



GOVERNMENT OF SINDH
SCHOOL EDUCATION & LITERACY DEPARTMENT
Karachi, dated: 20th November, 2019

NOTIFICATION

School Education & Literacy Department, Government of Sindh is pleased to notify the reviewed Curriculum for Grade XI and XII for the subjects of Sindhi, Biology, Physics, Chemistry, English Literature and Computer Science, Ethics for Grade III and IV, Computer Science for Grade IX and X developed by the Directorate of Curriculum, Assessment & Research (DCAR).

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Secretary to Government of Sindh

NO: SO (G-III) SELD/3-910/18

Karachi, Dated: 20th November, 2019

Copy is forwarded for information and necessary action:

1. The Chairman, Sindh Textbook Board, Jamshoro.
2. The Director, Directorate of Curriculum, Assessment & Research, Jamshoro
3. The Chief Program Manager, Reform Support Unit (RSU), Karachi.
4. The Chief Advisor, School Education & Literacy Department, Karachi.
5. The P.S to Secretary School Education & Literacy Department, Karachi.
6. Office Order File.



Ahsan
20/11/2019
SECTION OFFICER (G-III)

SINDH CURRICULUM FOR COMPUTER SCIENCE

GRADES XI-XII
2019



GOVERNMENT OF SINDH
SCHOOL EDUCATION AND LITERACY DEPARTMENT

DIRECTORATE OF CURRICULUM, ASSESSMENT &
RESEARCH SINDH
JAMSHORO

TABLE OF CONTENT

Acronyms	02
Introduction	04
Major Changes in Reviewed Curriculum	05
Framework of Curriculum	05
Competencies of Computer Science Curriculum	07
Competencies, Standards and Benchmarks of the Curriculum	08
UNITS FOR GRADE XI	
UNIT 1: Overview of Computer System	11
UNIT 2: Computer Memory.....	13
UNIT 3: Inside System Unit	14
UNIT 4: Operating System	15
UNIT 5: Programming Concept Using C++	17
UNIT 6: Arrays, String and Structure	19
UNIT 7: Computer Communication & Networks	20
UNITS FOR GRADE XII	
UNIT 1: System Development Life Cycle	21
UNIT 2: Pointers	22
UNIT 3: Object Oriented Programming Using C++	22
UNIT 4: File Handling	23
UNIT 5: Database Fundamentals.....	24
UNIT 6: Introduction to Multimedia.....	26
UNIT 7: Wireless and Mobile Communication.....	27
Assessment and Evaluation	32
UNIT-WISE WEIGHTAGES	33
The Distribution of Time – Theory and Lab	34
The Textbook	35
Sample Programs and Practical Journals	38
The Web-based Resources	40
Suggestions and Feedback.....	41
Computer Science Provincial Review Committee (PRC)	42

ACRONYMS

AC	Accumulator
ALU	Arithmetic and Logic Unit
CD	Compact Disc
CDMA	Code Division Multiple Access
CLI	Command Line Interface
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CU	Control Unit
DOS	Disk Operating System
DSL	Digital Subscriber Line
DVD	Digital Versatile Disk
EEPROM	Electrically Erasable Programmable Read-Only Memory
EISA	Extended Industry Standard Architecture
EPROM	Erasable Programmable Read-Only Memory
GCD	Greatest Common Divisor
GUI	Graphic User Interface
HDMI	High-Definition Multimedia Interface
HTML	Hyper Text Mark-up Language
I/O	Input/ Output
IDE	Integrated Development Environment
ISDN	Integrated Services Digital Network
IT	Information Technology
LAN	Local Area Network
LED	Light Emitting Diode
MAN	Metropolitan Area Network
MB	Mega Byte
OOP	Object Oriented Programming
OS	Operating System
PCI	Peripheral Component Interconnect
PROM	Programmable Read-Only Memory
RAM	Random Access Memory
ROM	Read Only Memory
SD	Secure Digital
URL	Uniform Resource Locator
USB	Universal Serial Bus
VGA	Video Graphic Array
VISA	Virtual Instrument Software Architecture

WAN	Wide Area Network
Wifi	Wireless Fidelity
WiMax	Worldwide Interoperability for Microwave Access
WWW	World Wide Web

INTRODUCTION

In recent past, nothing has affected the entire human life more than Computer science. Computer and allied technologies are playing vital role in reshaping the society at an amazing speed as well as magnitude. As a matter of fact, almost every modern technology, whether directly or indirectly, depends on the applications of computer science. An amazing fact about computer is that its accuracy, reliability and the productivity are continuously increasing while on the other hand its prices and sizes are decreasing day by day. Now, we find computer everywhere and in reach of everyone. It is becoming mandatory for every student to receive quality computer education irrespective of what field they have chosen to pursue. Education is all about solving the problems. And in the modern era computers are the tools to assist the problem-solving process. We live in the era where we cannot secure the future of our children without inculcating the knowledge and skills of using Information and communication Technology (ICT). The 21st century learning skills like Critical Thinking, Creativity, Collaboration, Communication, Information Literacy, Media Literacy, Technology Literacy and others are largely associated with the ICT. Every employer in today's job market demands these skills. In order to prepare our students to face the challenges of modern age and make them the successful professionals, we must equip them with ICT knowledge and skills.

THE CONTEXT

Currently Computer Science is not a compulsory subject in HSC which it should be. Computer Science is considered in Science General Group. Any student who has passed SSC from any other group i.e. Science or Humanities can take Computer Science. It means that at HSC there are students who have already studied Computer for two years as well the students who just starting. Developing a curriculum that offers new concepts to the earlier and building the foundation of latter is challenging.

Students who choose Computer Science have to leave Chemistry. This is great disadvantage for the students of this group as if they have left with very few choices at university level. Removing this obstacle may attract more students to opt Computer Science which is the need of the time because the field of ICT has uncountable opportunities; currently and in near future.

RATIONALE FOR REVIEWING THE NATIONAL CURRICULUM 2009

After the 18th amendment, provinces are mandated to develop and review curriculum documents. In Sindh, the updated textbooks of Computers Science were not developed yet. Therefore, it was good opportunity to review and update the concepts that emerged during recent years before publishing new books. Further, the National Curriculum of Computer Science was developed in 2009. Keeping in view, the drastic changes occurring in the field of science and technology it is our responsibility to offer up to date learning experience to our students.

MAJOR CHANGES MADE IN REVIEWED CURRICULUM

The National Curriculum for Computer Science 2009 is the foundation of this reviewed curriculum. However, the contextual and contemporary changes have been made in it. The framework given in the National Curriculum 2009 was in descriptive form. The first change that was made in the reviewed curriculum was to reshape the curriculum framework. Therefore, in the reviewed Curriculum Standards are placed under Competencies (see figure 1; on next page). Secondly, the Standards and Benchmarks are updated, and few new concepts are introduced. Thirdly, some old concepts from the National Curriculum 2009 have been deleted, some are modified, and some new concepts are added. Fourthly, to avoid any boredom or monotonous learning experience, some chapters are shuffled. Fifthly, in order to nourish the aesthetic sense and the creativity of students, a new competency “Multimedia and Graphics” has been introduced. Finally, the Computer Programming portions has been made relevant to the real world problems and the practical portions has been enriched with new and more interesting activities.

One more important consideration that made throughout the review process was engagement and interest of the two different strata of student; one, the students who have already opted Computer Science in SSC (Grade IX and X) and two, the students who have chose subject of Computer Science at HSC (Grade XI). Therefore, in each competency, some SLOs are dedicated to build the foundation for the new students while the same may be treated as revision for the students who have already studied these concepts..

The Committee of reviewers recommends that this curriculum should be evaluated after two years of its implementation. And, in the light of the demands and interest of actual users i.e. students and teachers, further changes may be made.

FRAMEWORK OF CURRICULUM

Competencies, standards, benchmarks and student learning outcomes (SLOs) formulate the framework of Curriculum for Computer Science for Grade XI-XII. This curriculum framework provides a comprehensive image of the curriculum.

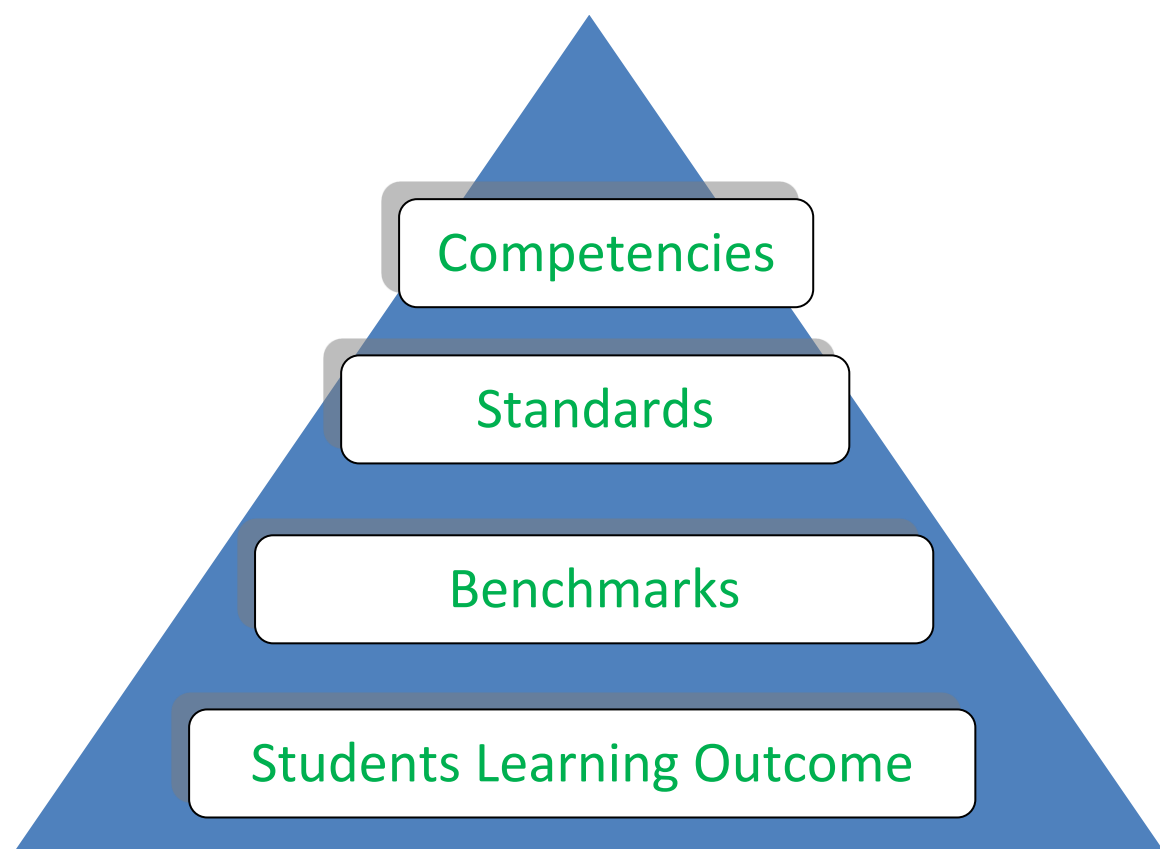


Figure No. 1: Curriculum Framework

- **Competency:** Competencies or strands are the key learning area that student will accomplish and learn
- **Standard:** The standard defines the competency by specifying broadly, the knowledge, skills and attitudes that students will acquire, should know and be able to do in a particular learning area during twelve year of schooling.
- **Benchmark:** The benchmark further elaborates the standards, indicating what the students will accomplish at the end of each developmental level in order to meet the standards.

- **Student Learning Outcome:** Student Learning Outcomes (SLOs) are based on the knowledge, skills, abilities, and attitudes that students are intended to have achieved at the end of a unit. SLOs are measurable instructional goals established for a specific group of students over a set period of time. SLOs serve as one of the measures of student growth. These are built on the description of the benchmarks and describe what student will accomplish at the end of each grade.

COMPETENCIES OF COMPUTER SCIENCE CURRICULUM FOR GRADE XI-XII

This reviewed curriculum of Computer Science Curriculum of Grade XI and XII is underpinned on the following seven competencies described in the Curriculum of Grade IX and X. These competencies are further elaborated by the Standards and Benchmarks which progress according to the age levels.

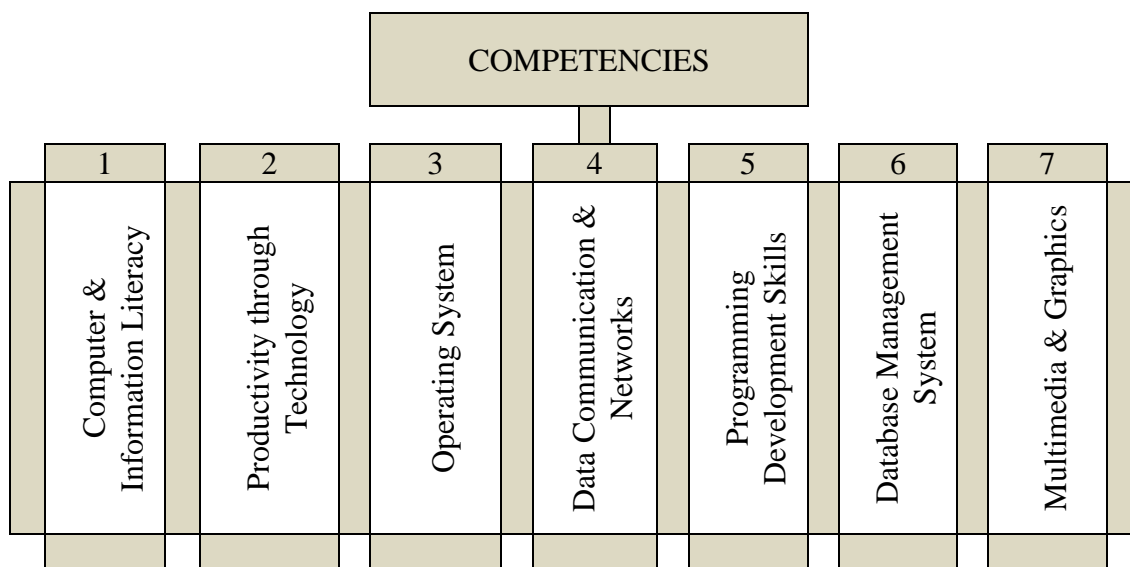


Figure No. 2: Competencies in Computer Science Curriculum

Competencies, Standards and Benchmarks of the Curriculum

Sr.	Competency	Standard	Benchmark
1	Computer and Information Literacy	Students will understand the fundamentals of computer and Information Technology (IT), possess Computing skills for speedy information handling and check virus attacks and authentication loopholes to take appropriate remedial measures.	1.1. Understand operations of computer using various hardware components and software modules. 1.2. Understand memory, its types and usages 1.3. Recognize the physical components of computer and understand their functions
2	Productivity Through Technology	Students will develop their understanding about the use of productivity tools (like Word Processor, Spreadsheet, presentation tools, graphic tools and) which will help to enhance learning, to increase productivity and to promote creativity.	This Competency was covered in elementary and secondary classes.
3	Operating System	To describe different types of operating systems and their functions and understand process management	3.1 Explain various types of Operating Systems 3.2 Describe functions of Operating Systems 3.3 Know the process management 3.4 Use and manage GUI System
4	Data Communication & Networks	To have knowledge of communication using transmission media and devices with various technologies, describe communication in different types of networks, know communication standards	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

		and identify commonly used technologies in wired and wireless networks.	4.4 Describe ISO's OSI 7 layers model 4.5 Explain TCP/IP protocol sites used on the Internet 4.6 Illustrate understanding of wireless technologies
5	Programming Development Skills	To write code to solve problems using high level programming languages and understand the concept of Object-Oriented Programming (OOP).	5.1 Understand and relate the concept of System Development Life Cycle 5.2 Program in C++ languages using data types and control structures 5.3 Understand the concept of Object-Oriented Programming 5.4 Understand the concept of Pointers and File handing and use them in programs
6	Database Systems	To understand database fundamentals, types, terminologies, entities and relationships, and ER-models and develop database application in MS Access.	6.1 Know database system and its operation 6.2 Build ER-data models 6.3 Understand the use of DBMS 6.4 Create, populate and manage tables 6.5 Create different types of queries in MS Access 6.6 Design ER model in MS Access
7	Multimedia and Graphics	To Understand and Use the Multimedia Applications for Academic and Entertainment purposes.	7.1 Understand the concept of Multimedia and different Medium/ Application 7.2 Use the Multimedia Package to develop Audios and Videos 7.3 Understand the concept of importing and exporting

Competencies Covered through Units

Competency	Computer and Information Literacy	Productivity Through Technology	Operating System	Data Communication & Networks	Programming Development Skills	Database Systems	Multimedia and Graphics
Grade XI	Unit 1: Overview of Computer System Unit 2: Computer Memory Unit 3: Inside System Unit		Unit 4: Operating System	Unit 7: Computer Communication & Networks	Unit 5: Programming Concept Using C++ Unit 6: Arrays, String and Structure		
Grade XII				Unit 7: Wireless and Mobile Communication	Unit 1: System Development Life Cycle Unit 2: Pointers Unit 3: Object Oriented Programming Using C++ Unit 4: File Handling	Unit 5: Database Fundamentals	Unit 6: Introduction to Multimedia

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 System	<ul style="list-style-type: none">• Describe term computer system<ul style="list-style-type: none">○ Computer Hardware○ Computer Software○ Basic Operations of Computer○ Computer Memory• Demonstrate the block diagram of computer system consisting hardware, software, basic operations and memory
1.2 Computer Hardware and their examples	<ul style="list-style-type: none">• Classify the hardware (input, output, storage, processing and communication) devices as per their functionality.<ul style="list-style-type: none">• Input Devices<ul style="list-style-type: none">○ Keyboard○ Mouse○ Joy Stick / Joy Pad○ Scanning Devices○ Data Tablets / Stylus○ Voice Recognition Devices○ Touch Sensitive Screens○ Webcam○ Bar Code Scanner○ Microphones• Output Devices<ul style="list-style-type: none">○ Monitors (LED, LCD, Plasma, CRT)○ Printers (All Types)○ Plotters○ Multimedia Projectors○ Speakers / Headphones○ SGD (Speech Generating Device)• Storage Devices and Media<ul style="list-style-type: none">○ Hard Disk○ Flash Drive/USB/Pen Drive

	<ul style="list-style-type: none"> ○ CD / DVD / CD-R/ CD-RW ○ Blu-ray Drive ○ SD Card and Micro SD Card ● Communication Devices <ul style="list-style-type: none"> ○ Network Interface Card ○ Modem ○ Data Terminals Equipment's ○ Fax Machines ○ Switch/ Hub ○ Gateway ○ Routers
1.3 Computer Software	<ul style="list-style-type: none"> ● Explain system software and its types <ul style="list-style-type: none"> ○ Operating Systems ○ Device Drivers ○ Language Translator ○ Antimalware (Antivirus, Trojan Horses) ● Discuss Application software <ul style="list-style-type: none"> ○ General Purpose Software ○ Special Purpose Software ● Describe Utility software <ul style="list-style-type: none"> ○ Compression Software ○ Data Recovery Software ○ Disk Manager
1.4 Computer Memory	<ul style="list-style-type: none"> ● Explain Primary and Secondary Memory ● Compare primary and secondary memory as per their functions.
1.5 Cutting Edge Technology	<ul style="list-style-type: none"> ● Describe how computers are affecting the technologies ● Explain the Artificial Intelligence (AI) ● Discuss the AI application in different fields ● Discuss Cloud Computing and its advantages

UNIT 2: COMPUTER MEMORY

Contents and Scope	Learning Outcomes/Skills
2.1 Memory Measurement Units	<p>The students will be able to:</p> <ul style="list-style-type: none">• Understand the memory measurement units<ul style="list-style-type: none">○ Bit○ Nibble○ Byte○ Kilo Bytes KB○ Mega Bytes MB○ Giga Bytes GB○ Tera Bytes TB
2.2 Primary/ Main Memory	<ul style="list-style-type: none">• Differentiate between volatile and non-volatile memory• Discuss the following types of computer memory:<ul style="list-style-type: none">○ RAM<ul style="list-style-type: none">- Static RAM- Dynamic RAM○ ROM<ul style="list-style-type: none">- PROM- EPROM- EEPROM
2.3 Secondary Memory	<ul style="list-style-type: none">• Explain secondary storage devices<ul style="list-style-type: none">○ Hard Drive• Describe other Peripheral Storage Devices<ul style="list-style-type: none">○ Flash Drive (USB)/ Data Traveler○ External Hard drive○ SD Card/ Micro SD Card○ Combo drives

UNIT 3: INSIDE CENTRAL PROCESSING UNIT (SYSTEM UNIT)

Contents and Scope	Learning Outcomes/Skills
3.1 System Unit	<p>The students will be able to:</p> <ul style="list-style-type: none">• Describe the characteristics of different CPU casings• Discuss the main components of system unit<ul style="list-style-type: none">○ Power supply○ Motherboard/Main Board○ Hard drive○ Combo drive○ Ports○ Cooling System
3.2 Motherboard/ Mainboard	<ul style="list-style-type: none">• Recognize the various components on motherboard<ul style="list-style-type: none">○ Microprocessors○ BIOS (ROM)○ RAM Slot○ CMOS Battery○ Jumpers○ Ports○ Expansion Slots○ System Bus• Outline the function of each component
3.3 Microprocessor	<ul style="list-style-type: none">• Explain the role of internal architecture of microprocessor<ul style="list-style-type: none">○ Clock○ Registers○ Arithmetic and Logic Unit(ALU)○ Control Unit (CU)○ Cache• Recognize the External Architecture of Microprocessor (Based on pins)<ul style="list-style-type: none">○ Address pins○ Data pins○ Control pins○ Interrupt Pins

	<ul style="list-style-type: none"> ○ Power Pins ● Understand the microprocessors specifications in terms of Technology, Generation, Clock speed, Bits, Bus width, Cache
3.3 Buses	<ul style="list-style-type: none"> ● Define buses <ul style="list-style-type: none"> ○ Address Bus ○ Data Bus ○ Control Bus ● Differentiate the types of buses on the basis of data flow direction (Uni-directional and Bi-directional).
3.4 Ports	<ul style="list-style-type: none"> ● Discuss the types of ports <ul style="list-style-type: none"> ○ Serial Ports ○ Parallel Ports ○ USB ○ HDMI
3.5 Expansion Slots	<ul style="list-style-type: none"> ● Explain the functions of different types of slots for expanding the computer system <ul style="list-style-type: none"> ○ PCI ○ EISA ○ VISA

UNIT 4: OPERATING SYSTEM

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
4.1 Introduction to Operating System	<ul style="list-style-type: none"> ● Define Operating System & its objectives ● Discuss the most used operating system for computers (Windows, Mac, DOS and UNIX) ● Explain the following features of Operating System <ul style="list-style-type: none"> ○ Batch Processing ○ Multi-Tasking ○ Time Sharing

	<ul style="list-style-type: none"> ○ Multi-Processing ○ Parallel Processing ○ Distributed ○ Embedded
4.2 Functions of Operating System	<p>Describe the following main functions of operating system:</p> <ul style="list-style-type: none"> ○ Booting ○ Process Management ○ Memory Management ○ File Management ○ I/O System Management ○ Secondary Storage Management ○ Network Management ○ Protection System ○ Command-Interpreter
4.3 Process Management	<ul style="list-style-type: none"> ● Define a process ● Describe the following states of processing <ul style="list-style-type: none"> ○ New ○ Running ○ Waiting/ blocked ○ Ready ○ Terminated ● Differentiate between <ul style="list-style-type: none"> ○ Thread and process ○ Multi-threading & multi-tasking
4.4 Working with GUI OS	<ul style="list-style-type: none"> ● Familiarize with environment of the Windows Operating System ● Apply data management techniques (files/ folders) <ul style="list-style-type: none"> ○ Creation ○ Deletion ○ Copying ○ Renaming ● Understand the concept drives and paths ● Apply files and folders searching options ● Understand the Properties and Attributes of files

	<p>and folders</p> <ul style="list-style-type: none"> • Demonstrate the management of the hardware software resources through control panel • Use DirectX (dxdiag) command to analyze the computer resources • Show and Change System Configurations by using msconfig command to show
4.5 Advance Operating Systems	<ul style="list-style-type: none"> • Describe OS other than Windows • Explain the Open Source OS and their advantages • Discuss the Operating System for Mobile Devices (Andorid and its versions)

UNIT 5: PROGRAMMING CONCEPT USING C++

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
5.1 Overview of Programming Concepts	<ul style="list-style-type: none"> • Explain data types & Operators used in C++ • Discuss input output streams • Use cascading technique in input output streams • Build different programs by using operators
5.2 Review of Control Structure	<ul style="list-style-type: none"> • Use Selection / Decision Making Structure to develop programs <ul style="list-style-type: none"> ○ if Statement ○ if-else statement ○ elseif statement ○ switch- default statement ○ Nested if- else • Use Iteration Statement /Loops in programs <ul style="list-style-type: none"> ○ for ○ while ○ do-while ○ Nested loops • Differentiate Jump Statements <ul style="list-style-type: none"> ○ break ○ continue

	<ul style="list-style-type: none"> ○ goto
5.3 Function	<ul style="list-style-type: none"> • Discuss type of functions and their advantages <ul style="list-style-type: none"> ○ Pre-defined ○ User Defined • Explain the signature of function (Name, Arguments, Return type) • Apply the following terms related to functions through programming <ul style="list-style-type: none"> ○ Function declaration (prototype) ○ Function definition (declarator&body) ○ Function call • Explain Scope & Visibility <ul style="list-style-type: none"> ○ local, global, and static variables • Differentiate/Compare between formal and actual parameters • Define inline functions in a program • Define the statement 'exit function'
5.4 Passing arguments and returning values	<ul style="list-style-type: none"> • Apply passing arguments to user defined functions <ul style="list-style-type: none"> ○ Constants ○ By value ○ By reference • Use default argument • Use "return" statement to return values from function •
5.5 Function overloading	<ul style="list-style-type: none"> • Explain function overloading and its advantages • Write a code for function overloading by using <ul style="list-style-type: none"> ○ Number of arguments ○ Data types of arguments ○ Return types

UNIT 6: ARRAYS, STRINGS AND STRUCTURES

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
6.1 Introduction to arrays	<ul style="list-style-type: none">• Discuss the concept of an array and its elements• Explain the following<ul style="list-style-type: none">○ Array Name○ Array Size○ Array Index• Describe defining and initializing an array of different data types (with syntax)• Explain how to access an element in an array• Develop a program to traverse an array (using loop)• Use the sizeof() function to find the size of an array
6.2 Two dimensional Arrays	<ul style="list-style-type: none">• Explain two dimensional array and its initialization with syntax• Write a program to access a two-dimensional array
6.3 Strings	<ul style="list-style-type: none">• Explain strings and how to define a string• Understand the appropriate use of string terminator ('\0')• Write a statement to initialize a string• Apply the following string functions<ul style="list-style-type: none">○ strlen()○ strcat()○ strcpy()○ strcmp()○ substr()
6.4 Structures	<ul style="list-style-type: none">• Explain Structure and its declaration• Explain how to define structure Variable• Write code for Initializing and accessing structure members.

UNIT 7: COMPUTER COMMUNICATION AND NETWORKS

Contents and Scope	Learning Outcomes/Skills
7.1 Basic of Networks	<ul style="list-style-type: none"> • Describe the Networks and its advantages • Discuss Network components: <ul style="list-style-type: none"> ○ Sender ○ Receiver ○ Medium ○ Message ○ Protocol
7.2 Data Flow Direction (Communication Modes)	<ul style="list-style-type: none"> • Define following Data flow directions (Communication Modes) <ul style="list-style-type: none"> ○ Simplex ○ Half Duplex ○ Full Duplex
7.3 Transmission Medium	<ul style="list-style-type: none"> • Describe Transmission medium and their types: <ul style="list-style-type: none"> ○ Guided Medium (Twisted Pair, Coaxial & Fiber Optic) ○ Unguided medium (Radio waves, Microwave, Infrared)
7.4 Network Types and Topologies:	<ul style="list-style-type: none"> • Discuss Types of networks: <ul style="list-style-type: none"> ○ Local Area Network (LAN) ○ Wide Area Network (WAN) Describe following topologies <ul style="list-style-type: none"> ○ Ring ○ Star ○ Bus ○ Mesh ○ Hybrid ○ Tree
7.5 Standard Organizations Network Architectures	<ul style="list-style-type: none"> • Explain Standard organizations <ul style="list-style-type: none"> ○ ISO ○ IEEE ○ ITU ○ ASCII • Describe following network architectures <ul style="list-style-type: none"> ○ ISOs OSI Model ○ TCP/IP Model ○ Internet Model

CURRICULUM FOR COMPUTER SCIENCE – GRADE XII

UNIT 1: SYSTEM DEVELOPMENT LIFE CYCLE

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
1.1 System Development Life Cycle	<ul style="list-style-type: none"> • Define a System • Explain System Development Life Cycle (SDLC) and its importance in software development. • Define the following stakeholders roles in (SDLC) <ul style="list-style-type: none"> ○ Project Manager ○ Business Analyst (Requirement) ○ System Architect (Design) ○ Software Developer/Development Team (Coding) ○ Tester/Testing team (Testing) ○ Operational Team (Implementation) ○ Production Support Team (Maintenance)
1.2 Phases of Software Development Life Cycle	<ul style="list-style-type: none"> • Describe the following Phases of System/Software Development Life Cycle(SDLC) <ul style="list-style-type: none"> ○ Planning and Requirement Analysis: <ul style="list-style-type: none"> – Problem Identification – Planning – Feasibility – Analysis ○ Software Requirement Engineering <ul style="list-style-type: none"> – Requirement Gathering <ul style="list-style-type: none"> ▪ Functional Requirement ▪ Non-Functional Requirement – Content and structure of the Specification (SRS) ○ Designing the product Architecture <ul style="list-style-type: none"> – Design (Algorithm, Flow Charts) ○ Developing or Implementation <ul style="list-style-type: none"> – Coding and program development ○ Testing <ul style="list-style-type: none"> – Bugs and Errors ○ Deployment In the Market and Maintenance <ul style="list-style-type: none"> – SLA (Service Level Agreements)

UNIT 2: POINTERS

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
2.1 Pointers	<ul style="list-style-type: none">• Discuss pointers and their significance• Understand memory addresses• Explain the use of reference operator (&)• Explain the use of dereference operator (*)• Describe declaration of pointer variable with syntax• Write a statement to Initialize pointers• Create a simple program for using pointers(P)

UNIT 3: OBJECT ORIENTED PROGRAMMING CONCEPTS USING C++

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
2.1 OOPS Concepts	<ul style="list-style-type: none">• Discuss the concept/ principles of Object Oriented Programming.<ul style="list-style-type: none">○ Encapsulation○ Inheritance○ Polymorphism• Explain class and object• Describe the member of a class:<ul style="list-style-type: none">○ Data○ Member Functions
2.2 Encapsulation	<ul style="list-style-type: none">• Explain encapsulation• Understand the use of ‘access specifiers’:<ul style="list-style-type: none">○ Private○ Public• Discuss the concept of data hiding• Define constructor and destructor with syntax<ul style="list-style-type: none">○ Default constructor/destructor○ User defined constructor○ Constructor overloading• Use constructor and destructor in simple program• Write a code to declare object for accessing:<ul style="list-style-type: none">○ Data members○ Member functions

2.3 Inheritance	<ul style="list-style-type: none"> • Explain Inheritance • Discuss the concept of ‘reusability’ in inheritance • Define the following terms: <ul style="list-style-type: none"> ○ Base Class ○ Derived/ Inherited Class ○ Protected Access Specifier • Write code for accessing members of: <ul style="list-style-type: none"> ○ Base Class ○ Derived Class
2.4 Polymorphism	<ul style="list-style-type: none"> • Explain Polymorphism • Define the following terms: <ul style="list-style-type: none"> ○ Overloading ○ Overriding • Write code for: <ul style="list-style-type: none"> ○ Member function overloading ○ Member function overriding

UNIT 4: FILE HANDLING

Contents and Scope	Learning Outcomes/Skills
	Students will be able to:
4.1 File Handling	<ul style="list-style-type: none"> • Define file handling • Differentiate the binary and text file • Write code to open the file • Explain modes of opening file (read, write, append) • Define the concept of <ul style="list-style-type: none"> ○ BOF ○ EOF • Define streams <ul style="list-style-type: none"> ○ Single character I/O ○ String I/O ○ Binary I/O • Write simple programs to create and read data files

UNIT 5: DATABASE FUNDAMENTALS

Contents and Scope	Learning Outcomes/Skills
	Students will be able to:
5.1 INTRODUCTION TO DATABASE	<ul style="list-style-type: none"> • Discuss the Difference Between Flat File system and Database Management System • Discuss the Application of Database with examples. • Define the components of Database Management system <ul style="list-style-type: none"> ○ Hardware ○ Software ○ Data ○ Procedure ○ Data Access Language • Define the following Characteristics of Database <ul style="list-style-type: none"> ○ Data Normalization ○ Data Accuracy ○ Data integrity ○ Control Redundancy ○ Scalability ○ Security • Demonstrate diagrammatic representation of following Database Models <ul style="list-style-type: none"> ○ Object Relational Model ○ Entity Relational Model • Describe the following Database Users Roles. <ul style="list-style-type: none"> ○ Database Administrator(DBA) ○ Database Application Programmer/Developer
5.2 Database Abstraction Architecture, ERModeling and Normalization	<ul style="list-style-type: none"> • Demonstrate diagrammatic representation of following three Levels of data Abstraction. <ul style="list-style-type: none"> ○ Physical Level ○ Logical/Conceptual level ○ External Level/View level • Define the following basic concepts of relational database with Examples. <ul style="list-style-type: none"> ○ Table ○ Record or Tuple ○ Field or column name or attributes ○ Schema Designing • Demonstrate the following Entity Relation Diagram Basics

	<ul style="list-style-type: none"> ○ Diagrammatic representation of Entities Types ○ Diagrammatic representation of attributes ○ Diagrammatic representation of relationships ● Describe the following levels of Data Normalization: <ul style="list-style-type: none"> ○ 1st Normal Form 1NF ○ 2nd Normal Form 2NF ○ 3rd Normal Form 2NF ● Describe the following Integrity Constraints <ul style="list-style-type: none"> ○ Not Null Constraints ○ Primary key ○ Foreign Key ● Describe the following Entity Relations: <ul style="list-style-type: none"> ○ One to One ○ One to Many ○ Many to Many ○ Many to One
<p>5.3 Introduction to Structure Query Language (SQL)</p>	<ul style="list-style-type: none"> ● Describe the Structure Query language (SQL) concepts using: <ul style="list-style-type: none"> ○ Syntax of Structured Query Language (SQL) ○ Writing Basic SQL SELECT Statements ○ Where Clause with Select Statement ○ Mathematic Operation +, -, *, / in Select Statement ○ Rational Operator in Where Clause ● Describe the following Operators in SQL <ul style="list-style-type: none"> ○ Arithmetic Operator ○ Comparison Operator ○ Logical Operators ● Differentiate between Selection and Projection with example of SQL Syntax ● Define the syntax of following joins <ul style="list-style-type: none"> ○ Equijoin By syntax ○ Cross Join By syntax ● Describe the following SQL/DML Statements <ul style="list-style-type: none"> ○ Create Table ○ Inset and modify data into table ○ Deleting Table
<p>5.4 Planning a Database</p>	<ul style="list-style-type: none"> ● Design Schema of Library Management by particularizing the following steps for Database Design.

	<ul style="list-style-type: none"> ○ Determine the Purpose of the Database (Requirement Analysis) ○ Determine the tables you need in the Database ○ Determine the fields you need in the tables. ○ Identify fields with unique values. ○ Determine the relationships between tables(Up to 3NF). ○ Refine the design.
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UNIT 6: MULTIMEDIA

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
6.1 Multimedia and its importance	<ul style="list-style-type: none"> ● Define Multimedia ● Explain the importance and advantages of Multimedia
6.2 Components of Multimedia	<ul style="list-style-type: none"> ● Explain the following Components of Multimedia <ul style="list-style-type: none"> ○ Text ○ Graphics ○ Animation ○ Audio ○ Video ● List various file types used to store multimedia files.
6.3 Multimedia Packages	<ul style="list-style-type: none"> ● Describe Multimedia Applications <ul style="list-style-type: none"> ○ Web-Base Application ○ Non-Web Application ● Explain different available packages for Audio and Video Editing (Applicable tools may include Proshow Gold, JetAudioetc)
6.4 Using Multimedia	<ul style="list-style-type: none"> ● Define the following: <ul style="list-style-type: none"> ○ Scene/ Canvas ○ Layers ○ Key frames ● Make a video of 2 minutes on any topic by importing/ recording/ using text, graphics, Audio & Video ● Export Videos in different Formats

	<ul style="list-style-type: none"> • Demonstrate Uploading and sharing videos
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UNIT 7: WIRELESS AND MOBILE COMMUNICATION

Contents and Scope	Learning Outcomes/Skills
	The students will be able to:
8.1 Wireless and Mobile Communication	<ul style="list-style-type: none"> • Describe following: <ul style="list-style-type: none"> ○ Wireless communication ○ Mobile communication • Define basic terminologies of wireless communication: <ul style="list-style-type: none"> ○ Frequency Spectrum ○ Radio Signals ○ Radio Transceiver ○ Access Point ○ Line of Sight Communication
8.2 Short Distance Wireless Communication	<ul style="list-style-type: none"> • Compare the short distance wireless technologies on the basis of range, speed and frequency: <ul style="list-style-type: none"> ○ Wifi ○ WiMax ○ Bluetooth ○ Infrared ○ Microwave
8.3 Long Distance Wireless Communication	<ul style="list-style-type: none"> • Describe long distance wireless communication • Compare the different types of GPS: <ul style="list-style-type: none"> ○ Geostationary Earth Orbit (GEO) ○ Medium Earth Orbit (MEO) ○ Low Earth Orbit (LEO)
7.4 Cellular Network Concepts	<ul style="list-style-type: none"> • Describe the concepts of cellular networks • Define the components of cellular networks <ul style="list-style-type: none"> ○ Cell ○ Base Station ○ Frequency and Interface in Cells ○ Mobile Switching Center (MSC) ○ Base Transceiver Station (BTS)

7.6 Mobile Network Generations	<ul style="list-style-type: none"> • Discuss the generation and technologies used in cellular networks: <ul style="list-style-type: none"> ○ 2G (GSM) ○ 3G (GPRS) ○ 4G (LTE) ○ 5G (Future)
7.7 Ad hoc Networks	<ul style="list-style-type: none"> • Define Ad hoc Network • Differentiate between: <ul style="list-style-type: none"> ○ Fixed (Ad hoc Network) ○ Mobile Ad hoc Network (MANET)

Activities for Grade XI

1. Demonstrate the physical component of the CPU and motherboard
2. Assembling, disassembling and connecting different part of computer like RAM, Hard Disk, Cables etc.
3. Demonstrate the BIOS setting and selecting booting options
4. Demonstrate the components of Desktop and Windows Explorer
5. Manage files and folder using cut, copy, move, delete and rename operations through drag and drop and menu selection
6. Demonstrate the management of the hardware and software resources through control panel
7. Use files and folders searching options
8. Demonstrate the Properties and Attributes of files and folders, also change the attributes
9. Write program of Simple Calculator using Arithmetic Operators
10. Write of Program of simple Marksheet by using Selection Structures.
11. Input a number and find out whether it is a prime or composite
12. Input a 4 (four) digit number and display each digit in separate line
13. Calculate factors of a given numbers
14. Write a function to draw of stars for a given size
15. Write a function that returns larger number from 2 arguments
16. Write a program to sort list of items in array (numeric / string)
17. Search a Number/Character from inputted list of items (numeric /string)
18. Calculate average of all array members
19. Finding addition and multiplication of a matrices (Maximum 3 x 3)
20. Write a program to display your inputted name in reverse order using strlen().
21. Write a program to create structure to display employee data with structure members as name, designation and salary.

22. Demonstrate different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
23. Show usage of network devices
24. Set of network IP setting.
25. Connect the computers in Local Area Network.
26. Make centralised and decentralised Network.

Activities for Grade XII

1. Write program to define class “STUDENT” with data members ‘AGE’ and ‘PERCENTAGE’, take input and show data through object.
2. Write program that Initializes object data using constructors
3. Write a program to define class “TIME” with data members ‘HOURS’, ‘MINUTES’ and ‘SECONDS’, use constructors to initialize object input data and show results.
4. Draw a class “BASE” and inherit a class ‘DRIVE CLASS’ with it, define object of drive class and take input and show data through that object.
5. Draw ‘BASE’ and ‘DRIVE’ classes and show concept of overloading and overriding.
6. Write a program to display the address and the value of a variable using pointer
7. Write a program that send address of two variables as arguments to a function in pointers and double their values in function using pointers.
8. Develop a program to write and read a text file.
9. Develop a program to write and read a binary file using ‘student’ object (name, age, percentage).
10. Create Table by defining the attributes (columns) and assigning data types
11. Change the table structure by adding or removing columns and changing fields
12. Delete any specific table
13. Insert, delete and update records in table
14. Using SELECT command to fetch records with different clauses, operators and

functions

15. Write text in 2D or 3D and import image and save with different file formats.
16. Importing of Audio and Video files in a single file.
17. Use Scene / Canvas / Model to place different components like text and images
18. Apply Layers and Keyframes.
19. Make a video of 2 minutes on any topic by importing/ recording/ using text, graphics, Audio & Video
20. Export Videos in different Formats
21. Demonstrate Uploading and sharing videos

ASSESSMENT AND EVALUATION

Assessment is the process of gathering information by using a variety of tools and techniques that reflects how well a student is achieving the curriculum expectations in the 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 judgment and decisions based on the interpretation of evidence gathered through assessment. Assessment and evaluation should be based on the expectations outlined in the curriculum. There are various methods of assessing students learning such summative, formative and authentic assessment.

Summative Assessment

The type of assessment used at the end of a term, lesson, or year for the purposes of grading, certification, and evaluation of student progress is called summative assessment. Examples of summative assessment are quarterly, annual examinations and/or monthly test for which grades/marks are assigned to judge a student's progress. For Grade XI and XII, Summative Assessment is conducted by BISE.

Formative Assessment

On the other hand, formative assessment is conducted for the purpose of improving teaching and learning. They are conducted at the classroom level to assess student learning outcomes frequently and regularly. The results are used for immediate improvement of the teaching and learning process and also accountability purposes. Example of formative assessment could be class test, group tasks, discussions, and/or student learning portfolios which help teachers and students to understand

Authentic Assessment

Authentic Assessment is a form of assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills. An authentic assessment usually includes a task for students to perform and a rubric by which their performance on the task will be evaluated. The Authentic Assessment helps students to construct and apply their knowledge in real situations. This also provides the direct evidences of students' learning. In computer science this form of assessment is

very helpful. In current curriculum programming, database management and multimedia are the areas where teachers can develop tasks for Authentic Assessment.

Generally, at HSC level the Summative Assessment is more focused and privileged. This leads teachers to teach only for final exam or in other words teaching to the test. However, we should remember that each type of assessment has its own efficacy as well as limitation. The power of classroom assessment may not be ignored. There are substantial SLOs which cannot be assessed through paper-pencil test. Therefore teachers need to combine different assessment strategies to assure the students learning. In essence an effective learning-outcomes-oriented quality assurance system must be based on constant monitoring and effective feedback loops.

To ensure that assessment and evaluation lead to the improvement of student learning, teachers must use specific assessment and evaluation strategies that:

- Are aligned with student learning outcomes of the curriculum.
- Use variety of assessment strategies that cover all the areas given in curriculum
- 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. Especially through qualitative feedback.
- Are communicated clearly to students and parents in advance
- Maintain the record of the progress of each student

UNIT-WISE WEIGHTAGES

Following tables explain weightages of specified units with respect to grades IX-X. 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 unit

Unit-wise Weightages for Grade XI

Unit	Title	Weightage
1	Overview of Computer System	15%
2	Computer Memory	10%
3	Inside System Unit	15%
4	Operating System	10%
5	Programming Concept Using C++	20%
6	Arrays, String and Structure	15%
7	Computer Communication & Networks	15%
TOTAL		100%

Unit-wise Weightages – Grade XII

Unit	Title	Weightage
1	System Development Life Cycle	10%
2	Pointers	15%
3	Object Oriented Programming Using C++	25%
4	File Handling	15%
5	Database Fundamentals	15%
6	Introduction to Multimedia	15%
7	Wireless and Mobile Communication	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. It 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 should not grossly depart from the suggested time.

Unit-wise Time Distribution of Grade XI

Unit	Title	No. of Periods	
		Theory	Lab
1	Overview of Computer System	15	-
2	Computer Memory	10	-
3	Inside System Unit	10	10
4	Operating System	10	10
5	Programming Concept Using C++	20	20
6	Arrays, String and Structure	25	25
7	Computer Communication & Networks	25	-
TOTAL		180	

Unit-wise Time Distribution of Grade XII

Unit	Title	No. of Periods	
		Theory	Lab
1	System Development Life Cycle	15	-
2	Pointers	05	05
3	Object Oriented Programming Using C++	30	30
4	File Handling	05	05
5	Database Fundamentals	20	10
6	Introduction to Multimedia	20	20
7	Wireless and Mobile Communication	15	-
TOTAL		180	

THE TEXTBOOK DEVELOPMENT

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 repository of knowledge cannot be ignored. Research reports suggest that in most cases, textbooks are the only source for teachers and students to deliver the curriculum.

Textbook writers have a vital role to play in shaping the young minds through their writing. Characteristically, A textbook:

- content as well as presentation is thoughtfully planned
- is written by the qualified and competent subject expert(s) who are fully orientated with curriculum,
- is attractive and engaging and must stimulate the interest of teacher and the students.
- provides updated knowledge and inculcate latest skills as the subject of Computer Science demands,

Guidelines for Textbook Authors

In textbook writing generally the following aspects may be taken into consideration:

- The textbook should fulfill the objectives of teaching Computer Science at this level
- The text should be clear and concise. Unnecessary details must not be included.
- The material should not be cramped. To make it more digestible, it may be chunked into smaller parts with headings
- The author should continuously focus on standard, benchmarks and SLOs
- The textbook should be visually appealing and should maintain the interest of the students
- The title page should be attractive and representative of the content of the textbook
- The color scheme of pictures should be close to real life
- The textbook should include detailed table of contents
- Activities/ Exercises must be designed related to 21st Century learning skills like critical thinking and problem solving.
- The author should bring himself to the mental level of students, he/she is writing for
- The span of the textbook should be fairly reasonable

- The Computer Science textbook is expected to provide accurate and up-to-date information. In previous instance, the HSC level textbook was not updated for more than decade.
- Textbook should build vertical linkage between various concepts from lower to higher grade level
- 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
- Highlight the headings, sub-heading, key words, terms and definitions. For distinction use level heading
 - Level A: 4.1, 4.2
 - Level B: 4.1.1, 4.2.1
 - Level C: (a), (b), (c) or (i), (ii), (iii)
 - Level D: Bold but unnumbered.
- Figures and table must be clear and numbered as Fig.4.1, 4.2, 4.3----- followed by captions, label if needed (font size 9).

Textbook Style and Structure

To make a textbook an effective teaching and learning resource 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.
Content	The content of the units must cover all the SLOs. The command words help author about the scope of depth of the SLO.
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, graphs, drawing, and flowcharts etc that help students understanding the concepts. The visuals should be clear, large enough and most importantly relevant.

Unit Ending	
Checkpoint Exercises	Include multiple-choice questions, interpretive exercises, developing programs, fill-in and matching items. Students may also be asked to label diagrams or write a one word answer to short question and other current days exercises .
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.

SAMPLE PROGRAMS AND PRACTICAL JOURNALS

Teaching of Computer Science should aim to make students skillful. It will also be very helpful for the teachers and students if some sample programs are developed based on the SLOs given in the curriculum. These sample programs will stimulate students to apply the acquired skill and bring their own creativity.

Development of Practical Journals will help students to acquire the desired skill of programming, presentation, problem solving and creativity. This is also important that practical activities must not be based on cram and reproduce. Practical journal should not only cover all the practical activities listed in the curriculum but also explain them in easy manner. Practical exercises/ projects/ assignments help to develop conceptual understanding of the students. They should assist students in developing skills by applying knowledge to new situations.

THE TEACHERS' MANUAL

The Teachers' Manual is a great pedagogical resource for teachers. It informs teachers how to use the text book and guides how the content should be delivered to students that it facilitates the utmost students' learning. Teacher Manual can be seen as the means of helping teachers develop professionally. It should provide detailed explanation of key concepts and the way to teach a particular topic. Ideally the teacher's manual should come with the textbook.

The teachers' 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 and activities to assign
- Establish a test bank (having questions different from text) and suggest interactive way to assess 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

THE WEB-BASED RESOURCES

Internet is smart, effective and dynamic tool for education. The World Wide Web is growing at amazing speed. As of January 2019, there were over 1.94 billion websites on the Internet. However, the use of Web-based resources for teaching and learning is hindered by the difficulties in locating resources that are relevant, of high quality, and accurate. Web based resources are helpful for both teachers and students.

Some worldly acknowledge web learning resources are given in the following table according to the concepts given in this curriculum. Education Managers, Teachers, Teacher Educators, Students and Parents are encouraged to look beyond this list to enhance the learning process.

Title of Website	Universal Resource Locator (URL)
C Language	https://www.learn-c.org/
System Development Life Cycle	https://www.tutorialspoint.com/system_analysis_and_design/system_analysis_and_design_development_life_cycle.htm https://www.softwaretestinghelp.com/software-development-life-cycle-sdlc/
Computer Hardware	https://www.tutorialspoint.com/computer_fundamentals/computer_hardware.htm
Computer Software	https://www.tutorialspoint.com/computer_fundamentals/computer_software.htm
Operating System	https://www.geeksforgeeks.org/operating-system-introduction-operating-system-set-1/ https://www.studytonight.com/operating-system/types-of-os
Object Oriented Programming	https://www.upwork.com/hiring/development/object-oriented-programming/ https://www.studytonight.com/cpp/cpp-and-oops-concepts.php
Database Management System	https://www.guru99.com/what-is-dbms.html

	https://www.tutorialspoint.com/dbms/
Multimedia	https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm

SUGGESTIONS AND FEEDBACK

Curriculum should be a living document. The contemporary changes in the real world must be reflected in the curriculum. Therefore, it is always needed to evaluate and review the curriculum periodically. The Civil Society, Media, Scholars, Teacher Educator and Teachers can also play their role to improve and update the curriculum by sending their critique, suggestions and feedback to curriculum development and review organization. In case of any suggestion and feedback about this curriculum, all the stakeholder may write to Director, Directorate of Curriculum, Assessment and Research Sindh Jamshoro or email at dcarsindh@gmail.com.

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