

# BS (COMPUTER SCIENCE) SCHEME OF STUDIES

## UAF

**BS (CS)** 4 Years Degree Program {Bachelor of Science in Computer Science}  
 150 credit hours spread over 8 semesters.  
**Eligibility:** F.Sc Pre-Engineering, F.Sc Pre-Medical, Intermediate in General Science, Intermediate in Computer Science, Intermediate in Commerce, FA/DBA/D Com with minimum requirement 45 %.

### Bachelor of Science in Computer Science; BS (CS); 150 credit hours

Computer Science Courses (108/150)				
#	Code	Course Title	Credit hours	Semester
1	CS-301	Introduction to Computers	3 (2-2)	1
2	CS-303	Introduction to Computer Programming	4(3-2)	1
3	CS-302	Fundamentals of Algorithms	3 (2-2)	2
4	CS-304	Discrete Structures	4 (4-0)	2
5	CS-401	Object Oriented Programming	3 (2-2)	3
6	CS-403	Data Base Systems	3 (2-2)	3
7	CS-402	Data Structures	3 (2-2)	4
8	CS-404	Digital Logic Design	3 (2-2)	4
9	CS-406	Software Engineering – I	4 (3-2)	4
10	CS-505	Analysis of Algorithms	3 (3-2)	5
11	CS-507	Computer Organization & Assembly	4 (3-2)	5
12	CS-509	Numerical Analysis	3 (2-2)	5
13	CS-502	Operating System Concepts	4 (3-2)	6
14	CS-504	Computer Architecture	4 (3-2)	6
15	CS-512	Automata Theory	3 (3-0)	6
16	CS-508	Computer Graphics	4 (3-2)	6
17	CS-506	Data Communication	3 (2-2)	6
18	CS-603	Compiler Construction	4 (3-2)	7
19	CS-607	Computer Networks	4(3-2)	7
20	CS-602	Artificial Intelligence	4(3-2)	8
21	CS-604	Software Project Management	10 (0-20)	8
22	CS-408	Modern Programming Languages	4(3-2)	4
23	CS-503	Web Programming	4(3-2)	5
24	CS-501	Software Engineering - II	4(3-2)	5
25	CS-510	Advanced Object Oriented Programming	4(3-2)	6
26	CS-601	System Programming	4(3-2)	7
27	CS-605	Visual Programming	4(3-2)	7
28	CS-609	Distributed Database Systems	4(3-2)	7

Supporting Courses (25/150)				
29	Math-303	Calculus and Analytical Geometry	4(4-0)	1
30	Math-304	Multi Variable Calculus	4(4-0)	2
31	Math-405	Differential Equations	4(4-0)	3
32	Math-406	Linear Algebra	3 (3-0)	4
33	PHY-405	Circuit Theory	3 (2-2)	3
34	PHY-305	Basic Electronics	3 (2-2)	1
35	Stat-507	Statistics and Probability	4(3-2)	5

General Education Courses (17/150)				
36	Eng-301*	Introductory Exercises in Reading, Comprehension and Communication Skills.	2(2-0)	1
37	Eng-302*	Advanced Exercises in Reading, Comprehension and Communication Skills.	2(2-0)	2
38	MBA-306	Financial Accounting	3(3-0)	4
39	MBA-404	Financial Management	3(3-0)	2
40	MBA-407	Human Resource Management	3(3-0)	3
41	SSH-402*	Pakistan Studies	2(2-0)	4
42	IS-401 / SSH-301(A)*	Islamic Studies / Ethics	2(2-0)	3

## Scheme of Studies

### BS (Computer Science)

#### Semester 1 (16 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-301	Introduction to Computers	3(2-2)
2	CS-303	Introduction to Computer Programming.	4(3-2)
3	Phy-305	Basic Electronics	3(2-2)
4	Math-303	Calculus and Analytical Geometry	4(4-0)
5	Eng-301	Introductory Exercises in Reading, Comprehension and Communication Skills.	2(2-0)

#### Semester 2 (16 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-302	Fundamentals of Algorithms	3(2-2)
2	CS-304	Discrete Structures	4(4-0)
3	Math-304	Multi variable Calculus	4(4-0)
4	Eng-302	Advanced Exercises in Reading, Comprehension and Communication Skills.	2(2-0)
5	MBA-306	Financial Accounting	3(3-0)

#### Semester 3 (18 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-401	Object Oriented Programming	3(2-2)
2	CS-403	Data Base Systems	3(2-2)
3	Math-405	Differential Equations	4(4-0)
4	Phy-405	Circuit Theory	3(2-2)
5	MBA-407	Human Resource Management	3(3-0)
6	IS-401/ SSH-301(A)	Islamic Studies / Ethics	2(2-0)

#### Semester 4 (22 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-402	Data Structures	3(2-2)
2	CS-404	Digital Logic Design	3(2-2)
3	CS-406	Software Engineering - I	4(3-2)
4	CS-408	Modern Programming Languages	4(3-2)
5	MBA-404	Financial Management	3(3-0)
6	Math-406	Linear Algebra	3(3-0)
7	SSH-402	Pakistan Studies	2(2-0)

#### Semester 5 (22 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-501	Software Engineering II	4(3-2)
2	CS-503	Web Programming	4(3-2)
3	CS-505	Analysis of Algorithms	3(2-2)
4	CS-507	Computer Organization & Assembly	4(3-2)
5	CS-509	Numerical Analysis	3(2-2)
6	Stat-507	Statistics and Probability	4(3-2)

#### Semester 6 (22 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-502	Operating System Concepts	4(3-2)
2	CS-504	Computer Architecture	4(3-2)
3	CS-506	Data Communication	3(2-2)
4	CS-508	Computer Graphics	4(3-2)
5	CS-510	Advanced Object Oriented Prog.	4(3-2)
6	CS-512	Automata Theory	3(3-0)

#### Semester 7 (20 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-601	System Programming	4(3-2)
2	CS-603	Compiler Construction	4(3-2)
3	CS-605	Visual Programming	4(3-2)
4	CS-607	Computer Networks	4(3-2)
5	CS-609	Distributed Database Systems	4(3-2)

#### Semester 8 (14 credit hrs)

		<b>Subjects</b>	<b>Credit Hrs</b>
1	CS-602	Artificial Intelligence	4(3-2)
2	CS-604	Software Project	10(0-20)

## NEW COURSES IN COMPUTER SCIENCE

<u>COURSE NO.</u>	<u>TITLE WITH CONTENTS</u>	<u>CREDIT HRS</u>
<b>CS-301</b>	<b>Introduction to Computers</b>	<b>3(2-2)</b>
	Brief history of computers and their applications. Major components of a computer. Computer and Society. Social impact of computer age. Computers in offices, industry and education. Office automation tools; Word processing, Graphic packages, Databases and Spreadsheets. Current trends, research and future prospects. Legal and moral aspects of computer and internet usage. <b>Practical:</b> Use of Excel, Msword , windows and internet in daily life application.	
	<b>Books Recommended:</b>	
	1. Shelly G.B. and T.J. Cashman, 1996. Using computers - A gateway to information. Boyd & Fraser Publishing company, USA.	
	2. Sinha P.K. 1992. Computer Fundamentals. BPB publications, New Dehli.	
<b>CS-302</b>	<b>Fundamentals of Algorithms</b>	<b>3(2-2)</b>
	Using pseudo-language as a base. Introduction to algorithms, analyzing and designing algorithms, Algorithms complexity, Running time of an algorithms.	
	Introduction to Matrices and their Manipulation: properties of matrices, different type of matrices, matrix addition and multiplication, matrix inverse, solving system of linear equations.	
	Searching and Sorting Algorithms: Introduction, insertion sort, selection sort, bubble sort, merge sort, quick sort, radix sort, bucket sort, heap sort, sequential search, index sequential search, binary search.	
	Graph and their Related Algorithms: Application of graphs, sequential representation of graphs, Warshall's algorithms shortest path algorithms, linked representation of a graphs, graph traversal and spanning forest.	
	Trees and Related Algorithms: binary tree, internal and external node, traversing binary tree, binary search trees, searching and inserting in binary search tree, deleting from a binary search tree, constructing a tree, Huffman's algorithms, general search trees.	
	Introduction to Concepts of Iteration and Recursion: recursion definition, factorial function, fabonacci sequence, binary search, properties of recursive algorithms tracing and timing, The towers of Hanoi problem, translation from prefix to postfix using recursion.	
	Introduction to Order of Magnitude and Algorithm Complexity.	
	<b>PRACTICAL:</b> Implementation of algorithms using C++	
	<b>Books Recommended</b>	
	1. Weiss, M.A. 1995. Data Structure and Algorithm Analysis. Benjamin / Cummings publishing company, USA.	
	2. Langsam, Y. and M.J. Augenstein 1996. Data Structures Using C and C++. Prentice Hall Inc., USA.	
<b>CS-303</b>	<b>Introduction to Computer Programming</b>	<b>4(3-2)</b>
	Programming and problem analysis. Development of basic algorithms. Translation of algorithms into programs. Standard data types. Basic control structures and Functions. Structured data types; arrays, structures, Pointers and Files. Debugging and testing programmes <b>Practical:</b> programming assignments in C++	
	<b>Books Recommended:</b>	
	1. Terrence W.P. 1997. Programming Languages. Prentice Hall International Inc., USA.	
	2. Perry G. and M. Johnson 1992. Turbo C++ by examples. Library of Congress, USA.	
<b>CS-304</b>	<b>Discrete Structures</b>	<b>4(4-0)</b>
1.	<b>Algebraic Structures:</b>	
	Vector Spaces, Linear Independence, Bases and Dimension, Finite Field, Linear Transformations and Isomorphisms, Linear Transformations and Bases, Representation of Linear Transformations by matrices, Linear combination and Spanning set.	

2. **Sets, Sequences and Functions:**
3. **Elementary Logic:**  
Propositional Logic, Predicates and Quantifiers, Some computing applications.
4. **Methods of Proof:**  
Rules of Inference, Rules of Inference for Quantified, Methods of Proving Theorems, and Quantifiers.
5. **Mathematical Induction:**  
Examples of Proof by Mathematical Induction.
6. **Recurrence Relations:**  
Solving Recurrence relations, Solving Linear Homogeneous Recurrence Relations with Constant Coefficients, Solving Linear Nonhomogeneous Recurrence Relations with constant coefficients.
7. **Relations:**  
Relations and their properties, n-Ary Relations and their applications, Representing Relations, Closures of Relations, Equivalence of Relations, Equivalence of Relations and Partition.
8. **Partially Ordered Sets:**  
Lexicographic Order, Maximal and Minimal Element, Lattices, Topological Sorting.
9. **Combinatorics:**  
Counting Principles, Permutation Groups and Applications, Ramsey Theory, Difference Equation, Discrete Probability, Probability Theory.
10. **Basis Counting Techniques:**  
The Pigeon Hole Principle, Generalized Permutations and Combinations, Inclusion-Exclusion Principle Application of Inclusion-Exclusion Principle.
11. **Groups and Semi Groups:**  
Examples of Groups, Formation of Group in Vector Space, Formation of Group in Ring, subgroup and Lagrange's Theorem, Semi group Presentation

**Books Recommended:**

1. John, G.M., 1993. Application of Discrete Applied Mathematics. McGraw Hill Inc., USA.
2. Judith, L. 1990. Mathematical Structure for Computer Science. McGraw Hill. Inc., USA.

<b>CS-401</b>	<b>Object Oriented Programming</b>	<b>3(2-2)</b>
<ul style="list-style-type: none"> <li>• <b>Classes</b></li> <li>•</li> <li>• Class and Object</li> <li>• Encapsulation and Data Abstraction</li> <li>• Inline Functions and Function Overloading</li> <li>• Controlling Access to Class Members</li> <li>• Default Copy Constructor</li> <li>• Constructors and Destructors</li> <li>• Const Object and Const Member Function</li> <li>• Friend Functions and Friend Classes</li> <li>• Static Class Members and Static Functions</li> <li>•</li> <li>• <b>Operator Overloading</b></li> <li>•</li> <li>• Introduction</li> <li>• Restriction on Operator Overloading</li> <li>• Overloading Unary Operators</li> <li>• Overloading Binary Operators</li> <li>•</li> <li>• <b>Inheritance</b></li> <li>•</li> <li>• Introduction</li> <li>• Base classes and Derived Classes</li> <li>• Protected Data Members</li> <li>• Function Overriding</li> <li>• Constructors and Destructors in derived classes</li> <li>• Multiple Inheritance</li> <li>•</li> <li>• <b>Virtual Functions</b></li> <li>•</li> <li>• Introduction</li> <li>• Abstract Base Classes</li> <li>• Polymorphism</li> </ul>		







Aims of Operating System, Overview of various types of systems (Simple batch systems, Multi-programmed batch systems, Time-sharing systems, Personal computer systems, Parallel systems, Distributed systems, Real-time System), Computer-System Operation, I/O Structure, Storage Structure, Storage Hierarchy, Hardware Protection, common system components and a brief description of what the responsibilities of an operating system are with regard to each component, Operating system Services, Systems Calls.

## **Process Concepts**

Introduction to process Management, Process State Transition, PCB, Process Scheduling, Context Switch, Operation on process, Cooperating Processes, Intercrosses Communication.

## **Threads**

Introduction to Threads, Types of Threads, Multithreading Models.

## **Process Synchronization**

Race Conditions, Synchronization, Mutual Exclusion, Critical sections, Solution to the Critical Section Problems, Synchronization Hardware, Semaphores.

### **Deadlock**

Introduction to deadlock, Resource concepts, necessary conditions for Deadlock Methods of handling Deadlock, Deadlock prevention, deadlock avoidance Deadlock detection, Deadlock recovery.

## **Job and Processor Scheduling**

Introduction to Scheduling, Scheduling Levels, Scheduling Objectives, Scheduling Criteria Preemptive Vs Non-Preemptive Scheduling, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling.

## **Memory Management**

Introduction, Memory Allocation Methods, (Single, Fixed, Variable Partition), Compaction, Logical vs. Physical Address space, Fragmentation, paging, Segmentation, Segmentation with paging.

## **Virtual Memory**

Introduction to Virtual Memory, Demand Paging, page replacement strategies, Thrashing working sets, page fault.

## **File System**

File Concepts, File Attribute, File operations, File Type, File structure, Access Method, Directory Structure.

## **Security**

Introduction, Security Problem, Authentication, Prevention, Program Threats, System Threats.

## **Case Studies**

Linux, Windows 2000

### **Recommended Books**

1. Operating system by Silberschatze
2. Operating system by William Stallings

### **Reference Books**

1. An introduction to operating system by Harvey M. Dietel.
2. Modern operating system by Andrew S. Tannenbaum.
3. A Comprehensive Study of Operating Systems by Tariq Mahmood, Imran Saeed



➤ **Internet Basics**

- Basic terminologies of internet
- Basic concepts of Protocols (TCP/IP, HTTP), Internet Domains
- Client-Server Communication

➤ **Hyper Text Markup Language (HTML)**

- Use of HTML
- Commonly used HTML tags
- Lists and their types
- Adding graphics to HTML documents
- Tables in HTML
- Linking documents
- Frames

➤ **JavaScript**

- Use of JavaScript and its advantages
- Basic programming techniques in JavaScript
- Operators and Expressions
- Programming Constructs
- Functions
- Dialog Boxes
- JavaScript Document Object Model
- Browser Objects
- Handling Events using JavaScript
- Forms Object's Methods
- Built-in Objects in JavaScript

➤ **Introduction to VBScript**

- Using Variables
- Conditional Statements
- Loops (For...Next, Do...Loop, While...Wend)
- Subroutines and Functions
- Browser Objects and Object Hierarchy
- Window object (Status, Alert, Confirm, Prompt, Navigate)
- Window events (on Load, on Unload)
- Document Object

➤ **Data-Entry Form and Validation**

- Writing Validation for the page

➤ **Dynamic HTML**

- Cascading Style Sheet and its uses
- Use of classes in DHTML

➤ **Front-end Tool (FrontPage)**

➤ **Project**

**Recommended Books:**

- Web-Enabled Commercial Application Development using HTML, DHTML, JavaScript, Perl CGI  
By Ivan Bayross
- Creating Cool VBSCRIPT Web Page  
By Bill Hatfield, IDG Books  
**Practical:** Web page development

**Books Recommended:**

1. Deitel H.M. and P.J. Deitel., 1998. Java How to Program. Prentice Hall International, USA.
2. Naughton, P. and H. Schildt. 1998. The Complete Reference Java 2. Third Edition. McGraw Hill California, USA.

- Overview of the Organization of a Computer System and Architecture-Functions and Structures.
- Briefly History of Computers i.e., Structure of ENVIAC-Structure of Von Neumann Machine-Structure of IAS Computer-Microelectronics-highlights of Basic Architecture of IBM-PC.
- Introduction to RISC-CISC-RISC VS CISC.
- Introduction to system Bus-Components of Bus-Computer Components-Interconnection Structure-Bus Interconnection-PCI-Types of PCI Bus.
- CPU Functions-Fetch and Execute cycle-Register Organizations of CPU-instruction Cycle-Instruction Pipelining-Addressing-Instruction Format-Instruction set characteristics and Functions-Types of operations-Types of Operands, ALU Design-Processor control unit, Hardwired Control design and microprogramed Control Unit.
- Computer memory system, Main Memory, Cache Memory, Cache addressing, direct mapping, fully associative mapping, Set Associative Mapping, Secondary memories, Optical memory, RAID, Replacement Algorithms, Rite policy, Block Size, Number of cache, Single verses two level cache, Pentium cache organization, data cache consistency, cache control.
- Magnetic disk: data organization and formatting, RAID: level 0 to level 5.
- I/O Modules, Programmed I/O, Interrupt driver I/O, DMA, I/O channels and processor, Scheduling and Memory Management with reference to Operating system support.
- Introduction to computer Arithmetic, Integer Representation, Float Pointing Representation.
- Instruction sets: characteristics and functions, machine instruction characteristics, types of operands, types of operations.
- Instruction Addressing modes and formats, addressing , instruction formats.
- Instruction pipelining, pipelining strategy, dealing with branches

**practical**

Simulation of computer components using object oriented programming language.

**Recommended Books**

Computer Organization and Architecture by William Stalling

Computer System Architecture by Morris Mano

Rofiquzaman and Chandra Galgotia, Modern Computer Architecture, Publications (Pvt.) Ltd, 1965.

**CS-505      Analysis of Algorithms**

3(2-2)

**Introduction:****Algorithms**

Analyzing Algorithms

Designing Algorithms

Growth of Functions

Asymptotic Notation

Standard Notations and Common Functions

**Counting and Probability**

Counting

Probability

Discrete random variables

The Geometric and binomial distributions

The Tails of the binomial distribution

Probabilistic Analysis

**Graph Algorithms**

Elementary Graph Algorithms

Minimum Spanning Trees

Single Source Shortest Paths

All-Pairs Shortest Paths

Maximum Flow

NP-Completeness

Polynomial Time

Polynomial-Time Verification

NP-Completeness and Reducibility

NP-Completeness Proofs

NP-Complete Problems

**Algorithms for Parallel Computers**

Pointer Jumping

Work-Efficient Parallel Prefix Computing

**Practical:** programming of different algorithms

**Books Recommended:**

1. Wesis M. A. 1995. Data Structure and Algorithm Analysis. Benjamin Commings Company USA.
2. Adam. D. 2001. Data Structures and Algorithms in C++. Thomsan Asia Ltd, Singapore.
3. Introduction to Algorithms by Thomas H. Cormen, McGraw Hill Book Company New York.

**Practical:** programming of different algorithms

## **CS-506 Data Communications**

**3(2-2)**

### **Introduction**

Elements of Data Communication, Analog and Digital Transmission, Data Transmission Mode, Transmission Impairments, Topologies, Data Communication Networking, Protocols and protocol Architecture (TCP/IP, OSI Model).

### **Transmission Media**

Introduction, Guided Transmission Media, Wireless Transmission.

### **Data Encoding**

- Digital Data & Digital Signal,
- NIC Encoding Techniques
  1. Nrz-L, Nrzi, Bipolar Ami, Pseudoternary, Manchester
  2. Differential Manchester
- Digital Data and Analog Signals-Modem Encoding Techniques Ask, Fsk, Psk, Qpsk

Analog Data & Digital Signals-Coding Techniques (PCM, DM)

### **Data Link Control**

Flow Control Techniques, Stop & Wait, Sliding Window

### **Error Detection & Control Techniques**

- Error Detection
  - Even and odd parity check, CRC OR FCS

### **Error Control Techniques**

1. Stop and Wait ARQ, GO-Back-N ARQ
2. Selective-Reject ARQ, High-level Data Link Control Protocol

### **Multiplexing**

FDM, STDM, STDM

### **Circuit Switching**

Switched Networks, Circuit-switching Networks, Switching Concepts, Routing in Circuit-switched Networks, Control Signaling.

### **Packet Switching**

Packet-switching Principle, Routing, Congestion Control, X25

### **Recommended Book**

- 1) Data and computer Communications by William Stallings
- 2) Understanding data communication by Gilber held (Publisher Sams )
- 3) Prakash C. 1999. Data Communication, Prentice Hall International Inc., U.S.A

**Practical:** data communication ,analog and digital signal

## **CS-507 Computer Organization and Assembly**

**4(3-2)**

- Introduction to assembly Language

**Assembly Language Applications, Number System, Character Storage, Basic Elements of Assembly Language, Constants, Statements, Name**

- Hardware and Software Architecture

**Components of a Microcomputer ,CPU Registers, Segment registers, index registers, special register, flags Registers, Stack, DOS Architecture, Instruction execution cycle.**

- Assembly language Fundamentals

**DB, DW, DD, LAGBEL Directive, MODEL, Directive, Program Segments, Data Transfer Instruction, MOV, XCHG, INC, DEC, ADD, SUB, Flags affected by ADD, SUB, Addressing models, types of Operands, operators & expressions, Arithmetic operators, Boolean Operators, OFFSET operators.**

- Input/output services

**Interrupts, debugging , INT instruction, character output, string output, video model and video functions, cursor size and cursor movement.**

- Loops and comparisons

**LEA instruction, JP, JA, JB JG, JL, JE, JNE, JC, XZ, JZ Instructions, Loop instruction, CMP instruction, AND, OR, XOR, NOT, TEST, NEG Instruction.**

- Condition and procedures

**PUSH, POP, CALL, RET instructions, While Repeat Until, Case structure, Near and far Procedure.**

- Arithmetic

**SHL, SHR, SAL, SAR, ROL, ROR, MUL, DIV, ADC, SBB, XLAT.**

**Numeric conversion, String processing (MOVES,CMPS,SCAS,STOS,LODS)**

**Practical:** Programming using Assembly Language

- Recommended Books

1. Mono M.M. 1998. Digital Logic & Computer Design. Prentice Hall Inc., USA.
2. Kip R.I 2000.Assembly Language for IBM-PC. Macmillan Publishing Company, New Yor
- 3.) Assembly Language programming and organization of the IBM PC  
by Ytha Yu and Charles Marut.

## CS-508 Computer Graphics

4(3-2)

**Introduction to Computer Graphics:** Application of Computer Graphics.

**Overview of Graphics Systems:** RGB color model, Video Display Devices, Refresh Cathode-Ray Tubes, Raster Scan Displays and System, Random Scan Displays and system, Color CRT Monitors, Input Devices, hard-copy Devices.

**Output Primitives:** Points and Lines, Scan-Converting a Point, Scan-Converting a Line (Different algorithms, e.g., Direct method, Digital Differential Analyzer, Bresenham's Algorithm), Scan-Converting a Circle (Bresenham's Algorithm and Midpoint Circle Algorithm), Scan-Converting an Ellipse, Scan-Converting Arcs and Sectors, Region Filling, Scan-Converting a Character, Fill area Primitives, Fill area Functions.

**Two-Dimensional Geometric Transformations:** Basic Transformations, Translation, Rotation, and Scaling, Matrix Representations and Homogeneous Coordinates,

**Composite Transformation:** Translations, Rotations, and Scaling, General Pivot-point Rotation, General Fixed-point Scaling, General Scaling Directions, Concatenation Properties, General Composite Transformations and Computational Efficiency.

**Other Transformations:** Reflection and Shearing, Transformation between Coordinate.

**Two-Dimensional Viewing and Clipping:** Window-to-Viewport Mapping, Point Clipping, Line Clipping and Polygon Clipping, A 2-D graphics Pipeline,

**Three-Dimensional Concept:** 3-Dimensional Display Methods, Three dimensional object Representations.

**Three-Dimensional Transformations:** Geometric Transformation, Coordinate Transformations, Composite Transformations.

**Mathematics of Projection:** Taxonomy of Projection, perspective Projection, parallel Projection.

**Three-Dimensional Viewing and Clipping:** Three-Dimensional Viewing and Clipping, Viewing Transformation.

**Practical:** Application of Scan conversion algorithms for line, Circle, Ellipse and application of 2-dimesninal transformations.

### Text Book:

2. Hearn, D. and M. P. Baker, 1997, Computer Graphics, 2<sup>nd</sup> Edition in C, Prentice Hall Inc. USA.

## Reference Book

1. Foley, J. D., Andries, Van Dam, Steven K. Feiner and John F. Hughes, Computer Graphics, Principles and Practices, 2<sup>nd</sup> edition in C, Addison Wesley, New York, USA.
2. Xiang, Z., and R. A. Plastock, Schaum's Outline of Computer Graphics, McGraw Hill Book Company.

## CS-509 Numerical Analysis

3(2-2)

Mathematical Preliminaries, Solution of equations in one variable, Interpolation and Polynomial Approximation, Numerical Differentiation and Integration, Initial Value Problems for Ordinary Differential Equations, Direct methods for solving Linear Systems, Iterative techniques in Matrix Algebra, Solution of non-linear equations. Approximation Theory. Eigenvalues and Eigenvector computation.

**Practical:** programming of different numerical techniques

### Books Recommended:

1. Fnires, B. 1996. Numerical Analysis. PW Publishing Company, Boston, USA.
2. Watkins, S.D, 1991. Fundamental of Matrix Computations. John weley and sons, USA.

### **Advantages of Java**

- Platform independence
- Reusability and maintainability
- Applications, applets and servlets
- Concurrent programming with threads
- IP networking & distributed computing

### **Structure of a Java program**

- Compiling source code into byte code
- Overview of class libraries

### **Transitioning to Java**

#### **Features similar to C++**

- Similar syntax
- Loops and conditionals
- Expressions and relational operators
- Java references and C++ pointers

#### **Features unique to Java**

- Multiple inheritance with interfaces
- Dynamic linking and class loading
- Memory management via the garbage collector
- Static methods and instance methods
- Organizing classes with packages and visibility modifiers

### **Developing GUIs**

#### **Foundations of user interfaces**

- Basic GUI widgets
- Event-driven programming
- Modal vs. non-modal interaction

#### **Abstracts Windowing Toolkit (AWT/Swing)**

- The need for a portable windowing library
- Adding components to containers
- Arranging components using layout managers

#### **Java Foundation Classes (JFC)**

- Advantages of lightweight components
- Creating basic components: buttons, text fields, drop-down lists
- Dialogs and message boxes

#### **Event handling**

- Adapters and listeners
- Registering event handlers
- Inner classes and top-level classes

#### **Building applets**

- Embedding applets in Web pages
- The applet security model
- The applet life cycle: init(), start(), stop(), destroy()
- Deploying browser-independent applets with Java Plug-In
- Communicating with a back-end server

#### **Concurrent Programming with Threads**

##### **The Java Thread model**

- The advantages of multithreading
- Using synchronization primitives
- Thread blocking: join(), wait() & notify()

#### **Creating and managing threads**

- The Thread class and the Runnable interface
- Managing multiple threads with Thread Groups

### **Input and Output**

#### **Java streams**

- Streams, Readers and Writers

- Accessing files

#### Files and directories

- Creating, deleting and renaming files
- Obtaining directory & file information
- Streaming Java Objects

#### Internetworking

##### Sockets and Server Sockets

- Reliable connections with TCP
- Connectionless communications via UDP
- Developing multithreaded socket-based servers

#### Java Database Connectivity (JDBC)

- Connectivity to a relational database
- Executing SQL queries

#### Java Class Libraries and Development Tools

- The Java 2 core library
- Java Development Kit (JDK)
- Compiler
- Appletviewer

#### **Books Recommended**

1. Beginning Java 2 by Ivor Horton
2. Exploring Java by Patrick Niemeyers and Joshua Peck

#### **CS-512**

#### **Automata Theory**

**3(3-0)**

Define languages, Kleen's Clouser, Regular Expressions, Languages associated with regular expressions, Finite Automata, "FA" and their Languages, Transition graph, Kleen's Theorem, Converting "TG" into regular expressions, Converting regular expression into FA, Non deterministic Finite Automata, Moor and mealy machines, Transducers as model of sequential circuits, Regular Languages, Context-Free grammar, Trees, Ambiguity, Regular grammar, Killing Null Productions, Chomsky Normal Form, Left most derivation, Pushdown Automata, Building a CFG for every PDA, Context-Free Languages, Parsing simple Arithmetic.

#### **BOOK RECOMMENDED:**

1. Daniel I.A 1997. Introduction to Computer Theory. John Wiley & Sons Inc., USA
2. Kohavi Z.1996. Switching and Finite Automata Theory. McGraw Hill Inc, USA

## Course Description

In-depth training for software developers on Linux and UNIX System programming facilities. Learn how to develop sophisticated multi-process applications using system calls and library routines.

### Prerequisites

- Fundamental knowledge of Unix or Linux
- C or C++ Programming experience

## Course Contents (Theory)

### UNIX Standards

- Brief History of UNIX
- UNIX Systems
- Major Vendors
- Standards
- What is POSIX?
- Other Industry Specs and Standards

### Files and Directories

- The POSIX.1 Basic File Types
- File Descriptions
- Keeping Track of Open Files
- File Table Entries
- The v-node Structure
- The fcntl Function
- File Attributes
- The access Function
- Link, unlink, remove, and rename Functions
- Functions to Manipulate Directories

### System I/O

- Standard I/O vs System I/O
- System I/O Calls
- File and Record Locking

### Processes

- What is a Process?
- Process Creation and Termination
- Process Memory Layout
- Dynamic Memory Allocation
- Accessing Environment Variables
- Real and Effective User IDs

### Process Management

- Programs versus Processes
- The fork() System Function
- Parent and Child
- The exec System Function
- Current Image and New Image

- The wait() and waitpid() Function
- Interpreter Files and exec

## **Signals**

- What is a Signal?
- Types of Signals
- Signal Action
- Blocking Signals from Delivery
- The sigaction() Function
- Signal Sets and Operations
- Sending a Signal to Another Process
- Blocking Signals with sigprocmask()
- Scheduling and Waiting for Signals
- Restarting System Calls (SVR4)
- Signals and Reentrancy

## **Interprocess Communication**

- IPC
- IPC Facilities
- Common Operation - Get (IPCget)
- Common Operation - Control (IPCctl)
- Calls to Operate on the Facilities
- Commonalities between msg, sem, and shm
- IPC via Message Queues
- IPC via Shared Memory Segments
- Coordinating the Use of Shared Memory
- Semaphore Sets-semget() and semctl() Calls
- Semaphore Sets - the semop() calls
- Shared Memory Coordination Using Semaphores
- IPC Facility Handling ipcs and ipcrm

## **Date and Time Functions**

- Time Representations
- Decoding Calendar Time
- Shorthand Functions - asctime(), ctime()
- Formatting Calendar Time Shared
- Process Times
- The Difference Between clock() and times()
- High resolution Timers

## **Standard I/O**

- I/O Calls to manipulate streams
- I/O Calls which perform character I/O
- I/O Calls which perform string I/O
- I/O Calls which perform formatted I/O



- I/O Calls which perform binary I/O

## Practical

Writing programs using UNIX libraries routines.

### Books Recommended:

#### Advanced Programming in UNIX Environment

- 1.

### CS-602 Artificial Intelligence

4(3-2)

Introduction to Common LISP. AI classical systems: General Problem Solver, rules, simple search, means-ends analysis. ELIZA, pattern matching, rule based translators, OPS-5. Knowledge Representation: Natural language, rules, productions, predicate logic, semantic networks, frames, objects, scripts. Search: Depth first search, breadth first search, best first search, hill climbing, min-max search, A\* search. Symbolic Mathematics: solving algebra problems, translating English equations, solving algebraic equations, simplification rules, re-write rules, meta-rules, Macsyma, PRESS, ATLAS. Logic programming: resolution, unification, horn-clause logic, Prolog programming. Sample case studies of shells and Knowledge based systems.

**Practical:** Programming in prolog

### Books Recommended:

1. Luger, G.F. and W.A. Stubblefield, 1993. Artificial Intelligence. The Benjamin/Cummings Publishing company Inc., USA.
2. Elaine R., 1997. Artificial Intelligence. McGraw Hill Inc., USA.

### CS-603 Compiler Construction

4(3-2)

Compiler techniques and methodology. Organization of compilers. Lexical and syntax analysis. Parsing techniques. Object code generation and optimization, detection and recovery from errors. Contrast between compilers and interpreters.

**Practical:** construction of different compiler phases

### Books Recommended:

1. Aho, A.V., Sethi, R. and J.D. Ullman, 1997. Compilers Principles, Techniques and Tools. Addison-wesley Publishing company, USA.
2. Louden, K.C., 1998. Compiler Construction, Principles and Practice. Galgotia Publishing Pvt. Ltd, New Delhi.

### CS-604 Software Project Management

10(0-20)

Software Project management: Managing the development of software products, Software estimation, Planning, Monitoring and Controlling, Metrics and Measurement, Process maturity, Quality assurance, software quality standards, Human factors in people management, Leadership and team building. Developing a Software as a Project.

### Books Recommended:

1. Walker R. 1998. Software Project Management, Addison Wesley Longman Inc., USA.
2. Hold S. 2001. Software process Design, Clays Ltd, England

### CS-605

### Visual Programming

4(3-2)

## Introduction to Programming

Event Driven Programming, Visual Programming: Advantages of Visual Programming, Disadvantages of Visual Programming, Graphical User Interface (GUI).

## Introduction to Visual Basic

Introduction to VB, History of Visual Basic, Visual Basic Edition, Visual Basic IDE, Components of IDE, Application development steps in VB, Saving your project, Three Basic Controls, Working with your Project, Creating Executable Files, and Exiting Visual Basic

### Managing Forms & Controls:

Managing controls, Object Properties, Assigning properties at run time, Naming Controls, Object Methods, Object Events, Event Procedures, Managing Forms, Common Keyboard events, Common Mouse Events, Focus, Managing Controls on Form, Using Multiple Forms.

## Programming in Visual Basic

Programming in Visual Basic, Keywords, Data Types, Variables, Types of Variables, Constant, Mathematical Expression, Concatenation, Input and Output: Input and output using Controls, Input box, Message Box, Comments

### Conditional & Looping Structure:

Arrays,

Introduction, Declaring one dimensional arrays, Variation in Array Declaration, Accessing Individual elements in array, entering data in arrays, Reading data from arrays, Searching Arrays, Sorting Arrays, Two-dimensional arrays, Dynamic Arrays, Control Arrays,

## **Visual Basic Common Controls**

Intrinsic controls, Active X Controls, Common properties of controls, Command button control, Text box, Label, Check box, option buttons, Frame, List box, Combo box, Image and picture, Scroll bar Control, Drive ListBox, Dir list box, File ListBox, Combining Drivelistbox, Dirlistbox and Filelistbox, Timer, Shape, Line and OLE Control

### **Menu, MDI Forms & Dialog boxes:**

Menus, Designing Menus in VB, Menu Editor, Popup Menus, Toolbar, MDI, Common Dialog boxes, Types of Dialog boxes, Open Dialog boxes, Save AS Dialog box, font dialog box, print dialog box

## **Procedures, Functions & Modules**

Types of code block, procedures, Scope of Variables, Lifetime of variables, Static Variables, Function, Return type, Argument passing Mechanism, Exit sub & exit function, Module, Built-in-function

### **Error Handling & Debugging:**

Error handling in vb, Type of Errors, Handling Run-time Errors in VB, Err object, Debugging facilities in VB, Break point, stepping through code

### **File Handling:**

Introduction, File system object, File object, Folder object, drive object, TexStream object, Creating Sequential Files, Reading Sequential Files, Random Access Files

## **Database Programming**

Introduction, DBMS, Relational Databases, Keys in Relational databases, Relational ship, Database application in VB, Designing user interface, Data Control, Data Bound Controls, Record set object, DAO, DAO Hierarchy, SQL

## **Active X Data Object**

Introduction, Open database connectivity, OLE DB, Activex data object, ADO data control, ADO object Model, Connection object, Recordset object, Command object, Microsoft FlexGrid control, Master-detail tables

## **Visdata & Data Environment**

Visual Data Manager, Data Environment, Data Report Designer

### **A Complete Database Project Using ADO**

#### **Text Book:**

Visual programming Using Visual Basic  
by Tariq Mahmood, Imran saeed, Tasleem Mustafa, Ahsan Raza

#### **Reference Books**

Mastering Visual Basic, BPB Publisher  
Visual Basic in 21 Days

## **Computer Networks**

Course introduction, uses of computer networks, network hardware, network software, reference models, example networks, example data communication services, network standardization

The theoretical basis for data communications

Network Types

Network Models

Network Services

Difference between LANs, MANs and WANs

### **Network Protocols**

Protocol Stacks

OSI Model

### **Network Media**

Network Adapters

Transmission media

Wireless transmission

Data Transmission

### **Network Design**

Physical Topologies

ARCNET, Ethernet, Token Ring, FDDI

### **LAN, WAN Protocols**

#### **Connecting Networks**

LAN connectivity devices

Internetworking devices

#### **Network Administration**

User & security Administration

Broadband ISDN and ATM  
Cellular radio, Communication satellites  
Multiple access protocols, IEEE standard 802 for LANS & MANS Bridges  
High speed LAN, Satellite Networks  
The network layer in ATM networks

### **A simple transport protocol**

The internet transport protocols (TCP & UDP), The ATM AAL layer protocols  
Network security, DNS-domain name system  
SNMP-simple network management protocol  
Electronic mail, Usenet news  
The world wide web.

### **Text Book**

Network Essentials by Jason Nash, IDG books, 2000, ISBN 81-265-0034-4  
Andrew S. Tanenbaum, Computer Networks, 3<sup>rd</sup> Edition, Prentice Hall 1996, ISBN 0133499456

### **Reference Book/s**

William Stallings, Data and Computer Communications, 6<sup>th</sup> Edition, Prentice Hall 1999, ISBN 0130843709  
Alberto Leon-Garcia and Indra Widjaja, Communication Networks, McGraw Hill 2000, ISBN 0070228396

### **CS-609 Distributed Database Systems 4(3-2)**

Introduction to DDBMS, Overview of relational DBMS, DDBMS Architecture, Distributed Database Design[alternative design strategies, distribution design issues, Fragmentation], Views in distributed DBMSs. Data security, distributed semantic integrity control, Query decomposition, localization of distributed data, query optimisation, centralized query optimisation, join ordering in fragment queries, distributed query optimisation algorithms[INGRES Algorithm, R\* Algorithm.

**Practical:** Design and implementation using oracle the following:

- (I) Design of Distributed databases
- (II) Query decomposition
- (III) Data localization and optimization of distributed queries

### **Books Recommended:**

1. Tamer Ozsu and Patrick Valduriez, 2002. Principles of Distributed database systems.
2. Date, C.J., 1998. An introduction to Database systems. Addison-Wesley Publishing Company, USA.
3. McFadden, F.R. and J.A. Hoffer, 1994. Modern Database Management. Benjamin Publishing Company Inc., USA.

### **Math-303 Calculus and Analytic Geometry 4(4-0)**

Complex Numbers, De Moivre's Theorem and its Applications, Simple Cartesian Curves, Functions and Graphs, Symmetrical Properties, Curve Tracing, Limit and Continuity, Differentiation of Functions. Derivative as Slope of Tangent to a Curve and as Rate of Change, Application to Tangent and Normal, Linearization, Maxima/Minima and Point of Inflection, Taylor and Maclaurin Expansions and their convergence. Integral as Antiderivative, Indefinite Integration of Simple Functions. Methods of Integration: Integration by Substitution, by Parts, and by Partial Fractions, Definite Integral as Limit of a Sum, Application to Area, Arc Length, Volume and Surface of Revolution

### **Books Recommended:**

1. Thomas, G.W. 1992. Calculus with analytic geometry. Addison Wesley Pub. Company, U.K.
2. Krayszig, E. 1990. Advanced Engineering Mathematics. John Wiley and sons, New York.

### **Math-304 Multivariable Calculus 4(4-0)**

#### **1. Multivariable Functions and Partial Derivatives:**

Functions of Several Variables, Limits and Continuity, Partial derivatives, Differentiability, Linearization, and Differentials, Partial Derivative with constrained variables, directional Derivatives, Gradient Vectors and Tangent Planes, Extreme Values and Saddle Points, Lagrange Multipliers, Taylor's Formula.

#### **2. Multiple Integrals: Double Integrals,**

Areas, Moments and Centers of Mass, Double Integrals in Polar form, Triple Integrals in Integrals in Rectangular Coordinates, Masses and Moments in three Dimension, Triple Integrals in Cylindrical and Spherical Coordinates, Substitution in Multiple Integrals.

#### **3. Integration in Vector Fields:**

Lines Integrals, Vector Fields, Work, Circulation and Flux, Green's Theorem in the Plane, Surface Area and Surface Integrals, Stoke's Theorem.







## **8. Liabilities Common to Most Business Org.**

Current Liabilities, Long term liabilities, Evaluating the Safety of Creditors Claim, Estimated Liabilities, Loss Contingencies and Commitments.

## **9. Corporation Organizations and Stockholders**

What is Corporation, Advantages and Disadvantages of Corporation, Formation of Corporation, Stockholder Equity, Cash dividends, Capital Stock, Preferred Stock, Common Stock.

## **10. Corporation Operations and Additional stock Holders Equity Transactions Reporting the result of Operations**

Developing Productive Information, Unusual Items Reporting, Continuous Operations, Extra Ordinary Items, EPS, Primary and Fully Diluted EPS, Change in Accounting Principle.

## **11. Other Stockholder Equity Transactions**

Cash Dividends, Dividend Dates, Liquidating Dividend, Stock Dividends, Stock Splits, Statement of Retained Earnings, Prior Period Adjustment, Treasury Stock, Recording Purchases of Treasury Stock, Re-Issuance of Treasury Stock, Stock Payback Program.

### **Books Recommended:**

1. Vinayaham, M.&K.L.Magrafan 1992. Principles of Accounting, Eurasia, Pub. House, New Delhi.
2. Ghani, M.A. 1985. Principles of Accounting, National Publishing Corp. Lahore.
3. Malik, G.A.,S.A. Siddiqi and M.-ul-Hassan, 1995. Accounting Principles. Naveed Publications, 63-Shahrah-e-Quaid-e-Azam, Lahore.

### **MBA-404 Financial Management**

**3(3-0)**

Introduction to Financial Management, Concepts and Models in Valuation, The time value of money. Fundamentals of risk and portfolio analysis. Valuation of stocks and bonds. The capital Asset Pricing Model. The Arbitrage Pricing Model and other valuation models. The Cost of Capital: Capital structure and Dividend Policy, The cost of capital, Capital structure theory, Capital structure policy and optimal capital structure, Internal financing and dividends policy Capital Budgeting: The basis of capital budgeting, The determination and use of cash flow, Mutually exclusive investments and capital rationing, Annual equivalent cost and replacement decisions, Risk analysis and the optimal capital budget, Islamic guidelines for financial management: The rational of prohibition of interest, Alternate capital structure, Capital Budgeting in an Interest free economy, working Capital Management in 100% equity capital structure.

### **Books Recommended:**

1. Vanhorn, J.C. 1999. Fundamentals of Financial Management. Lawarance J.Gitman, N.Y., USA.
2. Khan, M. Y. & P.K.Jain 1995. Financial Management Second Edition. Eurasia, Publication house, New Dehli.

### **MBA-407 Human Resource Management**

**3(3-0)**

An overview of Human Resource Management and Human Resource Manager. The Environment of Human Resource Management, External and Internal Environment. Equal Employment Opportunity and Affirmative Action. Job Analysis: A Basic Human Resource Tool. Human Resource Planning, Recruitment, and Selection. Organization Change and Human Resource Development . Corporate Culture and Organization Development. Career Planning Development. Performance Appraisal.

### **Book Recommended:**

1. Brovee, H. 1997. Human Resource Management. McGraw Hill Inc., USA.
2. Willaim B and J. Werther 1997. Human Resource and Personnel Management. McGraw Hill , Inc, USA.

### **Eng-301 Introductory Exercises in Reading, Comprehension & Communication Skills. 2(2-0)**

Guided study of prescribed textbook and introductory exercises in rapid reading, Comprehension and summarization of passages pertinent to agricultural and related sciences. Practical applications of Principles of English grammar and usage of remedial exercises in essay writing on topic of social and scientific importance.

1. A Selection of English Prose (Textbook)
  - i) The Damned Human Race (Mark Twain)
  - ii) The Place of Science in A Liberal Education (Bertrand Russell)
  - iii) End of the Road (Muhammad Asad)
2. Essay Writing
3. Comprehension (Current English Passage)





Quaid-e-Azam and the demand of Pakistan

**Geo-Political and Strategic importance of Pakistan:**

Neighboring Countries, Pakistan relation with Central Asian Countries,  
Pakistan's importance with Reference to Middle East and the Super Powers.

**Contemporary Issues in Pakistan Social Issues:**

Literacy and Education, Population Growth, State of Science & Technology, Prospects for development in  
Information Technology, Unemployment and under employment, Drug addiction, Weaponization and  
lawlessness, Tribal Customs and intolerance.

**Books Recommended**

1. Zia-Ud-Din , 1995. The Analytical and Critical Essay on Pakistan Affairs. Azeem Academy Lahore.
2. Haq, M.Riaz, 2000. Towards Pakistan. Star Book Depot , Lahore.
3. Rabbani I., 2000. Pakistan Studies , Caravan Publishers Lahore.
4. Mehmood, Safdar. 2001. International Affairs . Jang Publishers Lahore.
5. Burke, S.M. 1975. Pakistan Foreign Policy, Oxford University Press Karachi.