, Process Manager, Virtual Memory Manager, Object manager, LPC facility, Security Reference Monitor.

Protected Subsystems: NT Subsystem's working, Win32 Subsystem-difference between Win16 & Win32, Testing and Queuing Model, Win32 Programming Support, Windows on Windows- Starting win16 programs, Multitasking with WOW VDM, Thunking 16-bit to 32-bit runtimes, Intercrosses Communication (IPC), MSDOS Emulation Layers.

Device Drivers: Windows device scheme, NT Drivers Models- Service Control Monitor, Kernel Mode, User modes, Virtual device mode, Driver requirements and operations.

TEXTS AND REFERENCE BOOKS :

- ❑ **The Complete Reference: Windows NT 4** - Griffith Wm. Kadnier - Tata McGraw Hill.(ISBN - 0-07-463222-1.)
- ❑ **Windows NT 4 Unleashed** - Robert Cowart -Techmedia (BPB Publications), ISBN- 81-7635-074-5.
- ❑ **Windows NT Server 4: MCSE Training Guide** - Joe Casad, Wayne Dalton - Techmedia. (BPB Publications), ISBN - 81-87105-45-3

2MSC(IT)5- (A1) ELECTIVE-I (OPERATING SYSTEM) (SYSTEM PROGRAMMING)

UNIT- I

Language Processors :Introduction, Language Processing activities, Fundamentals of language processing, Fundamentals of language specifications, Language processor development tools

UNIT -II

Data Structures for Language Processings, Scan & Painting, Search data structures, Allocation data structure, Scanning, Parsing

UNIT- III

Assembly language and macros and macro processors, Elements of assembly language programming, A simple assembly scheme, Pass structure of Assemblers, Design of two pass assembler, Macro definition & call, Macro Expansion, Nested macro calls, Advanced macro facilities

UNIT - IV

Compilers and interpreters, Aspects of compilation, Memory allocation, Compilation of Expressions, Compilation of control structures, Code optimization

UNIT - V

Linkers & S/W Tools, Relocation and linking concept, Design of a linker, Self Relocating programmes, Loaders, S/W tools for program development

Editors, Debug monitors, Program Environments, Users Interfaces

TEXTS AND REFERENCE BOOKS:

- ❑ **SYSTEM PROGRAM & OPERATING SYSTEM** - BY D. M. DHAMDHERE

**2MSC(IT)5(B1)-ELECTIVE-I
(COMPILER DESIGN)
(THEORY OF COMPUTATION)**

UNIT-I

Theory of Computation: Formal language, Need for formal computational models, Non-Computational problems, Diagonal argument and Russel's paradox

UNIT-II

Deterministic Finite Automaton (DFA), Non-deterministic Finite Automaton (NFA). Regular languages and regular sets, Equivalence of DFA and NFA, Minimizing the number of states of a DFA, Non-Regular languages

UNIT-III

Pushdown Automaton (PDA), Deterministic PushDown Automaton (DPDA), Non-equivalence of PDA & DPDA.

UNIT-IV

Context free grammars. Greibach Normal Form (GNF) and Chomsky Normal Form (CNF), Ambiguity, Parse free representation of Derivations. Equivalence of PDA's and CFG's . Parsing techniques for parsing of general CFG's

UNIT-V

Turing machine(TM): One tape, Multitape . The notions of time and space complexity in terms of TM. Construction of TM for simple problems. Computational complexity.

Chomsky Hierarchy of language : Recursive and Recursively – enumerable languages.

TEXTS AND REFERENCE BOOKS:

- ❑ INTRODUCTION TO AUTOMATION THEORY, LANGUAGES & COMPUTATION - BY JOHN E HOPCROFT, RAJEEV MOTWANI, JEFFREY D. ULLMAN.
- ❑ THEORY OF COMPUTER SCIENCE (AUTOMATA, LANGUAGES AND COMPUTATION) - BY MISHRA & CHANDRASEKARAN (2ND EDITION) PHI ISBN-81-203-1271-6

- ❑ ELEMENTS OF THE THEORY OF COMPUTATION - BY LEWIS & PAPADIMITRIOU , PHI ISBN 81-203-1016-0
- ❑ INTRODUCTION TO LANGUAGES AND THEORY OF COMPUTATION - BY JOHN C . Martin (2nd edn) ISBN-0-07-463722-3
- ❑ THEORY OF COMPUTATION - BY BERNARD M.MORET PEARSON ISBN-81-7808-550
- ❑ FUNDAMENTALS OF THEORY OF COMPUTATION - BY RAYMOND GREENLAW & H.JAMES HOOVER (HARCOURT) ISBN : 81-7867-036-4
- ❑ ELEMENTS OF DISERETE MATHS - BY C.L.LIU, TMH 2nd edn ISBN-0-07-043476-X

**2MSC(IT)5(C1) ELECTIVE I
(NETWORK TECHNOLOGY)
(DATA COMMUNICATIONS)**

UNIT -I

Analog and Digital Transmission, Frequency Spectrum, Synchronous & Asynchronous Transmission, Simplex, Half duplex, Full duplex, Attenuation distortion, noise, Ideal channel, Channel capacity, Baud rate, Bit rate, Base band, Broadband Channel, Multiplexing, FDM, TDM, STDM, Concentrator, T1 carrier.

UNIT-II

Modulation Techniques for Digital Signal, ASK, FSK, PSK, Analog Modulation, AM, FM, PM. PCM, PAM, Delta Modulation, Natural sampling, Flat top sampling, PWM, digital encoding, Schemes, NRZ Encoding, Manchester encoding, Multilevel Binary, Biphasic

UNIT -III

Type of modem, Component and feature of modem, Some modem standards V.24,

Rs 232 Interface, Null Modem, X.21 interface, X.25 Network, Switches

UNIT -VI

Information theory, Entropy, Joint & conditional entropy, Information rate, Channel capacity of BSC, Shannon theorem, Circuit switching, Packet switching, Frame relay concept, Cell relay concept.

UNIT-V

Error detection & error correction code, Parity check, Cyclic redundancy check, Hamming distance code, Study of electromagnetic spectrum

TEXTS AND REFERENCE BOOKS:

- ❑ Data Communications – BY William Stallings PHI Publication
- ❑ Data Communication -BY P.C. Gupta PHI Publication
- ❑ Understanding Data Communication & N/W- BY William A. SHAY
- ❑ Computer N/W-BY A.S Tanenbaum
- ❑ Local Area N/W -BY Gerde .E Keiser

**2MSC(IT)5(D1) ELECTIVE-I
(DIGITAL SIGNAL PROCESSING)
(MATHEMATICAL PREREQUISITES)**

ADVANCED CALCULUS AND MATHEMATICAL ANALYSIS

- ❑ Sets, Relations, Functions, Natural numbers, Integers, Rational, Real numbers
- ❑ Complex number, Argand diagram, n^{th} roots of unit, Exponential
- ❑ Function with complex argument, Euler's formula
- ❑ Sequence & series Convergence, Absolute convergence, Continuity Differential,
- ❑ Taylor's theorem, Riemann integrals, Sequence & series of functions,
- ❑ Uniform convergence
- ❑ Ordinary Differential equations, Linear Differential equations

PROBABILITY AND STATISTICS

- ❑ Probability, Random variable, Mathematical expectation, Density function.
- ❑ Probability distribution. Normal, Cauchy, Poisson distribution, Binomial distribution.
- ❑ Correlation & statistical independence.
- ❑ Basics of sampling theory, Sample, Mean & Variance

MATRICES AND LINEAR ALGEBRA

- ❑ Vector spaces and Linear transformation, Matrix of a Linear Transformation,
- ❑ Matrix Algebra, Systems of Linear Equations

TEXTS & REFERENCE BOOKS:

- ❑ REAL ANALYSIS – BY W. RUDIN
- ❑ COMPLEX ANALYSIS – BY AHLFORS
- ❑ PROBABILITY THEORY – BY W. FELLER

2MSC(IT)5(E1) ELECTIVE – I
STREAM NAME- (SOFTWARE ENGINEERING)
(FUNDAMENTALS OF SOFTWARE ENGINEERING)

UNIT-I

Data information and data processing, data structure, need for data processing, data processing cycle and functions, methods and applications of data processing, major functional areas within the data processing department, Advantages and drawbacks of Electronic Data Processing

Definition of a system, characteristics of a system :- Organization, Interaction, Interdependence, Integration, Central objective, Elements of a system : Outputs and Inputs, Processor, Control feedback environment, Boundaries and Interfaces, Types of system : Physical and Abstract system, Open and Closed system, Man made information systems

ROLE OF SYSTEM ANALYST : What does it takes to do system analysis? , Qualities of a system analyst, Responsibilities of a system analyst, Multi faceted role of the analyst

UNIT-II

Initial investigation : needs identification, determining the user's information requirements, problem definition and project initiation, background analysis, Fact findings, fact analysis

INFORMATION GATHERING AND FACT FINDINGS TECHNIQUES : What kind of information do we need? Information about user staff, firm, workflow,

Information Gathering tools: Review of literature, Procedure and forms, On-site observation, Interviews and Questionnaires .Types of questionnaire and interviews

UNIT-III

TOOLS OF STRUCTURED ANALYSIS : What is structured analysis ? Tools of structured analysis :- Conventional flowchart, Structured flowchart, Data Flow Diagram (DFD), Data Dictionary, Decision tree, Decision Table and Structured English .

FEASIBILITY SURVEYS : Aims of Feasibility Study, Identifying current deficiencies, Identifying alternative solutions, Feasibility Considerations, Steps in feasibility analysis, Feasibility Report, Cost, Cost & Benefit Categories, Cost & benefit classifications

UNIT -IV

SYSTEM DESIGN :-Design objectives, Logical and Physical design, Design methodologies, Input and output design, Form design

QUALITY ASSURANCE & TESTING : Quality Assurance, levels of quality assurance, Why is system testing necessary ? Test Plan, Levels and types of testing, Documentation

UNIT-V

IMPLEMENTATION AND SOFTWARE MAINTENANCE : Conversion, Post-implementation review, Software maintenance, maintenance issues, Enhancement

DATA PROCESSING RESOURCES : Renting of computers, outright purchase of computers, leasing of computers, computer bureaux, steps involved in selecting a computer system, Cost elements involved in Computer Based Information System, Problems encountered during computer installation, failures of early computer based information system, Factors involved in selection of a computer based information system

TEXTS AND REFERENCE BOOKS :-

- ❑ SYSTEM ANALYSIS AND DESIGN - BY E. M. AWAD .
- ❑ SYSTEM ANALYSIS AND DESIGN - BY. V. K. JAIN .
- ❑ DATA PROCESSING AND COMPUTER APPLICATIONS - BY V.K. KAPOOR .

3MSC(IT)1- CURRENT TRENDS AND TECHNOLOGIES

The topics of current interest in computer science and computer Applications shall be covered. The experts shall use their judgment from time to time to include the topics of popular interest, which are expected to be known for an application development software professional, currently, they include:

UNIT-I

PARALLEL COMPUTING : Parallel virtual machine (PVM) and message passing interface (MPI) libraries and calls. Advanced architectures, Today's fastest computers.

UNIT-II

MOBILE COMPUTING : Mobile connectivity-cells, framework, wireless delivery technology and switching methods, mobile information access devices mobile data internetworking standards, cellular data communication protocol, mobile databases- protocols, scope, tools and technology. M-business. WAP/Blue tooth.

E-Technologies

UNIT-III

ELECTRONIC COMMERCE : Framework, media convergence of applications, Consumer applications, organization applications

ELECTRONIC PAYMENT SYSTEMS : Digital token, smart card, credit card, risk in electronic payment system, designing electronic payment system

ELECTRONIC DATA INTERCHANGE (EDI) : Concept, application (legal, security & privacy) issues, EDI & electronic commerce, standardization & EDI, EDI software implementation, EDI envelop for message transport, Internet based EDI

DIGITAL LIBRARY & DATA WAREHOUSING : Concept, type of digital document issue behind document infrastructure, corporate data warehousing.

SOFTWARE AGENTS : Characteristics and properties of agents, technology behind software agents.

UNIT-IV

BROAD BAND TELECOMMUNICATION : Concepts, frame relay, cell relay, switched multi mega bit data service, asynchronous transfer mode, main concept in geographical information system E-cash, E-Business, ERP packages

UNIT-V

DATA WAREHOUSING : Data warehousing environment, architecture of a data warehousing methodology, analysis design, construction and administration

DATA MINING : Extracting models & patterns from large database, data mining techniques, classification, regression, clustering, summarization, dependency modeling, link analysis, sequencing analysis, mining scientific & business data

CURRENT TRENDS IN WINDOWS PROGRAMMING: C# and .NET

TEXTS AND REFERENCE BOOKS:

- ❑ BOOKS WILL BE ACCORDING TO THE LATEST TECHNOOGIES AND CAN BE CHANGED TIME TO TIME

3MSC(IT)2- PROGRAMMING IN JAVA**UNIT-I**

Importance and features of JAVA, Keywords, Constants, Variables, and Data Types. Operators and Expressions, Decision making, branching and looping: If Else, Switch? Operators, While, Do. While, For Statement, Labeled Loops Statement, Jump statements: Break, Continue, and Return, Arrays and Strings, Creating and Arrays, one and two Dimension Arrays, Strings Arrays, Methods, String and String Buffer Classes, Wrapper Classes

UNIT-II

Classes, Objects and Methods, Defining a class, adding variables and Methods, creating objects constructors, class inheritance, Inheritance, Basics types, using super, multi level hierarchy, abstract and final classes, object class, packages and interfaces, Access protection, Extending interfaces, packages.

Exception Handling, Fundamentals exception types, uncaught exceptions, throws, throw, try -catch, final, built in exceptions, creating your own exceptions, Multithreading, Fundamentals, Java Thread model: priorities, synchronization, messaging, thread class, Run able interface, Inter thread communication, suspending, resuming and stopping threads.

UNIT-III

Input/Output, Basics, Streams, Byte and Character stream, predefined streams, reading and writing from console and files. Using standard Java Packages (Lang, util, io), Networking, Basics, networking classes and interfaces, using java.net package, doing TCP/IP and Datagram programming. Applet Programming, Creating and executing Java applets, inserting applets in a web page, Java security.

UNIT-IV

AWT Classes, Event Handling and Swing classes, AWT Programming, Working with windows, Graphics and Text, using AWT controls, Layout managers and menus, Handling image, animation, sound and video, Event Handling, Different mechanism, the Delegation Event Model, Event Classes.

Event Listener interfaces, Adapter and Inner Classes, Java Swing, Applet, Icons and Labels, Text fields, Buttons, Combo Boxes, Tabbed and Scroll Panes, Trees, Tables.

UNIT-V

JDBC, Setting the JDBC connectivity with a backend database, RMI, Two tier and Multi tier Architecture, Object serialization, RMI Fundamentals, Programming using Java RMI Classes and interfaces, Servlets, Background, Life Cycle, Java Servlet Development kit, Servlet API, Handling HTTP Requests and responding, Using Cookies, Session Tracking and security issues.

TEXTS & REFERENCE BOOKS:

- ❑ **JAVA THE COMPLETE REFERENCE** BY PATRICK NAUGHTON AND HERBERT SCHIEDT.
- ❑ **PROGRAMMING WITH JAVA** BY E. BALAGURUSWAMY.
- ❑ **USING JAVA 1.2** BY JOSEPH WEBER.

3MSC(IT)3- INTERNET AND E-COMMERCE**UNIT-I**

ELECTRONIC COMMERCE : Technology & Prospects, Internet Commerce Architecture, and Internet Based E-Commerce: Issues, Problems & Prospects.

STRUCTURE OF ASP APPLICATION : Objects, Component, Integrating objects & components into ASP, Response Object, Request Object

UNIT-II

HTML : Concepts of Hypertext, Versions of HTML, Elements of HTML syntax, Head & Body Sections, Building HTML documents, Inserting texts, Images, Hyperlinks, Backgrounds and Colour controls, Different HTML tags, Table layout and presentation, Use of font size & Attributes, List types and its tags, Use of Frames and Forms in web pages, ASP & HTML Forms

UNIT-III

VB SCRIPT : Defining Memory Variables, Defining Constants, The complete IF construct, The Loop construct, The While Loop, The For Loop, The Case construct

UNIT-IV

WORKING WITH ASP APPLICATION : Application Concept, Application & the Global. As a file using Application object & variables

USING ACTIVE SERVER PAGES WITH DYNAMIC HTML : Client-Side Form Validation, Working with the file system - Reading and Writing to a File, Working with Files, Working with Drives and Folders

UNIT-V

USING ASP WITH DATABASES : Creating Connections with OLE DB and ODBC, Connecting to Microsoft Access Database

Executing a SQL Statement with the connection object, Advanced Methods & Properties of connection object, Working with Recordsets - Retrieving a Recordset, Recordset Cursor and Locking Types, Advanced Methods and Properties of the Recordset Object, Generating Dynamic Content from the Server - Detecting Browser

Properties, Using the Content Rotator Component, The Content Linking Component, Case Study on creating a Job Site

TEXTS & REFERENCE BOOKS:

- ❑ ACTIVE SERVER PAGES 2.0 (UNLEASHED) BY STEPHEN WALTHER: TECHMEDIA

3MSC(IT)4- LINUX AND WEB SERVSEER ADMINISTRATION

UNIT – I

Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell.

Linux File system-Boot block, super block, Inode table, data blocks, How Linux access files, storage files, Linux standard directories, Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, more, less, creating and viewing files, using cat, file comparisons, View files, disk related commands, checking disk free spaces.

Partitioning the Hard drive for Linux, Installing the Linux system, System startup and shut-down.

UNIT-II

Essential linux commands Understanding shells, Processes in linux-process fundamentals, connecting processes with pipes, Redirecting input output, manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep, Printing commands, grape, fgrep, find, sort, Cal, banner, touch, file, file related commands-ws, sat, cut, grep, dd, etc.

Mathematical commands- bc, expr, factor, units.

vi, joe, vim editor

UNIT-III

Shell programming Basic of shell programming, Various types of shell, shell programming in bash, conditional and looping statements, case statements, parameter passing and arguments, Shell variables, shell keywords, Creating Shell programs for automate system tasks and report printing, use of grep in shell, awk programming.

UNIT-IV

System administration Common administrative tasks, identifying administrative files – configuratinn and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing

groups, modifying group attributes, Temporary disable user's accounts, creating and mounting file system, checking and monitoring system performance file security & Permissions, becoming super user using su.

Getting system information - host name, disk partitions & sizes, users, kernel.

Backup and restore files, linuxconf. utility in GUI, reconfiguration hardware with kudzu

Configure desktop-X configurator, understanding XF86config file, starting & using X desktop. KDE & Gnome graphical interfaces, changing X settings.

UNIT-V

Basic networking administration Setting up a LAN using Linux, choosing peer to peer vs client/server model, setting up an Ethernet Lan, configuring host computers, checking Ethernet connecting, connecting to internet, administration in a networked environment, common networking administrative tasks, the network file system, configuring Ethernet, initializing Ethernet Interface, ifconfig, netstat and netconfig commands a TCP/IP networks, DNS services, routing using Linux, SLIP & PPP services, UUCP.

Installation & Administration of mail server, ftp server and Apache web server.

TEXTS & REFERENCES BOOKS :

- ❑ USING LINUX BY JACK TACKETT, DAVID GUNTER, PHI, EEE EDITION
- ❑ RED HAT LINUX7.X BIBLE -CRISTOPHER NEGUS, IDG BOOKS INDIA LTD.
- ❑ LINUX INSTALTION AND ADMINISTRATION, NICHOLAS WELLS, COURSE TECHNOLOGY (VIKAS PUBLISHING, NEW DELHI).
- ❑ UNIX - SUMITABA DAS
- ❑ UNIX SHELL PROGRAMMING - YASHWANT KANETKAR, BPB PUBLICATIONS,
- ❑ RED HAT LINUX UNLEASHED TECHMEDIA (BPB PUBLICATIONS)
- ❑ LINUX NETWORKING AND SECURITY - WELLS, COURSE TECHNOLOGY (VIKAS PUBLISHING, NEW DELHI).

**3MSC(IT)5(A2)-ELECTIVE-II
(OPERATING SYSTEM)
DISTRIBUTED OPERATING SYSTEM**

UNIT -I

- ❑ Introduction to the distributed systems
- ❑ Pros and Cons of distributed processing
- ❑ Hardware & Software concept
- ❑ Design issues
- ❑ Layered protocols
- ❑ Client server model, Addressing Primitives & Implementation issues
- ❑ ATM Layers & Switching

UNIT- II

- ❑ RPC Basic operation, Parameter passing, Binding, Implementation issues
- ❑ Design issues in group communication
- ❑ Clock synchronization
- ❑ Mutual exclusion
- ❑ Election Algorithms

UNIT -III

- ❑ Automatic transaction
- ❑ Deadlocks in distributed system
- ❑ Thread usage
- ❑ System models
- ❑ Processor allocation, design and implementation issues, Algorithms

UNIT-IV

- ❑ Scheduling in distributed systems
- ❑ Fault tolerance
- ❑ Introduction to real time distributed system
- ❑ Distributed file system design & implementation

UNIT-V

- ❑ Distributed shared memory
- ❑ Architecture
- ❑ Design & implementation issues
- ❑ Granularity, consistency models
- ❑ Replacement strategy

TEXT & REFERENCE BOOKS

- ❑ Andrew S Tanenbaum: **Distributed operating system**, Pearson Education Asia 2001
- ❑ **Distributed operating system**: P K Sinha

3MSC(IT)5(B2) ELECTIVE – II (COMPILER DESIGN) SYSTEM SOFTWARE

- ❑ Language Processors
- ❑ Introduction, Language Processing activities, Fundamentals of language processing
- ❑ Fundamental of language specification, LP Development tools
- ❑ Data Structure for Language Processing
- ❑ Search Data Structures, Allocation Data Structures
- ❑ Scanning & Parsing
- ❑ Assemblers
- ❑ Elements of ACP, Pass structure of assemblers, Design of a 2 pass assembler
- ❑ Macros & Macro Processors
- ❑ Definition and call, Expansion, Nested Macro calls, Advanced Macro facilities
- ❑ Design of a Macro Preprocessor
- ❑ Compilers & Interpreters
- ❑ Aspect of compilation, Memory allocation, Compilation of expressions & control structure, Code optimization, Interpreters
- ❑ Linkers
- ❑ Relocation and linking concepts, Design of a linker, Self-relocating programs
- ❑ A linker for MS-DOS, Linking for Overlays, Loaders
- ❑ Software tools
- ❑ S/W tools program development, Editors, Debug monitors, Programming Environments, User interfaces

TEXT AND REFERENCE:

- ❑ System Programming & Operating System By D.M.Dhamdhare

3MSC(IT)5(C2) ELECTIVE- II (NETWORK TECHNOLOGIES) NETWORKING TECHNIQUES

UNIT-I

The Transport & Upper Layers : Role of transport protocol, TCP and UDP, Operating the TCP Protocol, Programming Interface to TCP, ISO Transport Protocol, Real time transport Protocol, RTCP, Session layer, Session control protocol, Presentation layer.H.323 protocol

UNIT-II

Routing & Traffic control : Link state Routing, Distance vector routing, Broadcast & Multicast routing, ISO Routing, and Routing on the Internet, Hierarchical Routing, Routing information protocol, IP addressing subnetting, and supernetting.

UNIT-III

Causes of congestion, Method to control congestion.

General Principles of congestion control congestion prevention policies, Traffic shaping, Choke packets, Load shedding, Maxflow algorithm.

Data compression, Entropy & source encoding, JPEG & MPEG Standard, Compression of video signals.

UNIT-IV

Security : Security attacks, security services, a model for internetworking Security, conventional

encryption model, classical encryption techniques, the data encryption standards,

Key distribution, Random Number Generation, Principles of public key cryptosystems,

Key management, RSA Algorithms, Authentication requirements, Authentication functions, Cryptographic checksums, Hash Functions

UNIT-V

Security : Digital Signature, Authentication protocol Cryptographic Algorithms, the MD5 Message Digest Algorithm, Secure Hash Algorithms (SHA), International Data Encryption Algorithm (IDEA),

LUC Public Key Encryption, Kerberos, X.509 Directory Authentication Service. Pretty Good Privacy (PGP), Diffie-Hellman Key exchange, Digital Signature standards (DSS), Privacy enhanced mail (PEM).

TEXT AND REFERENCE BOOKS:

- ❑ **Communication and network** by Lewis Mackenzie (McGraw-Hill)
- ❑ **Communication Network fundamental concepts and key architecture** by Alberto Leon-Garcia & Indra Widjaya (McGrawHill)
- ❑ **Computer Network** by Andrew S. Tanenbaum
- ❑ **Understanding Data Communication & Networks** by William A. Shay

3MSC(IT)5(D2) ELECTIVE-II (DIGITAL SIGNAL PROCESSING) NUMERICAL TECHNIQUES

Representation of numbers on a computer, Errors in numerical calculation, Absolute relative and percentage errors Error Propagation.

Discretization : representation of continuous functions by a table of values. Interpolation Finite differences, forward, backward and symmetric difference. Newton's formulae for interpolation, Gauss and Sterling's formulae. Practical implementation. Interpolation with unevenly spaced points. Lagrange's formula. Divided differences, and general interpolation formula. Inverse interpolation.

Solution of nonlinear algebraic equations in one variable by bisection, regula falsi, Newton-Raphson method. Maximization and minimization.

Numerical differentiation. Numerical quadrature: Trapezoidal rule, Simpson's rules, Romberg integration, Newton-Cotes Integration formulae, Euler Maclaurin formula, and its applications. Numerical calculation of Fourier integrals. Practical implementation.

Numerical solution of ordinary differential equations. Euler method, Runge-Kutta methods. Error estimation, Richardson extrapolation, and the coefficients of Dormand and Prince. Multi step methods (Predictor-corrector methods), Adams-Moulton method. Boundary value problems and the shooting method. Practical implementation.

Generation of a random variable with prescribed probability distribution. Normal, Poisson, and Cauchy distributions. Linear congruential generators. Errors in generating pseudo-random numbers: Independence and correlation of sequences of pseudo-random number generators.

Solution of systems of linear equations. Gaussian elimination. Ill Conditioned matrices, and pivoting, Iterative methods. Eigenvalue problems. Householder method.

Discrete Fourier Transform. Fast Fourier Transform. Convolution and deconvolution using FFT.

TEXT & REFERENCE BOOKS:

- ❑ S.S.Sastry, **Introductory Methods of Numerical Analysis**, Prentice Hall (Eastern Economy Edition) New Delhi, 1999 Rs.125
- ❑ William H.Press et al, **Numerical Recipes in C**, Second ED., Cambridge University Press, 1992 Rs.325.
- ❑ H.M.Antia, **Numerical Methods for Scientists and Engineers**, 2002, Hindustan Book Agency New Delhi/Birkhauser-Verlag Rs.900.
- ❑ E. Hairer, S.P.Norsett, G. Wanner, Solving **Ordinary Differential Equations I**, Nonstiff Problems, Springer Verlag, Berlin, 2nd ed 1993, or 1st ed. 1987

3MSC(IT)5(E2) ELECTIVE -II (SOFTWARE ENGINEERING) BUSINESS SYSTEM AND MIS

UNIT-I : THE EVOLVING ROLE OF SOFTWARE

- ❑ S/W Engineering: a layered approach
- ❑ S/W Process models
- ❑ Linear sequential model
- ❑ Prototype model
- ❑ Evolutionary S/W process Models
- ❑ Risk Management
- ❑ Reactive & proactive risk strategies
- ❑ Risk identification
- ❑ Risk projection
- ❑ Risk mitigation, monitoring & management
- ❑ Project scheduling & tracking

UNIT II : DESIGN FOR REAL TIME SYSTEMS

- ❑ System considerations
- ❑ Real-time systems
- ❑ Analysis & simulation of real time system

UNIT III: S/W TESTING STRATEGIES

- ❑ A strategic approach to S/W testing
- ❑ Unit testing, Integration, Validation
- ❑ System testing
- ❑ Art of debugging

UNIT- IV: TECHNICAL METRICS FOR OBJECT ORIENTED

- ❑ The intent of object oriented matrices
- ❑ Metrics of DD Design model
- ❑ Class oriented metrics
- ❑ Operation oriented metrics
- ❑ Metrics of OO Testing
- ❑ Metrics for OO Projects

UNIT-V : SOFTWARE REUSE

- ❑ Management Issues, The reuse process, Domain engineering, Building reuse components
- ❑ Economics of S/W reuse, Software reengineering, Business process reengineering
- ❑ Reverse reengineering, Restructuring, Forward reengineering

TEXTS AND REFERENCE BOOKS :

- ❑ SOFTWARE ENGINEERING BY R.S.PRESSMAN
- ❑ AN APPROACH TO SOFTWARE ENGINEERING BY PANKAJ JALOTE
- ❑ SOFTWARE ENGINEERING – A PRACTITIONER'S APPROACH, FIFTH EDITION BY ROGER S. PRESSMAN, McGraw-Hill

4MSC(IT)1 - PROGRAMMING IN VC++**UNIT- I**

Elements of GUI & Visual design, Designing and Creating a Visual C++ Program, Project work spaces, Debug and Release Targets, Cleaning up, various features of the Visual C++ IDE.

UNITS – II & III

Basics of Windows Architecture, Simple WIN 32 SDK executables,

UNIT- IV

Basics of MFC & MFC-based executables..

UNIT-V

MESSAGES AND EVENTS : Understanding Message maps and message loops, Events and Event handling, Mouse events, Keyboard events, Dynamic data Exchange and verification, creating Menus, Modeless dialog boxes.

UNIT-VI

GRAPHICS : Device contexts, working with images, bitmaps and icons, creating bitmap buttons, creating and using Pens, Brushes, and Fonts.

UNIT-VII

DOCUMENTS AND VIEWS : Document - View Architecture basics, the document class and view class, creating SDI applications, Multitasking, creating MDI Applications, Working with menu in documents,

Toolbar and status bar.

UNIT-VIII

HANDLING FILE AND DATA APPLICATIONS : Printing and Print preview, Saving, loading and transferring data, Serialization, File handling, using Databases and Record views, Database access, The Visual C++ ODBC class.

TEXTS & REFERENCE BOOKS :

- ❑ CHARLES PETZOLD, PROGRAMMING WINDOWS, 5TH EDITION, MICROSOFT PRESS, 1999
- ❑ JEFF PROSISE, PROGRAMMING WINDOWS WITH MFC, MICROSOFT PRESS, 2000

- ❑ IVOR HORTON, **PROGRAMMING VISUAL C++** STANDARD EDITION, WROX PRESS, 1999
- ❑ JON BATES AND TIM TOMPKINS, **PRACTICAL VISUAL C++ 6**, 2ND EDITION.
- ❑ CHUCK SPHAR, **LEARN VISUAL C++ NOW**, MICROSOFT PRESS/PHI, 1999
- ❑ DAVID KRUGLINSKI, GEORGE SHEPHERD & SCOT WINGO, **PROGRAMMING VISUAL C++**, MICROSOFT PRESS, INDIAN REPRINT, 2000
- ❑ MIKE BLASZCZAK, **PROFESSIONAL MFC WITH VISUAL C++**, WROX PRESS, 1999, INDIAN REPRINT, 2000, SHROFF PUBLISHERS AND DISTRIBUTORS

4MSc(IT)2 : COMPONENT ARCHITECTURE AND PROGRAMMING (COM, DCOM)

UNIT-I

INTRODUCTION TO MICROSOFT'S OBJECT TECHNOLOGY : Understanding OLE - OLE 1.0, OLE 2.0, OLE Controls, Structured Storage, Monikers, OLE Automation, An overview of Active X- Active X Documents, Asynchronous Storage, ActiveX Controls, Internet Monikers. Active-X Technologies - Active-X Hyperlinks, Active-X Conferencing, Active-X Server Extension, Active-X Script, Distributed Com (DCOM)

UNIT- II

BUILDING COM OBJECTS AND INTERFACES : Introduction to objects and classes, objects from a COM perspective, Encapsulation in COM, Interfaces, Inheritance in COM, method overriding Polymorphism and Class objects in COM. Clients and Servers, Local Server, Remote Servers, Proxies, remote procedure call, Generating GUI using UUIDGEN & GUIDGEN Exploring unknown, Implementing and COM Client and Server.

UNIT-III

COM PROGRAMMING WITH MFC : An Introduction to the MFC, MFC and OLE/Active-X, The Active-X Template Library, Multiple Interfaces and Inheritance. Multiple Interfaces by using Nested classes, Declaring nested classes, Declaring and Implementing Interface Maps, Implementing Icon for nested classes, using aggregation to simulate Inheritance, Interface Definition Languages.

UNIT-IV

DISTRIBUTED OBJECTS OVERVIEW : The Evolution of Distributed System, Client / Server - Two -Tier, Three-Tier, N-Tier.

Distributed COM- Object RPCS, the OXID, Passing Interface Painters, Optimizing DCOM, Caching OXID, Introduction to COM Security, DCOM and CAPI.

UNIT-V

THE CORBA ARCHITECTURE : Overview and History, The Object Request Broker, Interface Definition Language, The CORBA Communication Model, The CORBA object model, CORBA Client and

Servers, stubs and skeletons, Interface Definition Language (IDL) - IDL ground rules, coupling and cohesion, primitive and constructed types, container and exception type, The any type, Building a CORBA Application, Building a CORBA Server, Building a CORBA Client

TEXT & REFERENCE BOOKS:

- ❑ **COM/DCOM PRIMER PLUS:** BY CHRIS CARRY, VINCANT MAYFIELD
TECHMEDIA PUBLICATION
- ❑ **TEACH YOURSELF CORBA IN 14 DAYS:** BY JEREMY ROSENBERGER
TECHMEDIA PUBLICATION

**4MSC(IT)3(A3)-ELECTIVE-III
(OPERATING SYSTEM)
O.S-DESIGN APPROACH**

UNIT-I

- ❑ Introduction to O.S.
- ❑ Virtual computers
- ❑ Hardware Interface – CPU, Memory, Interrupts, I/O devices.
- ❑ O.S. Interface – System calls, Meta Information, naming OS objects, Devices as files.
- ❑ Process concept
- ❑ Communication between processes
- ❑ Standard input & standard output
- ❑ Communication with pipes

UNIT II & III

- ❑ Operating systems and design
- ❑ Design process, Problems, Techniques
- ❑ Two level Implementation
- ❑ Interface Design
- ❑ Protocols connections, decomposition pattern
- ❑ System call interface
- ❑ Implementation of a simple OS, Process, Waiting
- ❑ System Initialization
- ❑ Process switching
- ❑ System call interrupt handling

UNIT IV & V

- ❑ Flow of Control
- ❑ Signaling
- ❑ Interrupts
- ❑ OS as Event & Table managers
- ❑ Memory Management
- ❑ Levels
- ❑ Linking & Loading
- ❑ Program, loading variations
- ❑ Dynamic memory allocation need
- ❑ Memory Management System Calls
- ❑ Device Controllers

- ❑ Terminal Devices – Display commands, Keyboard, events, disk devices
- ❑ I/O system software

TEXT & REFERENCE BOOKS:

Operating Systems A Design Oriented Approach By Charles Chowley (TMH) 6th Reprint 2000

**4MSC(IT)3(B3)-ELECTIVE -III
(COMPILER DESIGN)
COMPILER DESIGNING**

UNIT-I

Introduction to Compilers – Basic parsing Techniques – Parsers – Shift reduce parsing – Operator Precedence parsing – Top down parsing – Productive parsers

UNIT-II

Automatic Construction of efficient parsers – SCR – LACR – Canonical LR parsing tables

Syntax Directed translation

Intermediate code – Postfix rotation – Parse trees and syntax trees – Three address code, quadruples and triples – translation of assignment statements, Boolean expression postfix translations – translation with a atop down parser.

UNIT-III

Symbol – tables – contents – data structures for symbol tables

Run-time shortage administration – Error Detection and recovery – Lexical phase errors – Syntactic phase errors – Semantic errors.

UNIT-IV

Introduction to Code Optimizations – Principal sources of optimization – loop optimization – The DAG representation of basic blocks – Value numbers – Global data flow analysis

UNIT-V

Code Generation object programs Problems in Code generation a Machine Model- A Simple Code generator – Register allocation & assignment – Code generation from DAG's – Peephole Optimization

TEXT AND REFERENCE BOOKS:

- ❑ **Principles of Compiler Design** – Alfred V Aho & Jeffrey D Ullman.

**4MSC(IT)3(C3)ELECTIVE-III
(NETWORK TECHNOLOGIES)
ADVANCE NETWORKING**

UNIT-I : CELLULAR TRANSMISSION

Radio Frequency communications, wireless services categories line-of-sight. Microwave Transmission, Frequency and characteristics, Wireless, Private Branch Exchange, Wireless Local Area Network, Satellite orbits, and Signal propagation delay, VSAT Satellite voice services. Wireless & mobile computing, cellular system cell, cells for coverage, Cell radius, Mobile switching office, Hands off, Base Station, Frequency reuse and cluster, Micro cell, Microwave link,

UNIT-II : EDI & ATM

EDI Layered Architecture, EDI in action, advantage of EDI, Security of EDI messages, Indian Scenario, various types of switches, Crossbar switches, space division switches, Time division switches, Basics of ISDN, Broadband ISDN and ATM, ATM Switches. The knockout switch, Batched Banyan switch. VLAN (virtual LAN), HDLC, PPP (WAN protocol).

UNIT-III : OPTICAL NETWORK

Optical source, Physics of light emission and amplification in semiconductor, LED, Semiconductor lasers, edge-emitting laser. Vertical cavity surface emitting laser, modulation of laser light, direct modulation, external modulation, Photoconductor, Photodiode, Optical receiver, Optical fiber, optical transmission FDDI, HPPI, Fast Ethernet.

UNIT-IV : WIRELESS NETWORK

WLL Time division duplex (TDD), FDD, TDMA wireless application protocol, definition of 2.5G and 3G, Overview of 3G GSM, GSM Services, FDMA, Mobile IP, CDMA, Wireless LAN 802.11, HIPER LAN, Blue tooth.

UNIT-V

Key services for the Mobile Internet Characteristics of the Mobile Internet current WAP Technology for Wireless application, HTTP, JAVA, HTML, XML, Scripting languages overview of WAP

Architecture, Network Infrastructure Services supporting WAP Clients, Overview of WML

TEXT AND REFERENCE BOOKS:

- ❑ **COMMUNICATION AND NETWORK** by Lewis Mackenzie (McGraw-Hill)
- ❑ **COMMUNICATION NETWORK FUNDAMENTAL CONCEPTS AND KEY ARCHITECTURE** by Alberto Leon-Garcia & Indra Widjaya (McGrawHill)
- ❑ **COMPUTER NETWORK** by Andrew S. Tanenbaum
- ❑ **UNDERSTANDING DATA COMMUNICATION & NETWORKS** by William A. Shay

**4MSC (IT)3(D3) ELECTIVE – III
(DIGITAL SIGNAL PROCESSING)
DIGITAL SIGNAL PROCESSING**

UNIT-I

Classification of signals and systems
System modeling in terms of differential and difference equations
State variable representation

UNIT-II

Fourier series
Fourier transforms and their application to system analysis

UNIT-III

Laplace transforms
Application of Laplace transform to system analysis

UNIT - IV

Convolution and superposition integrals and their application
Z-transforms and their application to the analysis and characterization of discrete time systems.

UNIT-V

Random signals and probability
Correlation function
Spectral density
Response of linear system to random inputs
Sampling and data reconstruction process

UNIT-VI

Z-transforms discrete linear system
Frequency domain design of linear system
Quantisation effects in digital filters

UNIT-VII

Discrete Fourier transform and FFT Algorithm.
High-speed convolution and its application to digital filtering

TEXT & REFERENCE BOOKS

- ❑ **Digital Signal Processing Principles, Algorithms and application** by John G Proakis, Dimitrios G. Manolakis (PHI) 3rd Edition ISBN - 81 - 203 - 1129 - 9
- ❑ **Theory and application of Digital Signal Processing** by Lawrence R. Rabiner Bernard Gold (PHI) ISBN 81 - 203 - 0501 - 9.
- ❑ **Introduction to Digital Signal Processing** by Johny R Johnson (PHI) , ISBN-81-203-0760-7.

**4MSC(IT)3(E3) ELECTIVE-III
(SOFTWARE ENGINEERING)**

ADVANCE FEATURES OF SOFTWARE ENGINEERING**UNIT –I OBJECT ORIENTED SOFTWARE REUSE TAXONOMY**

- ❑ Object oriented software reuse crisis
- ❑ Benefits of an object oriented approach
- ❑ Importance of software reuse
- ❑ Object oriented software engineering goals & principles
- ❑ Principles of object oriented software engineering
- ❑ Objectives of object oriented software reuse
- ❑ Evolution of object oriented software reuse

UNIT II

- ❑ The object oriented software reuse paradigm.
- ❑ Characteristics of object oriented s/w engineering reuse
- ❑ Life cycle importance of object oriented software reuse
- ❑ Object oriented software reuse processes, Domain
- ❑ Domain Boundary, Domain specific architecture
- ❑ Software reuse classification
- ❑ Basic processes
- ❑ Ad hoc reuse, Opportunistic reuse
- ❑ Systematic reuse
- ❑ Formalizing the S/W reuse process
- ❑ Identifying reusable assets

UNIT-III

- ❑ Object oriented software reuse initiation
- ❑ Planning for software reuse
- ❑ Initiating planning for software reuse
- ❑ Infrastructure Development
- ❑ Preparing for a cultural change
- ❑ Assessing potential problems
- ❑ Standards and practices
- ❑ Design standard
- ❑ Policy & procedure development
- ❑ Education & Training
- ❑ Reuse issues, Legal issues

UNIT-IV

- ❑ Object oriented software reuse management.

- ❑ Establish Domain, Writing a software reuse plan
- ❑ Responsibilities & duties
- ❑ Domain Engineer, Domain Analyst
- ❑ Domain Designer, Configuration management
- ❑ Quality management, Operation & maintenance of the reuse center
- ❑ Customer & User participation, Training
- ❑ Establishment & Maintenance of the repository system
- ❑ Reuse life-cycle Phases
- ❑ Integration of reuse into S/W Development & Maintenance

UNIT-V

- ❑ Risk management in Software product procurement
- ❑ Specificity of S/W products procurement
- ❑ Procurement process, Technical Due diligence
- ❑ Assessment team, Capability assessment
- ❑ Software product assessment

TEXTS AND REFERENCE BOOKS :

- ❑ **SOFTWARE ENGINEERING - A PRACTITIONER'S APPROACH**, 5th Edition by Roger S Pressman.
- ❑ **AN APPROACH TO SOFTWARE ENGINEERING** BY PANKAJ JALOTE

4MSC(IT)3-(F1)-ELECTIVE-III (ARTIFICIAL INTELLIGENCE) INTRODUCTION TO AI

Introduction: What is AI? Foundations of AI, History, Intelligence, Agents, Agent Architectures, Environments.

Philosophy of AI

Problem Solving Agents: Problem Formulation, Search (Blind and Informed), Search Algorithms: Breadth-First, Uniform Cost, Depth-First, Limited Depth-First, Iterative Deepening, Bi-directional, Greedy, A*, Heuristics, IDA*, Hill Climbing, Simulated Annealing.

Game Playing: Minimax, Minimax with Alpha-Beta Pruning.

Knowledge representation I: Basics of Knowledge Representation, Knowledge representation Paradigms, Propositional Logic, Inference Rules in Propositional Logic, First Order Logic, Inference Rules in FOL, Modus Ponens, Proof by Refutation, Resolution.

Conceptual Dependency : Semantic networks.

Agents That Communicate: Speech perception, Language Understanding, Language Structure, Transition network Grammars.

TEXTS AND REFERENCES

- ❑ Stuart Russell & Peter Norvig : **Artificial Intelligence: A Modern Approach**, Prentice Hall, 1995.
- ❑ Kenneth Ford, Clark Glymour, & Patrick Hayes (editors): **Android Epistemology**, AAAI Press/MIT Press, 1995.
- ❑ Stuart C. Shapiro: **Common Lisp: An Interactive Approach**, Computer Science press, 1992.
- ❑ Ivan Bratko: **Prolog Programming for Artificial Intelligence**, Second Edition, Addison Wesley, 1990.
- ❑ Philosophy of AI
- ❑ *Abductive Inference: computation, philosophy, technology*, by John Josephson and Susan Josephson (Cambridge University Press, 1994)
- ❑ **Computer Power and Human Reason : From Judgement to Calculation**, by Joseph Weizenbaum (W H Freeman & Co, 1976)

**4MSC(IT)3(F2) ELECTIVE-III
(ARTIFICIAL INTELLIGENCE)
PRACTICAL ASPECTS OF AI
LOGIC, PROLOG & LISP PROGRAMMING**

1. Logic

Propositional logic, connectives, equivalence, tautologies, contradictions, and contingencies, converse and contrapositive, normal forms. Modus Ponens, and rules of inference. Theorems.

Elements of semantics.

Predicate logic, quantifiers, free and bound variables, normal form, reduction to normal form, Herbrand's theorem, rules of inference. Resolution and theorem proving.

2. Prolog

Introduction. History, syntax, semantics, getting started running programs.

Goals. Clauses, procedures, backtracking.

Data structures and unification. Recursion in data and process. Variables are holes in data structures.

List processing. Some practical programming examples.

Mappings. Some principles of structuring problem solving.

Accumulators. Ways of constructing tail-recursive procedures from specifications.

Difference structures. Probably the best programming technique ever invented.

Computing with difference structures. Ways of exploiting the above.

Modifying backtracking. Ways of specifying control over the default chronological backtracking execution rule.

Case studies. Case studies that demonstrate larger programs and use the programming techniques previously introduced.

At the end of the course students should

- ❑ be able to write programs in Prolog using techniques such as accumulators and difference structures
- ❑ know how to model the backtracking behaviour of program execution
- ❑ appreciate the unique perspective Prolog gives to problem solving and algorithm design
- ❑ understand how larger programs can be prepared using the basic programming schemata introduced in the course

3. LISP

LISP preliminaries, LISP functions, Arithmetic primitives, boolean primitives, list manipulation primitives. List definition and construction, extracting portions of a list, user defined functions, control structures and garbage collection.

4. Practical Project**5. Theoretical Assignment****TEXTS AND REFERENCES:**

- ❑ Clocksin, W.F. (1997). Clause and Effect: PROLOG Programming for the Working Programmer. Berlin: Springer-Verlag.
- ❑ Bratko, I. (1986). PROLOG: Programming for Artificial Intelligence. Addison-Wesley.
- ❑ Shoham, Y. (1994). Artificial Intelligence Techniques in PROLOG. Morgan Kaufmann.
- ❑ LISP : *The ANSI Common Lisp*, by Paul Graham (Prentice Hall, 1996)

**4MSC(IT)3(F3) ELECTIVE-III
(ARTIFICIAL INTELLIGENCE)
ADVANCED TOPICS IN AI****1. Statistical Reasoning:**

Use of Certainty Factors in Rule-Based Systems. Associating probabilities to assertions in first-order logic. Bayes theorem. Bayesian Networks. Fuzzy Logic.

2. Learning:

Learning to classify concepts using features of their instances. Learning a concept [Induction] from examples. Explanation-Based Learning. Version Spaces. Neural Nets with back propagation.

3. Artificial Neural Networks:

- ❑ Introduction to artificial neural networks
- ❑ Learning rules and methods
- ❑ Backpropagation
- ❑ Introduction to a neural network tool
- ❑ Building neural networks
- ❑ Current topics in neural networks

4. Genetic Algorithms:

- ❑ Introduction to evolutionary computing
- ❑ Reproduction, crossover and mutation
- ❑ Representation
- ❑ Fitness

5. Practical Implementation**6. Current topics in Artificial Intelligence**