National Curriculum for

COMPUTER SCIENCE

GRADES IX-X and XI-XII

2009



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ACRONYMS

1	AC	Accumulator
2	ALU	Arithmetic and Logic Unit
3	BOF	Beginning of File
4	CD	Compact Disc
5	CDMA	Code Division Multiple Access
6	CLI	Command Line Interface
7	CPU	Central Processing Unit
8	CRT	Cathode Ray Tube
9	CU	Control Unit
10	DBMS	Data Base Management System
11	DCL	Digital Command Language
12	DDL	Data Definition Language
13	DML	Data Manipulation Language
14	DOS	Disk Operating System
15	DR	Data Register
16	DSL	Digital Subscriber Line
17	DVD	Digital Versatile Disk
18	EEPROM	Electrically Erasable Programmable Read-Only Memory
19	EOF	End of File
20	EPROM	Erasable Programmable Read-Only Memory
21	GB	Giga Byte
22	GCD	Greatest Common Divisor
23	GUI	Graphic User Interface
24	HTML	Hyper Text Mark-up Language
25	HTTP	Hypertext Transfer Protocol
26	I/O	Input/ Output
27	IDE	Integrated Development Environment
28	IDE	Integrated Digital Environment
29	IR	Instruction Register
30	ISDN	Integrated Services Digital Network
31	IT	Information Technology
32	KB	Kilo Byte
33	LAN	Local Area Network

34	LCD	Liquid Crystal Display
35	LCM	Least Common Multiple
36	MAN	Metropolitan Area Network
37	MAR	Memory Address Register
38	MB	Mega Byte
39	MBR	Memory Buffer Register
40	OOP	Object Oriented Programming
41	OS	Operating System
42	PC	Program Counter
43	PIN	Personal Identification Number
44	PROM	Programmable Read-Only Memory
45	RAM	Random Access Memory
46	ROM	Read Only Memory
47	SDLC	Software Development Life Cycle
48	TB	Tera Byte
49	TCP/IP	Transmission Control Protocol/ Internet Protocol
50	URL	Uniform Resource Locator
51	VGA	Video Graphic Array
52	WAN	Wide Area Network
53	WAP	Wireless Application Protocol
54	WML	Wireless Markup Language
55	WWW	World Wide Web

INTRODUCTION

Information technology has opened new avenues that enable unprecedented access to vast bodies of knowledge and possibilities of collaboration among researchers and scientists. In order to safeguard the entitlement in this important sphere our children need to be exposed to information and communication technology at an early stage.

The National Scheme of Studies notified in 2007 includes the National Curriculum of Computer Science with the following provisions:

- Elective subject for the Humanities Group of SSC with 100 marks and 6 periods per week.
- Compulsory subject for Computer Science Group of HSSC with 200 marks (170 for theory and 30 for Practical), 6 periods a week including 2 periods for practical.

The intent of the curriculum is to prepare students achieve the following goals:

- Computer and Information Literacy
- Productivity through Technology
- Computer Hardware and Software
- Communication and Computer Networks Literacy
- Algorithmic Thinking and Problem-Solving
- Developing Programming Skills
- Database Systems
- Operating Systems
- System Development

The design of the curriculum combines theory and practice into a learning experience. It will provide the students with the first building blocks of computer and information literacy. They will learn to use computers effectively and incorporate the idea of algorithmic thinking into their daily problem-solving vocabulary. The students will be able to acquire information from electronic resources in a variety of formats.

Standards and Benchmarks

National Curriculum for Computer Science is comprised of nine standards which serve to define the skills and knowledge to be acquired by every student of grade level IX-XII. The benchmarks, thereafter, serve as a guide indicating how competencies are to be attained in order to meet the standards. They provide indicators of expectations from students at completion of the said grade level.

STANDARD – 1 COMPUTER AND INFORMATION LITERACY

To know the fundamentals of computer and IT, possess Computing skills for speedy information handling and check virus attacks and authentication loopholes to take appropriate remedial measures

Benchmarks

The students are expected to:

1.1 Know operations of computer using various hardware components and software modules

1.2 Use and manage Windows Operating System
1.3 Use computers realizing moral and ethical values
1.4 Identify careers in IT/Computing industry
1.5 Configure latest Anti-virus software and incorporate secure authentication mechanism to safeguard the machine

STANDARD – 2 PRODUCTIVITY THROUGH TECHNOLOGY

To have the knowledge and ability to use productivity tools appropriate to the task.

Benchmarks

The students are expected to:

2.1 Use productivity tools (like Word Processor, Spreadsheet and Urdu editor) which help to enhance learning, to increase productivity and to promote creativity

STANDARD – 3 COMPUTER HARDWARE AND SOFTWARE

To have the knowledge of computer system and its operation utilizing various hardware components and different types of software.

Benchmarks

The students are expected to:

3.1 Identify and use different types of computer hardware components
3.2 Recognize components in computer casing such as motherboard, power supply, ports, slots, memory chips, processor and expansion cards and know their functions
3.3 Know CPU components and their working
3.4 Describe different types of computer memory, measuring units and their performance
3.5 Identify and explain operation/working of commonly used I/O devices
3.6 Explain basic logic gates and their operations with the help of Truth Table
3.7 Simplify Boolean Expressions/functions using K-map up to four variables

STANDARD – 4 COMMUNICATION AND COMPUTER NETWORK LITERACY

To have knowledge of communication using transmission media and devices with various technologies, describe communication in different types of networks, know communication standards and identify commonly used protocols and technologies in wired and wireless networks

Benchmarks

The students are expected to:

4.1 Recognize communication medium and devices
4.2 Understand transmission impairments associated with appropriate communication technologies

4.3 Describe communication in different types of networks
4.4 Describe communication standards
4.5 Explain TCP/IP protocol sites used on the Internet
4.6 Illustrate understanding of wireless technologies and protocols

STANDARD – 5 ALGORITHMIC THINKING AND PROBLEM SOLVING

To analyze given problems, develop flowcharts and algorithms for solving problems methodically

Benchmarks

The students are expected to:

5.1 Write algorithms using various I/O requirements for solving problems
5.2 Draw flowcharts for given problems

STANDARD – 6 DEVELOPING PROGRAMMING SKILLS

To write code to solve problems using high level programming languages and understand the concept of Object Oriented Programming (OOP)

Benchmarks

The students are expected to:

6.1 Program in C/ C++ languages using standard structures

STANDARD – 7 DATABASE SYSTEMS

To understand database fundamentals, types, terminologies, entities and relationships, normalization up to 3NF and ER-models and develop database application in MS Access/SQL Server/Open Access creating tables and forms and generating queries and reports

Benchmarks

The students are expected to:

7.1 Know database system and its operation
7.2 Build ER-data models
7.3 Develop relational schema
7.4 Understand the use of DBMS
7.5 Create, populate and manage tables
7.6 Build forms with different methods and manipulate them for data management
7.7 Create different types of queries
7.8 Generate reports of various layouts and styles

STANDARD – 8 OPERATING SYSTEMS

To describe different types of operating systems and their functions and understand process management

Benchmarks

The students are expected to:

8.1 Explain various types of Operating Systems

8.2 Describe functions of different Operating Systems

8.3 Know the process management

STANDARD – 9 SYSTEM DEVELOPMENT

To describe SDLC, its importance and objectives covering various terminologies, management terms, process models and risk analysis and management

Benchmarks

The students are expected to:

9.1 Explain System Development Life Cycle and its phases

9.2 Describe software process models

9.3 Know the role of different personals in SDLC

CURRICULUM FOR COMPUTER SCIENCE – GRADE IX

UNIT 1 FUNDAMENTALS OF COMPUTER

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
1.1 Introduction to Computer	i) Know about the evolution of computer ii) Describe brief history and generations of computer iii) Define the types of computer (Analog, Digital and Hybrid computers) iv) Understand the conventional classification of digital computers (Mainframe, Mini and Micro computers with cutting edge technology)
1.2 Role of computer	i) Describe the uses of computers in: • Education • Business • Defence • Media • Manufacturing ii) Know the scope of the following careers in IT: • Software Engineer - Programmer - System Analyst • Hardware Engineer • Network Administrator • Database Administrator • Web Designer • Multimedia Designer • Information Security Analyst • Teacher
1.3 Computer hardware	i) Describe the following hardware: • Input devices • System unit – Motherboard – Processor (ALU, CU, Registers) • Storage devices

	• Output devices • Memory: – Memory units – ROM – RAM – Cache ii) Differentiate between port, expansion slot and expansion card.
1.4 How a computer works	Explain the following four basic operations by constructing block diagrams of: • Input operation • Processing operation • Storage operation • Output operation
1.5 Computer software	i) Define the following basic components of system software: • Operating System • Device drivers • Utility programs • Language processors ii) Identify the use of following application software: • Productivity software • Business software • Entertainment software • Education software iii) Elaborate the following terms • Open source software • Shareware • Freeware

UNIT 2 FUNDAMENTALS OF OPERATING SYSTEM

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
2.1 Introduction	i) Know the objectives of Operating System. (O.S.) ii) Get familiar with the functions of O.S. • Memory management • I/O management • Files management • Resource management • Users management iii) Differentiate between common types of O.S. • Command Line Interface (CLI) - DOS - Unix • Menu Driven Interface (Novel , DOS) • Graphical User Interface (GUI) - Macintosh - Linux - Windows
2.2 Operating System	i) Classify Operating System • Single user O.S. • Multi users O.S. ii) Describe the following types of O.S. • Batch processing • Time sharing processing • Real time processing
2.3 Getting started with GUI O.S.	i) Identify the basic icons of GUI O.S. ii) Manage data (Files / folders)
2.4 System Installation	i) Install Operating System ii) Install Office Automation Software iii) Install Antivirus

UNIT 3 OFFICE AUTOMATION

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
3.1 Word Processing	i) Recognize and define word processor ii) Manage a document (Create, open, Save, Save As, Print) iii) Edit text of the document using the following options (Select, Insert, Copy, Cut, Paste, Move, Delete text) iv) Show / Hide toolbars (Standard, Formatting, drawing, Word Art) v) Insert symbols vi) Use of the Equation Editor vii) Format text (Text, Paragraph, Page) viii) Insert page breaks and section breaks ix) Insert header, footer and page numbers x) Insert and position pictures within a document xi) Insert Word Art xii) Create a table with formatting (Add, Delete, Resize rows and columns, Adding or xiii) changing border lines and shading, Merging and splitting cells) xiv) Change the margins of the document xv) Use of Hyperlink
3.2 Spreadsheet	i) Know the Basics of Spreadsheet • Naming cell and sheets • Filling column and rows • Addressing cells (Relative and absolute addresses) • Paste special ii) Work with functions and formulas iii) Represent the data graphically iv) Manipulate and format data (Filter, validation, protection, conditional formatting)
3.3 Urdu editor	Use Urdu editor

UNIT 4 DATA COMMUNICATION

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
4.1 Basics of Communication	i) Define the following terms • Data • Data transmission • Analog signals • Digital signals ii) Explain the following components of a communication system • Sender • Receiver • Message • Protocol • Transmission Medium iii) Discuss the following properties of a good communication system • Delivery • Accuracy • Timeliness iv) Describe the following modes of data communication • Synchronous transmission • Asynchronous transmission
4.2 Transmission Medium	i) Differentiate between guided and unguided media ii) Discuss the following guided media • Twisted pair cable • Coaxial cable • Fiber optic cable iii) Discuss the following unguided media • Radio waves • Microwave • Infra-red • Satellite iv) Explain the following transmission impairments in communication mediums • Attenuation • Amplification

	• Distortion • Cross talk
4.3 Communication Devices	Describe the uses of following communication devices • Dialup modem • Network Interface card • Router • Switch / Access Point
4.4 Communication Terminologies	i) Elaborate the following terms with corresponding formulas and standard units • Data rate • Baud rate • Bandwidth • Signal to Noise Ratio ii) Use appropriate formulae (e.g., formulae for data rate, baud rate etc.) to determine the characteristics of a communication channel

UNIT 5 COMPUTER NETWORKS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
5.1 Networks	i) Define a computer network ii) Describe the uses of networks iii) Define data transmission modes iv) Define network architecture v) Explain the following types of network architecture • Client/server network • Peer-to-peer network • Point-to-point network
5.2 Types of Networks	i) Explain the following types of networks on the basis of spatial distance • Local Area Network (LAN) • Metropolitan Area Network (MAN) • Wide Area Network (WAN) ii) Define a network topology iii) Explain with detailed diagrams the following network topologies • Bus topology • Ring topology • Star topology • Mesh topology
5.3 Communication over the Networks	i) Explain the following types of lines which use the telephone networks for data communications • Dial-up lines • Digital Subscriber Line (DSL) • Integrated Services Digital Network (ISDN) lines • CDMA ii) Explain the following types of modem • Dial-up modem • DSL modem • ISDN modem iii) Compare the above data communication lines on the basis of: • Transfer rates • Costs per month • Advantages • Disadvantages

UNIT 6 COMPUTER SECURITY AND ETHICS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
6.1 Computer Security	i) Explain the importance of computer security ii) Define the following terms • Cyber crime • Hacker • Cracker iii) Explain the following attacks • Virus • Worm • Adware • Spyware • Malware
6.2 Computer Viruses	i) Know that a virus, worm, adware, spyware and Malware can spread via: • Infected flash drives/ CD's • Pirated software • Network and Internet • E-mail attachments ii) Know the common symptoms of an attack by a virus, worm, adware, spyware and Malware iii) Know that the following software can help safeguard against viruses, worms, adware and spyware • Antivirus • Anti spyware
6.3 Authentication Mechanisms	i) Differentiate between authentication and authorization ii) Differentiate between authorized access and unauthorized access iii) Explain in detail the following authentication methodologies • Username and password • Personal Identification Number (PIN) • Access cards • Biometrics

	iv)	Explain the term multimodal authentication
6.4 Computer Ethics	i)	Know that computer ethics are the moral guidelines that govern the use of computers and information systems
	ii)	Discuss the following areas of computer ethics • Information accuracy • Information ownership/ Intellectual property rights • Software piracy • Information privacy

CURRICULUM FOR COMPUTER SCIENCE – GRADE X

UNIT 1 PROGRAMMING TECHNIQUES

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
1.1 Understanding the Problem	i) Define the problem ii) Analyse the problem iii) Plan the solution of problem iv) Define candid solutions of problem v) Select the best solution on the basis of: • Speed • Cost • Complexity
1.2 Algorithm	i) Define an algorithm ii) Explain role of algorithm in problem solving iii) Describe the criteria for measuring efficiency of an algorithm on basis: • Inputs needed • Processing to be completed • Decision to be taken • Outputs to be provided iv) Write algorithms for solving the following problems: - • To find the sum, product and average of five given numbers • To display the larger one out of the three given unequal numbers • To find acceleration of a moving object with given mass and the force applied • To find the volume of a cube, cylinder or sphere • To find the area of a triangle, parallelogram, rhombus or trapezium • To assign grade to a subject based on the achieved marks • To find the interest on an amount

	• To calculate the exponent of a given number • To find a sequence of odd numbers starting from a given number • To count multiples of a given number lying between two numbers • To produce a multiplication table for a given number • To convert Celsius to Fahrenheit temperature and vice versa • Find even numbers in integers ranging from n_1 to n_2 (where n_1 is greater than n_2) • Add members of two lists • Calculate GCD of given two numbers • Determine whether a given number is prime number or not • Determine prime numbers in integers ranging from n_1 to n_2 (where n_1 is greater than n_2)
1.3 Flow Chart	(i) Define a flow chart (ii) Explain importance of a flow chart for solving a Problem (iii) Determine the following requirements from the given problem or algorithm • Inputs needed • Processing to be completed • Decision to be taken • Outputs to be provided (iv) Use of flow chart symbols (v) Draw flow charts of algorithms discussed earlier in unit-1 (1.2 (iv))

UNIT 2 PROGRAMMING IN C

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
2.1 Introduction	i) Define Computer Program • Program Syntax • Program Semantic ii) Explain the following levels of programming languages • Low level languages – Machine Language – Assembly language • High level languages – Procedural language – Structured language – Object Oriented language iii) Elaborate the characteristics of a high level language iv) Know the following popular high level programming languages: • C/ C++ • Visual Basic • C# • Java v) Explain the difference between a compiler and an Interpreter
2.2 Programming Environment	i) Describe the concept of Integrated Development Environments (IDE) ii) Explain the following modules of the C programming environment • Editor • Compiler • Linker • Loader • Debugger

2.3 Programming Basics	i) Define header files ii) Identify the reserved words iii) Describe the structure of a C program covering • Pre-processor Directives – **include** – **define** • main ( ) function • Body of main { } iv) Explain the purpose of comments and their syntax
2.4 Constants and Variables	i) Explain the difference between a constant and a variable ii) Explain the rules for specifying variable names iii) Know the following data types offered by C and the number of bytes taken by each data type • Integer – **int** (signed/unsigned), short/long • Floating point – **float** • Double precision – **double** • Character – **char** iv) Use of type casting. v) Define **Constant** qualifier – **const** vi) Explain the process of declaring and initializing variables and constant qualifiers

UNIT 3 INPUT / OUTPUT HANDLING

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
3.1 Input / Output functions	i) Use output functions like: • printf ( ) • puts ( ) • Cout ii) Use input functions like: • scanf ( ) • getch ( ), getche ( ), getchar ( ) • gets ( ) • Cin iii) Use statement terminator (semicolon) iv) Define Format specifiers • decimal - %d • integer - %i • float - %f • double - %g,e • char - %c • long int - %ld v) Define an escape sequence vi) Explain the use of the following escape sequences using programming examples: • Alert - \a • Backspace – \b • Newline – \n • Carrage Return – \r • Tab – \t • Display backslash – \\ • Display single quotation marks – \’ • Display double quotation mark – \”

3.2 Operators	i) Define an arithmetic operator. ii) Use the following arithmetic operators: • Addition (+) • Subtraction (-) • Multiplication (*) • Division (/) • Remainder (%) iii) Use the following assignment operators: • Assignment operator (=) • Compound assignment operator (+ =, -, =, * =, / =, % =) • Increment operator (++) - Prefix - Postfix • Decrement operator (--) - Prefix - Postfix iv) Define relational operators. v) Use the following relational operators: • Less than (<) • Greater than (>) • Less than or equal to (<=) • Greater than or equal to (>=) • Equal to (= =) • Not equal to (! =) vi) Define a logical operator. vii) Use of the following logical operators: • AND (&&) • OR (‖) • NOT (!) viii) Differentiate between the assignment operator (=) and equal to operator (==). ix) Differentiate between the unary and binary operators x) Define an expression ternary (conditional) operator xi) Define and explain the order of precedence of operators

UNIT 4 CONTROL STRUCTURE

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
4.1 Control Structure	i) Define a control statement. ii) Define a conditional statement iii) Know the structure of **if** statement: iv) Use **if** statement v) Know the structure of **if-else** statement vi) Use **if-els**e statement vii) Know that the **switch** statement is composed of: • Switch • Case • Default • Break viii) Know the role of **break** in **Switch** statement ix) Use nested selection structures x) Differentiate among all selection structures xi) Write codes for flowcharts discussed in unit-1

UNIT 5 LOOP STRUCTURE

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
5.1 Loop Structure	i) Explain the concept of loop structure ii) Know that **for** loop structure is composed of: • For • Initialization expression • Test expression • Body of the loop • Increment / decrement expression iii) Know that **while** loop structure is composed of: • while • Test expression • Body of the loop iv) Know that **do while** loop structure is composed of: • Do • Body of the loop • While • Test expression • Statement terminator v) Explain the use of **break** and **continue** statements vi) Differentiate among all loop structures vii) Explain the concept of a nested loop viii) Write codes for flowcharts discussed in unit-1

UNIT 6 COMPUTER LOGIC AND GATES

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
6.1 Data Representation in a computer	ii) Recall that data is represented using binary pulses (0 and 1) iii) Explain that binary pulses have a respective low and high voltage
6.2 Logic Gates	i) Explain digital logic and logic gates ii) Know that the following are the three basic logic gates: • AND • OR • NOT iii) Explain a truth table. iv) Explain the following logic gates with the help of truth tables: • AND • OR • NAND • NOR • NOT • Exclusive NOR (XNOR) • Exclusive OR (XOR) v) Explain that further logic gates may be formed using the basic logic gates vi) Explain briefly with examples the conversion of Boolean expression to logic circuit
6.3 Simplification using K Maps	i) Describe K-Map ii) Simplify two variable Boolean function/expression iii) Simplify three variable Boolean function/expression iv) Build logic circuits from the simplified expressions

UNIT 7 WORLD WIDE WEB AND HTML

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
7.1 Introduction	i) Define the following terms: • World Wide Web (WWW) • Web page • Web site • Web Browser • Web Server • Uniform Resource Locator (URL) • Search Engine • Home Page • Web Hosting ii) Explain the following types of Web sites: • Portal • News • Informational • Educational • Personal • Business • Entertainment
7.2 Introduction to HTML	i) Define Hypertext Markup Language (HTML) ii) Explain the steps involved to: • Create and save an HTML file • Display a webpage iii) Identify the tags used to mark-up HTML elements iv) Identify the following elements: • HTML • Head section • Body section
7.3 Text Formatting	i) Describe the steps involved to: • Specify a page title • Create a paragraph

	• Insert line breaks • Insert spaces • Add headings/sub-headings ii) Identify the text formatting tags used to format the text in various font styles, colours and sizes iii) Use appropriate text formatting tags to define: • Font size • Font colour • Font face • Bold text • Italic text • Subscripted text • Superscripted text • Underline text
7.4 Creating Lists	i) Differentiate among unordered list, ordered list, definition list and nested list ii) Create: • Unordered list • Ordered list • Definition list • Nested list
7.5 Images and Backgrounds.	i) Add: • An image • Border to the image ii) Specify: • Width of the image • Height of the image • An alternate text for the image iii) Apply: • Background colour to a webpage • Foreground colour to a webpage iv) Assign a background image to the webpage

7.6 Hyperlinks	i) Define a hyperlink ii) Create a hyperlink to a webpage iii) Define an anchor iv) Create an anchor to hyperlink within a webpage v) Create a graphical hyperlink
7.7 Creating Tables	i) Create a table in the webpage ii) Apply the following table attributes: • Border • Cellspacing • Cellpadding • Align • Valign • Nowrap • Colspan • Rowspan
7.8 Creating Frames	i) Define a frame ii) Differentiate between a frame and a frameset iii) Create a frameset iv) Create a frameset with multiple frames

CURRICULUM FOR COMPUTER SCIENCE – GRADE XI

UNIT 1 OVERVIEW OF COMPUTER SYSTEM

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
1.1 Introduction to Computer	i) Identify computing device ii) Define the term computer and its basic operation (I/O, Storage, Process) iii) Define and classify. (Micro computer, Mainframe, Super, Mobile Computing) iv) Differentiate Hardware and Software with example
1.2 Computer Software	i) Describe types of software (System software, Application software) ii) Describe the types of system software: • Operating System • Device Driver • Utility Software • Language Processor iii) Describe Application software: • Productivity software • Business software • Entertainment software • Education software iv) Elaborate the following terms • Licensed software • Open source software • Shareware • Freeware v) Define firmware

1.3 Computer Hardware	i) Define the Computer Hardware (Input/output, Memory, CPU) ii) Describe the Input devices • Keyboard • Pointing devices - Mouse - Track ball - Joystick - Touch Screen * - Light Pen - Touch Pad * • Microphone • Digital camera * • Scanners - Hand held scanner - Flat-bed scanner - Optical scanner • Magnetic card/Devices based system. iii) Describe the following output devices: • Monitors - CRT - LCDs • Printers - Impact printer (Dot Matrix, Drum, Chain) - Non Impact Printer (DeskJet , Laser) • Plotters • Speakers iv) Differentiate between soft copy and hard copy

* used as a Input/ Output dual purpose

UNIT 2 COMPUTER MEMORY

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
2.1 Introduction	Define the following: • Bit • Byte (KB, MB, GB, TB) • Memory WORD
2.2 Main Memory	i) Explain the difference between chip memory and magnetic memory ii) Differentiate between volatile and nonvolatile memory iii) Explain the following fundamental types of computer memory: • Internal processor memory - Cache (L1, L2) - Register • RAM - Static RAM - Dynamic RAM • ROM - PROM - EPROM - EEPROM
2.3 Secondary Memory	i) Explain secondary storage devices ii) Explain the difference between sequential access and direct access iii) Describe the following types of magnetic memory, and optical disk with their working mechanism, advantages and disadvantages: • Magnetic tapes • Magnetic disks • Optical disks (CD, DVD, Blue Ray) iv) Describe the following chip Memories with advantages and disadvantages: • Flash Memory • Memory Cards

UNIT 3 CENTRAL PROCESSING UNIT

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
3.1 Inside CPU	i) Describe the basic components of CPU : • Arithmetic and Logic Unit(ALU) • Control Unit (CU) • Registers • Cache • Internal Buses ii) Describe the functions of the following types of registers: • General purpose registers: - Accumulator (AC) - Base register - Counter register - Data Register (DR) • Special purpose registers: - Instruction Register (IR) - Memory Address Register (MAR) - Memory Buffer Register (MBR) - Program Counter (PC) iii) Explain the system bus and its types: • Data bus • Address bus • Control bus
3.2 CPU Operations	i) Define instruction and its types ii) Explain instruction format iii) Describe instruction cycle.(fetch, decode, execute) iv) Describe CISC and RISK architecture v) Differentiate the following processors with reference to Clock speed, Bits, Bus width, Cache, Architecture: • Intel P4 • AMD Athlon

UNIT 4 INSIDE SYSTEM UNIT

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
4.1 Computer Casing/System Unit	i) Differentiate between the CPU and system unit ii) Identify the Computer Casing and its types iii) Explore the system unit • Power Supply • Mother Board - BIOS(Basic Input Output System) - Port - Expansion Slot (AGP, PCI, PCI Express) - Ribbon Cable (Data Cable, IDE, SATA 1, 2 , FD Cable) - Memory Slot - Disk Controller - Cooling System - Buses
4.2 Ports and Slots on the Motherboard	i) Describe the following Ports: • Serial Ports • Parallel Ports • PS/2 Port • USB port • Fire Wire port ii) Identify the following expansion cards: • Sound card • Video Card • Modem card • Network card iii) Memory chips: • SIMM • DIMM • SDRAM • DDR

UNIT 5 NETWORK COMMUNICATION AND PROTOCOLS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
5.1 Introduction	Explain the following: • Basic Network Components (Sender, Receiver, Medium) • Modes of Communication (simplex, half duplex, full duplex, Synchronous, Asynchronous) • Communication Media (Guided, Un-Guided) • Communication Devices (Switch, Router, Gateway) • Network Architecture (Client/Server, Peer to Peer) • Network Types (LAN, MAN, WAN, VPN) • Network Topologies (Star, Ring, Bus, Mesh)
5.2 Data Communication standards	i) Identify the purpose of a communication standard ii) Define OSI model and explain concept of its layers iii) Provide examples of protocols and devices on every layer of OSI Model
5.3 TCP/IP	i) Describe TCP/IP as a Protocol sites used for communication over the Internet by discussing: • Architecture • Ports • Application ii) Compare the TCP sites with OSI model iii) Differentiate between circuit switching and Packet switching iv) Describe IP Addressing scheme (Classes, Subnets, Masks)

UNIT 6 WIRELESS COMMUNICATIONS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
6.1 Introduction	i) Explain a wireless network ii) Explain the advantages and disadvantages of wireless networks iii) Define the following terms: • Radio signals • Radio transceiver • Access Point • Line of sight communication iv) Difference between short distance and long distance wireless communications
6.2 Short Distance Wireless Communications	Explain the following types of short distance wireless technologies: • Wi-Fi • Wi Max • Bluetooth • Infra-red
6.3 Long Distance Wireless Communication	Explain the following types of long distance wireless communications: • Cellular Communication • Global Positioning System (GPS) – Geostationary Earth Orbit (GEO) – Medium Earth Orbit (MEO) – Low Earth Orbit (LEO)
6.4 Mobile Device communication	i) Explain the requirements of mobile communication ii) Identify features and limitations of mobile communication system iii) Explain the architecture for communications over mobile devices • Web Protocol stack (HTTP/TCP/IP) • WML • WAP

UNIT 7 DATABASE FUNDAMENTALS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
7.1 Introduction	i) Explain the difference between data and information ii) Explain the file management system iii) Define database iv) Explain the database management system v) Identify the advantages of database management system over the file management system vi) Identify the role of a Database Administrator (DBA) vii) Describe the following types of database models: • Hierarchical database • Network database • Relational database • Object-Oriented database • Object Relational Database. viii) Explain the following types of database languages for relational databases: • Data Definition Language (DDL) • Data Manipulation Language (DML) • Data Control Language (DCL)
7.2 Basic Database Terminologies	Define the following terms related to relational databases: • Field / Attribute / Column • Record / Tuple / Row • Table / Relation • View • Data type • Key
7.3 Planning a Database	Explain the following steps for designing a database: • Problem Identification/ Definition • Feasibility study

		• Requirement Analysis • Identifying Entities and Attributes • Assigning names to Tables and Columns
7.4	Data Modeling and Entity-Relationship Diagram	i) Explain the following through pictorial examples: • Entity • Attribute • Relationship • Keys ii) Explain the cardinalities and modalities with the help of pictorial examples iii) Draw Entity-Relationship (ER) diagrams for the systems like: • Library Management System. • Student Management System • Ticket Booking System.
7.5	Relational Schema	i) Transform the ER models to the Relational Schema: • Transforming Entities • Transforming Attributes • Transforming Relationships ii) Normalize relations up to third normal form including integrity rules.

UNIT 8 DATABASE DEVELOPMENT

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
8.1 Introduction	i) Identify various relational database management systems (MS Access, Open Office Base, SQL Server) ii) Select any suitable DBMS as an application for creating and maintaining databases iii) Explain the steps involved to create and save a database iv) Explain the following in Database Environment: • Database Toolbar • Database Window • Objects – Tables – Queries – Forms – Reports
8.2 Working with Tables	i) Explain different ways of creating , saving and editing a table in database ii) Identify various available data types iii) Create a primary key and foreign key in the tables iv) Create and edit relationship among tables v) Use navigation buttons to navigate through records in a table vi) Add, modify and delete records from a table
8.3 Working with Forms	i) Explain different ways of creating , saving and editing a form in a database ii) Know different Form views iii) Use the navigation buttons to navigate through records displayed in a Form iv) Add, modify and delete records v) Use Form controls

8.4	Working with queries and commands	i) Explain different ways of creating, saving and editing a query in a database ii) Use following queries on database • SELECT(Where, Group by, Order by) • UPDATE • DELETE • INSERT • ALTER
8.5	Generating Reports	i) Use the report wizard to generate a report ii) Use various report layouts/styles to produce reports iii) Set the sort order of records that will appear on the report iv) Customized reports using queries (macros and arithmetic expressions) v) Save, view and print the report

CURRICULUM FOR COMPUTER SCIENCE – GRADE XII

UNIT 1 OPERATING SYSTEM

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
1.1 Introduction to Operating System	i) Define an operating system ii) Describe commonly-used operating systems(DOS, Windows, Unix, Macintosh) iii) Explain the following types of operating system: • Batch processing Operating System • Multi-programming Operating System • Multi-tasking Operating System • Time -Sharing Operating System • Real-Time Operating System • Multi-processor Operating System • Parallel Processing Operating Systems • Distributed Operating Systems • Embedded Operating System iv) Define the following features/characteristics of operating system: • Single-user Operating Systems • Multi-user Operating System
1.2 Operating System Functions	Describe the following main functions of operating system: • Process Management • Memory Management • File Management • I/O System Management • Secondary Storage Management • Network Management • Protection System • Command-Interpreter
1.3 Process Management	i) Define a process ii) Describe the new, running, waiting/blocked, ready and terminated states of a process iii) Differentiate between: • Thread and process • Multi-threading & multi-tasking • Multi-tasking and multi-programming

UNIT 2 SYSTEM DEVELOPMENT LIFE CYCLE

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
2.1 System Development Life Cycle	i) Define a System ii) Explain System Development Life Cycle (SDLC) and its importance iii) Describe objectives of SDLC iv) Describe stakeholders and their role v) Explain the following: • Planning • Feasibility • Analysis • Requirement Engineering – Requirement Gathering o Functional Requirements o Non Functional Requirements – Requirements Validation – Requirements Management • Design (Algorithm, Flow Chart, Pseudo code) • Coding • Testing /verification • Deployment/Implementation • Maintenance/Support vi) Explain the role of following in the system development life cycle • Management • Project Manager • System Analyst • Programmer • Software Tester • Customer

UNIT 3 OBJECT ORIENTED PROGRAMMING USING C++

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
3.1 Introduction	i) Define Program ii) Define header files and reserved words iii) Describe the structure of a C++ program • Pre-processor Directives – **include** – **define** • Main function • Body iv) Know the use of a statement terminator (;) v) Explain the purpose of comments and their syntax
3.2 C++ Constants and Variables	i) Explain the difference between constant and variable ii) Explain the rules for specifying variable names iii) Know the following data types offered by C++ and the number of bytes taken by each data type • Integer – **int** (unsigned, short, long) • Floating point – **float** • Double precision – **double** • Character – **char** iv) Define **constant** qualifier – **const** v) Explain the process of declaring and initializing variables vi) Use type casting
3.3 Input/ Output Handling	i) Explain the use of **cout** statement for displaying output on the screen ii) Explain the use of **cin** statement to get input from the keyboard during execution of the program iii) Define **getch( )**, **gets( )** and **puts( )** functions iv) Define escape sequence v) Explain use of the following escape sequences using programming examples • Alert - **\a** • Backspace – **\b** • Newline – **\n** • Carrage Return – **\r**

	• Tab – **\t** • Display backslash – **** • Display single quotation marks – **\'** • Display double quotation mark – **\"** vi) Make use of most commonly used I/O handling functions vii) Use manipulators **endl** and **setw**
3.4 Operators in C++	i) Define the following operators and show their use with examples: • Assignment operator (=) • Arithmetic operators (+, -, *, /, %) • Arithmetic assignment operators(+ =, -, =, * =, /=, % =) • Increment and decrement operators (++, --) - Prefix - Postfix • Relational operators (<, >, <=, >=, = =, ! =) • Logical operators (AND, ||, OR &&, NOT **!**) • Ternary operator (? **:**) ii) Identify unary, binary and ternary operators iii) Define an expression iv) Define and explain the order of precedence of operators. v) Define and explain compound expression vi) Define compound expressions

UNIT 4 CONTROL STRUCTURES

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
4.1 Decisions	i) Explain the use of the following decision statements: • **If** • **If-else** • **Else-if** • **Switch-default** ii) Know the concept of nested **if** iii) Use **break** statement and **exit** function
4.2 Loops	i) Explain the use of the following looping structures: • **For** • **While** • **Do-while** ii) Use continue statement iii) Know the concept of nested loop

UNIT 5 ARRAYS AND STRINGS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
5.1 Introduction	i) Explain the concept of an array ii) Know how array elements are arranged in memory iii) Explain the following terms related to arrays • Size of array • Name of array • Index iv) Explain how to define and initialize an array of different sizes and data types v) Explain how to access and write at an index in an array vi) Explain how to traverse an array using all loop structures vii) Use the **size of ( )** function to find the size of an array
5.2 Two dimensional Arrays	i) Explain the concept of a two dimensional array ii) Explain how to define and initialize a two dimensional array of different sizes and data types iii) Explain how to access and write at an index in a two dimensional array
5.3 Strings	i) Explain what are strings. ii) Explain how to define a string iii) Explain the techniques of initializing a string iv) Explain the most commonly used string functions

UNIT 6 FUNCTIONS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
6.1 Functions	i) Explain the concept and types of function ii) Explain the advantages of using functions iii) Explain the signature of function (Name, Arguments, Return type) iv) Explain the following terms related to functions • Function prototype • Function definition • Function call v) Explain the difference between local, global, and static variables vi) Explain the difference between formal and actual parameters vii) Know the concept of local and global functions viii) Use inline functions
6.2 Passing arguments and returning values	i) Pass the arguments: • Constants • By value • By reference ii) Use default argument iii) Use **return** statement
6.3 Function overloading	i) Define function overloading ii) Know advantages of function overloading iii) Understand the use of function overloading with: • Number of arguments • Data types of arguments • Return types

UNIT 7 POINTERS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
7.1 Pointers	i) Define pointers ii) Understand memory addresses iii) Know the use of reference operator (&) iv) Know the use of dereference operator (*) v) Declare variables of pointer types vi) Initialize the pointers

UNIT 8 OBJECTS AND CLASSES

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
8.1 Classes	i) Define class and object ii) Know the member of a class: • Data • Functions iii) Understand and access specifier: • Private • Public iv) Know the concept of data hiding v) Define constructor and destructor • Default constructor/destructor • User defined constructor • Constructor overloading vi) Declare object to access • Data members • Member functions vii) Understand the concept of following only with daily life examples: • Inheritance • Polymorphism

UNIT 9 FILE HANDLING

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
9.1 File Handling	i) Know the binary and text file ii) Open the file • Modes of opening file iii) Know the concept of • BOF • EOF iv) Define stream v) Use the following streams • Single character • String

Computer Science Lab Activities

Activities for Grade IX

1. Operating System
    i. Installation of O.S. (Windows / Linux)
    ii. Manage files and folders
    iii. Customize desktop
    iv. Installation of drivers (Sound, VGA, Modem, Printers)
    v. Installation of Antivirus Software
2. Word
    i. Write different applications / letters
    ii. Design class time table
    iii. Design greeting / invitation cards
3. Spread Sheet
    i. Create a mark sheet
    ii. Create a utility bill
    iii. Create a Stock Control list for a grocery shop
4. Urdu Editor
    1. Create a document to write poems
    2. Design invitation / greeting cards

Activities for Grade X

1. Installation of C – Compiler
2. Familiarization with IDE of C – Compiler
3. Write some programmes using printf ( ), Scanf ( ), Format, Specifier, Escape Sequences, getch
4. Write programmes like:
    - Solving arithmetic problems to calculate average, percentage, and grades etc
    - Calculating area, volumes, parameters of some geometric shapes
    - Comparing numbers
    - Solving quadratic Equation
    - Finding factorial of given numbers
    - Finding Table of a given number
    - Generating / Summing of simple series (even/odd)
5. Create a webpage / website involving:
    - Lists

- Images and backgrounds
- Hyperlinks
- Tables

Activities for Grade XI

1. Recognition of component in System Unit
2. Resource Sharing (Hardware and Software using networking)

Database

Design and develop a database containing:

- Tables (3 to 5)
- Queries (4 to 6)
- Forms (upto 10)
- Reports (5 to 10)

Including all requirements of DBMS like relationships and main interface

Activities for Grade XII

1. Installation of C++ Compiler
2. Familiarization with IDE of C++ Compiler
3. Write some programs using:
    - Cin
    - Cout
    - Escape sequences
    - Setw
4. Write program for problems like:
    - Solving arithmetic problems to (calculate interest, percentage, average, ratio, grades etc.)
    - Calculating area / volume / perimeter of some basic geometrical shapes
    - Comparing numbers / strings
    - Solving quadratic equation
    - Finding out the GCD and LCM.
    - Reading a number and find out whether it is a prime or composite
    - Sorting a list of items (numeric / string)
    - Searching an item out of a list of items (numeric /string)
    - Generating random numbers for a dice using function
    - Finding addition and multiplication of a matrices (Maximum 3 x 3)
    - Finding the transpose of a matrix (3 x 3)

- Generating and summing simple series
- Reversing a given number / string
- Finding out a specific day of a week for a given data using function.

5. Write a programme to sum two and three numbers of different date types
6. Write a programme to display the address and the value of a variable using pointer
7. Writer a programme to create and display student object with data members as name, age and class
8. Write a programme to create and read a data file

ASSESSMENT AND EVALUATION

Assessment is the process of gathering information using a variety of tools and techniques that reflect how well a student is achieving the curriculum expectations in a subject. As part of assessment teachers provide students with descriptive feedback that guides their efforts towards improvement. The quality of assessment largely determines the quality of evaluation. Evaluation refers to the process of judgement and decisions based on the interpretation of evidence gathered through assessment. Rowntree* (1990) defined assessment as having two purposes: firstly to support and provide feedback to learners and improve their ongoing learning, and secondly to report on what they had already achieved. In essence the first is formative assessment and the second is summative assessment. Morgan and O'Reilly' (1999) believe that assessment is the engine that drives and shapes learning, rather than an end of course event that grades and reports on performance.

Assessment and evaluation should be based on the expectations outlined in the national curriculum. To ensure that assessment and evaluation lead to the improvement of student learning, teachers must use specific assessment and evaluation strategies that:

- Address both what students learn and how well they learn
- Are administered over a period of time and designed to provide opportunities for students to demonstrate full range of their learning
- Ensure that each student is given clear directions for improvement
- Promote students' ability to assess their own learning, and
- Are communicated clearly to students and parents in advance

For assessment and evaluation of grade level IX-X and XI-XII the institutions adopt their own criteria. The means by which each institution achieves quality should differ according to the circumstances in which it operates, but each must give priority to meet students expectations in terms of learning outcomes they can legitimately expect to achieve. In essence an effective learning-outcomes-oriented quality assurance system must be based on constant monitoring and effective feedback lops.'

Unit-wise Weightages

Following tables explain weightages of specified topics with respect to grades IX-X and XI-XII. They will be supportive to:

- The teachers and education planners to develop the assessment and evaluation strategies,
- The textbook writers to give a specific weightage to a particular topic

Unit-wise Weightages – Grade IX

Unit	Title	Weightage
1.	Fundamentals of Computer.	15%
2.	Fundamentals of Operating System.	15%
3.	Office Automation.	25%
4.	DATA Communication.	20%
5.	Computer Networks.	15%
6.	Computer Security and Ethics.	10%
	TOTAL:	100%

Unit-wise Weightages – Grade X

Unit	Title	Weightage
1.	Programming Techniques.	10%
2.	Programming in C.	10%
3.	Input / Output Handling.	15%
4.	Control Structure.	15%
5.	Loop Structure.	15%
6.	Computer Logic and Gates.	15%
7.	World Wide Web and HTML.	20%
	TOTAL:	100%

Unit-wise Weightages – Grade XI

Unit	Title	Weightage
1.	Overview of Computer System	10%
2.	Computer Memory	10%
3.	Central Processing Unit	10%
4.	Inside System Unit	15%
5.	Network Communication and Protocols	10%
6.	Wireless Communications	10%
7.	Database Fundamentals	15%
8.	Database Development	20%
	TOTAL:	100%

Unit-wise Weightages – Grade XII

Unit	Title	Weightage
1.	Operating System	10%
2.	System Development Life Cycle	10%
3.	Object Oriented Programming Using C++	10%
4.	Control Structure	15%
5.	Arrays and Strings	15%
6.	Functions	15%
7.	Pointers	5%
8.	Objects and Classes	10%
9.	File Handling	10%
	TOTAL:	100%

The Distribution of Time – Theory and Lab

Teaching schedules are among the integral parts of classrooms. They help school management to run and monitor the teaching of a particular subject. The following tables, indicating unit-wise time distribution for theory and lab classes, will be supportive to the teachers and education planners. Although the time to be spent may be varied according to circumstances, it is advisable that teachers do not grossly depart from the suggested time.

Unit-wise Time Distribution – Grade IX

Unit	Title	No. of Periods	
		Theory	Lab
1.	Fundamentals of Computer	20	5
2.	Fundamentals of Operating System	20	5
3.	Office Automation	10	45
4.	DATA Communication	30	---
5.	Computer Networks	30	---
6.	Computer Security and Ethics	15	---
	TOTAL:	180	

Unit-wise Time Distribution – Grade X

Unit	Title	No. of Periods	
		Theory	Lab
1.	Programming Techniques	15	---
2.	Programming in C	10	5
3.	Input / Output Handling	10	10
4.	Control Structure	10	25
5.	Loop Structure	10	25
6.	Computer Logic and Gates	15	---
7.	World Wide Web and HTML	20	25
	TOTAL:	180	

Unit-wise Time Distribution – Grade XI

Unit	Title	No. of Periods	
		Theory	Lab
1.	Overview of Computer System	15	5
2.	Computer Memory	15	5
3.	Central Processing Unit	15	5
4.	Inside System Unit	15	10
5.	Network Communication and Protocols	25	5
6.	Wireless Communications	15	---
7.	Database Fundamentals	10	25
8.	Database Development	10	25
TOTAL:		200	

Unit-wise Time Distribution – Grade XII

Unit	Title	No. of Periods	
		Theory	Lab
1.	Operating System	10	5
2.	System Development Life Cycle	15	---
3.	Object Oriented Programming Using C++	10	5
4.	Control Structure	20	20
5.	Arrays and Strings	15	15
6.	Functions	15	15
7.	Pointers	10	5
8.	Objects and Classes	10	10
9.	File Handling	10	10
TOTAL:		200	

THE TEXTBOOK

There are many important entities involved to revamp the entire education system. The school has to play its own role, parents have to contribute their share and teachers have to assume a significant place in fostering education. Print materials, particularly the textbooks, have to play a key role towards providing quality education at all levels. Although there are many stakeholders that contribute towards the overall learning of the child yet the importance of textbook as a reservoir of information / knowledge cannot be ignored.

Textbook writers have a vital role to play in penetrating the young minds through their writing. A textbook

- whose content as well as presentation is thoughtfully planned
- which is written by qualified and competent subject expert(s), and
- which is attractive and engaging

must stimulate the interest of teacher and the taught.

Guidelines for Textbook Authors

Textbooks aimed at lower level tend to include more learning features than those at higher level. However in textbook writing generally the following aspects may be taken into consideration:

- The textbook should be in line with the objectives of National Curriculum
- The author should continuously focus on standard and benchmarks
- The textbook should be visually appealing and should maintain interest of the students
- The title page should be attractive and representative of the content of the textbook
- The colour scheme of pictures should be close to real life
- The textbook should include detailed table of contents
- The text should be clear and concise
- The material should not be cramped. To make it more digestible, it may be chunked into smaller parts with headings
- The author should bring himself to the mental level of students, he is writing for
- The span of the textbook should be fairly reasonable
- The textbook is expected to provide accurate and up-to-date information
- The text material should be arranged in a logical manner; simple to complex, familiar to unfamiliar and concrete to abstract
- The text material must be free from ambiguities and errors

Textbook Style and Structure

To make a textbook an effective teaching and learning tool its style and structure is given due importance. The material needs to be structured in a coherent and logical way, and that writing style should be reader friendly.

Unit Opening	
Unit Outline	Include list of headings.
Student Learning Outcomes (SLOs)	One SLO for each heading may be included. If they are numerous then a reasonable number is acceptable.
Short Introduction	Explain what this unit covers and why.

Unit Body	
Key Terms	Use italics for emphasis and bold for key terms. Define key terms when first introduced and collate them with their definitions for the glossary.
Tips or Hints	Separated from the main body of text, they allow the author to speak directly to the student, offering useful advice or flagging important points.
Visuals	Include pictures that illustrate the use and importance of computer and technology.

Unit Ending	
Checkpoint Exercises	Include multiple-choice questions, interpretive exercises, fill-in and matching items. Students may also be asked to label diagrams or write a one word answer to short question.
Lab Exercises	Include computer lab exercises, appropriate to the unit.
Summary	Include a review of the main concepts. This can relate to the SLOs by covering each in turn (bullet points work well). The summary should not include any new information.

End of Textbook	
Glossary.	Include only the key terms in the glossary.
Bibliography.	Include bibliography and list of books for suggested reading.
Index.	Include index for the key terms used in the book.

The Workbook

Workbooks contain writing activities and exercises that are related to each unit in the textbook. Workbook exercises help to develop students' conceptual understanding of the topics dealt with in the text. They assist students in developing skills by applying knowledge to new situations. A workbook has the following basic features:

A workbook should

- Be easy for students to understand and follow
- Involve clear and explicit instructions
- Be stimulating, challenging and innovative
- Correspond to knowledge and skill developed in the textbook
- Consist of many exercises and activities for each unit, topic and sub-topic
- Be non-repetitive in style and structure
- Avoid using too many activities for one topic or skill
- Include exercises and activities which are different from those in textbook or teacher's manual
- Suggest accessible and affordable materials/resources for the proposed activities

THE TEACHER'S MANUAL

Ideally the teacher's manual should come with the textbook. The manual is aimed at informing teachers how the textbook is written and how best to use it to facilitate student learning. It can be seen as a means of helping teachers develop professionally. It provides detailed explanation of key concepts and the way to teach a particular topic. Its basic features are as below:

The teacher's manual should

- Be easy to understand and use
- Help teachers to teach text and extend activities
- Give sequenced instructions for each activity
- Include detailed lesson plans
- Suggest projects to assign
- Include teaching learning resources
- Establish a test bank (having questions different from text) and suggest interactive quizzes corresponding to each unit
- Involve various up-to-date and relevant teaching strategies and rationale for suggested teaching
- Explain how to implement each teaching strategy
- Identify constraints and strengths of each strategy or activity
- Identify resources needed for teaching strategies and extension of activities
- Expand and develop teachers repertoire of knowledge and skills
- Identify assessment strategies

THE WEB-BASED RESOURCES

The World Wide Web is growing very fast to access an immense volume of rapidly evolving information. It is acting as a driving force since its ease of use makes the internet trivially accessible. Through web-based links like the ones mentioned below the teachers, parents and students can

- Access various sites around the world;
- Access additional information and currency on the topics,
- View three-dimensional figures, graphics, lesson plans, activities and various books of interest

Title of Website	**Universal Resource Locator (URL)**
About.com	www.about.com
Coloring.com	www.colouring.com
Computer Knowledge	www.cknow.com/vtutor/index.html
Excel Tutorial	www.usd.edu/triu/tut/excel
Funbrain	www.funbrain.com
HowStuffWorks	www.howstuffworks.com
Internet4Classrooms	www.internet4classrooms.com/on-line.word.htm
Learn the Net	www.learnthenet.com/english/index.html
PowerPoint in the classrooms	www.actden.com/pp
Robot Magazine	www.robotmag.com
Typing Master	www.typingmaster.com
Typing Tutor	www.typingtutor.com
Wikipedia	en.wikipedia.org

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