National Curriculum for

COMPUTER SCIENCE

GRADES IX-X and XI-XII

2009

GOVERNMENT OF PAKISTAN
MINISTRY OF EDUCATION
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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 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

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

Computer Science Curriculum Development Committee

1. Mr. Zulqarnain Jaffery,
Assistant Professor (Computer Science),
COMSATS Institute of Information
Technology, H-8, Islamabad.

2. Mr. Muhammad Khalid,
Lecturer (Computer Science),
OPF Boys College, H-8,
Islamabad

3. Mr. Shaukat Ayub Burki,
Assistant Professor (Computer Science),
IMCB, F-7/3,
Islamabad

4. Ghazi Hussain Shah,
Assistant Professor (Computer Science),
IMCB, F-8/4,
Islamabad.

5. Mrs. Shahina Naz,
Lecturer (Computer Science),
IMCG, F-6/2,
Islamabad.

6. Mrs. Sabah Faisal,
Lecturer (Computer Science),
ICG, F-6/2, Islamabad.

7. Ms. Lubna Kausar,
Lecturer (Computer Science),
IMCG, F-7/4,
Islamabad.

8. Mr. Abdullah Memon,
Lecturer (Computer Science),
IMCB, F-10/3,
Islamabad

9. Mr. Zahid Ali,
Lecturer (Computer Science),
IMCB, I-10/1,
Islamabad.

10. Dr. Tariq Mahmood,
Deputy Educational Adviser,
Ministry of Education (CW),
Islamabad.

11 Mr. Munawar Din Awan,
Assistant Educational Adviser,
Ministry of Education (CW),
Islamabad.

Computer Science Curriculum Advisory / Review Committee

1. Prof. Dr. M. Abid Khan,
Chairman,
Department of Computer Science,
University of Peshawar,
Peshawar.

2. Dr. Muhammad Ali Maud,
Chairman,
Department of Computer Science,
University of Engineering and
Technology, Lahore.

3. Mr. Muhammad Zahid Shaikh,
Chairman,
Department of Computer Science and
Software Engineering,
Mehran University of Engineering and
Technology, Jamshoro, Sindh.

4. Prof. Dr. Aftab Ahmed Maroof,
Director,
FAST-National University of Computer
and Engineering Science, Islamabad.

5. Ms. Mussarrat ul Ain,
Lecturer (Computer Science),
Department of Computer Science,
Fizaia College, E-9, Islamabad.

6. Mr. Muhammad Khalid,
Lecturer (Computer Science),
Department of Computer Science,
OPF Boys College, H-9,
Islamabad.

7. Mrs. Shahina Naz,
Lecturer (Computer Science),
Department of Computer Science,
IMCG, F-10/2,
Islamabad.

8. Mr. Shaukat Ayub Burki,
Assistant Professor (Computer Science),
Department of Computer Science,
IMCB, F-7/3,
Islamabad.

9. Dr. Tariq Mahmood,
Deputy Educational Adviser,
Ministry of Education (CW),
Islamabad.

10 Mr. Munawar Din Awan,
Assistant Educational Adviser.
Ministry of Education (CW),
Islamabad.