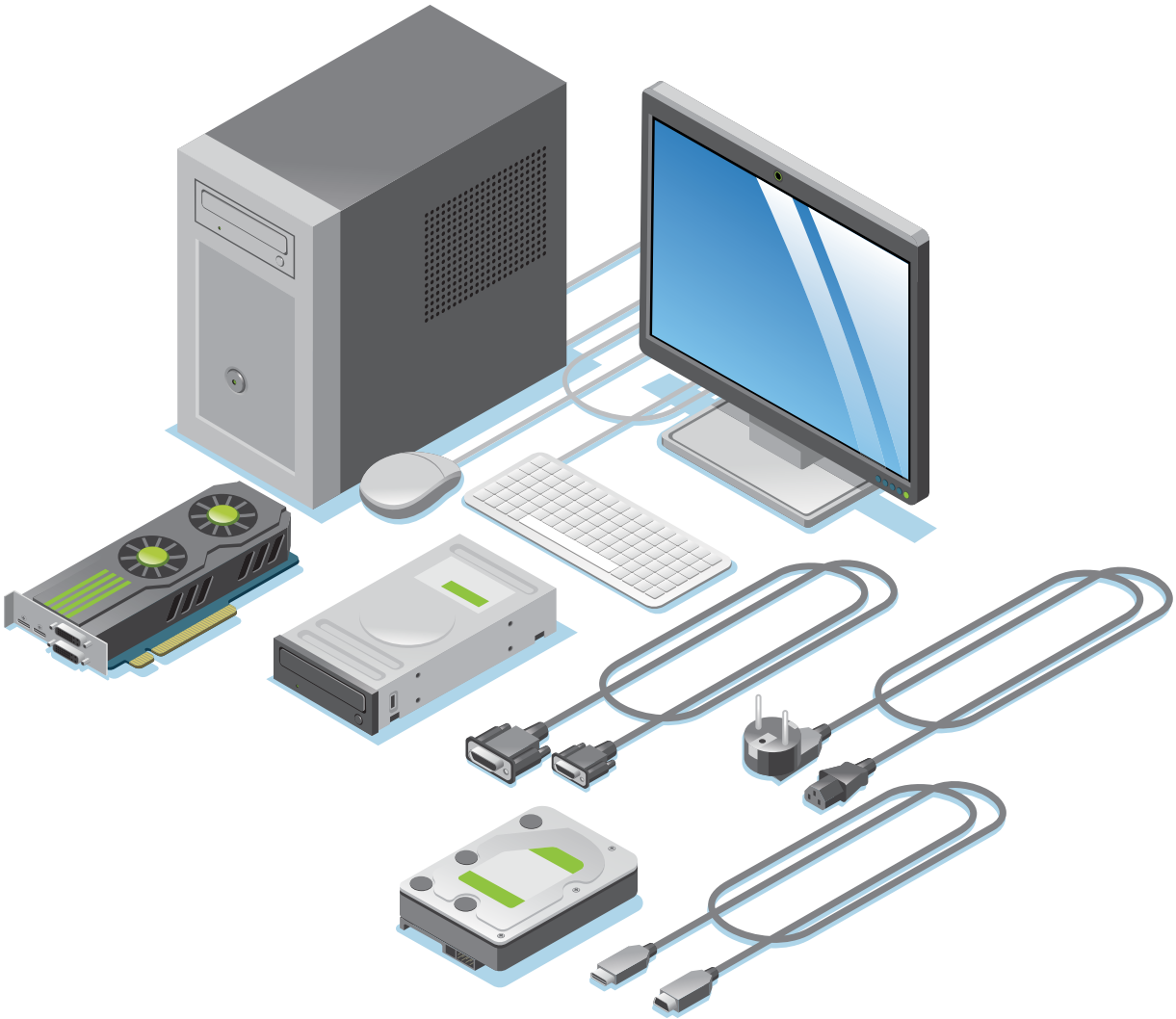
National Curriculum of Pakistan
2022-23

TECHNICAL EDUCATION

COMPUTER HARDWARE

Grades 9-10



NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

بسم الله الرحمن الرحيم

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It is with great pride that we, at the National Curriculum Council Secretariat, present the first core curriculum in Pakistan's 75-year history. Consistent with the right to education guaranteed by Article 25-A of our Constitution, the National Curriculum of Pakistan (2022-23) aspires to equip every child with the necessary tools required to thrive in and adapt to an ever-evolving globalized world.

The National Curriculum is in line with international benchmarks, yet sensitive to the economic, religious, and social needs of young scholars across Pakistan. As such, the National Curriculum aims to shift classroom instruction from rote learning to concept-based learning.

Concept-based learning permeates all aspects of the National Curriculum, aligning textbooks, teaching, classroom practice, and assessments to ensure compliance with contemplated student learning outcomes. Drawing on a rich tapestry of critical thinking exercises, students will acquire the confidence to embark on a journey of lifelong learning. They will further be able to acknowledge their weaknesses and develop an eagerness to build upon their strengths.

The National Curriculum was developed through a nationwide consultative process involving a wide range of stakeholders, including curriculum experts from the public, private, and non-governmental sectors. Representatives from provincial education departments, textbook boards, assessment departments, teacher training departments, *deeni madaris*, public and private publishers, private schools, and private school associations all contributed their expertise to ensure that the National Curriculum could meet the needs of all Pakistani students.

The experiences and collective wisdom of these diverse stakeholders enrich the National Curriculum, fostering the core, nation-building values of inclusion, harmony, and peace, making the National Curriculum truly representative of our nation's educational aspirations and diversity.

I take this opportunity to thank all stakeholders, including students, teachers, and parents who contributed to developing the National Curriculum of Pakistan (2022-23)

Dr. Mariam Chughtai
Director
National Curriculum Council Secretariat
Ministry of Federal Education and Professional Training

Computer Hardware
Grades 9-10
Progression Grid

Domain A : Computer System (Hardware and Software)
Standard : Students develop an understanding of a computer system, hardware and software components and the interplay between these components

Grade 9	**Grade 10**
Benchmark : Students will be able to demonstate: the working of a computer system; the distinction between hardware and software components; identification of types of computer system from microcontrollers to embedded microprocessors to PCs to supercomputers.	
Student Learning Outcomes	
[SLO : CHW-09-A-01]: Students will be able to identify and explain the building blocks of a computer system in terms of its hardware and software components.	[SLO : CHW-10-A-01]: Students will be able to identify and explain the building blocks of a computer system and various abstraction layers in hardware and software (like application, database, network, operating system asbtraction layer etc).

[SLO : CHW-09-A-02]: Students will be able to explain the space-time history of evolution of personal computer.	[SLO : CHW-10-A-02]: Students will be able to explain the space-time history of evolution of personal computer, supercomputer and the most recent quantum computer.
[SLO : CHW-09-A-03]: Students will be able to recognize different types of hardware components in a personal computer: CPU, memory, storage, motherboard, Input/Output peripherals (USB, HDMI, Ethernet)	[SLO : CHW-10-A-03]: Students will be able to recognize different types of hardware components: CPU, memory, storage, motherboard, Input/Output peripherals (USB, HDMI, Ethernet). The students will be able to assemble these components to build a computer.
	[SLO : CHW-10-A-04]: Students will be able to explain the interaction of hardware and software in performing tasks on a computer.

Domain B : Number System, Boolean Logic, Gates and Transistors

Standard : Students develop an understanding of a number system, boolean logic and gates which are the building block of computer.

Grade 9	**Grade 10**
Benchmark :	

Students will be able to convert different number systems (decimal, binary, octa, hexadecimal), boolean logic and different types of gates (NOT, AND, OR, XOR)	
Student Learning Outcomes	
[SLO : CHW-09-B-01]: Students will be able to explain different number systems (decimal, binary, octa, hexadecimal) and will know how computers store numbers.	[SLO : CHW-10-B-01]: Students will be able to explain different number systems (decimal, binary, octa, hexadecimal) and the 2's complement number system used in computers.
[SLO : CHW-09-B-02]: Students will be able to convert from one number system to another number system.	[SLO : CHW-10-B-02]: Students will be able to perform addition and subtraction in 2's complement format.
[SLO : CHW-09-B-03]: Students will be able to explain boolean logic and the working of basic gates (NOT, AND, OR, XOR).	[SLO : CHW-10-B-03]: Students will be able to demonstrate the working of basic gates (NOT, AND, OR, XOR) and will be able to build complex gates using the basic ones.
	[SLO : CHW-10-B-04]: Students will be able to build a 1-bit adder in hardware using the gates.
	[SLO : CHW-10-B-05]: Students will demonstrate the working of transistor and make connection between gates and transistors.

Domain C : Computer Architecture

Standard : Students develop an understanding of internals of computer architecture includingits components such as Central Processing Unit (CPU), Memory and Peripherals and the processing of instructions.

Grade 9	**Grade 10**
Benchmark I: Students will be able to demonstrate use of basics of computer architecture including its internal components such as CPU, Memory and Input/Output Peripherals and their interconnection.	
Student Learning Outcomes	
[SLO : CHW-09-C-01]: Students will be able to explain the basics of computer architecture and its components (CPU, Memory, Input/Output Peripherals).	[SLO : CHW-10-C-01]: Students will be able to explain the basics of computer architecture and its components (CPU, Memory, Peripherals) along with the internal working of these components
[SLO : CHW-09-C-02]: Students will be able to identify the role of CPU, Memory and Input/Output Peripherals.	[SLO : CHW-10-C-02]: Students will be able to design a little computer using CPU, Memory and Input/Output peripherals

[SLO : CHW-09-C-03]: Students will be able to explain how the components (CPU, Memory, Input/Output Peripherals) are connected together.	

Grade 9	**Grade 10**
Benchmark II: Students will be able to explain the processing of instructions by computer	
Student Learning Outcomes	
[SLO : CHW-09-C-04]: Students will be able to identify the basic operations (arithmetic, load/store) performed by a computer	[SLO : CHW-10-C-03]: Students will be able to explain basic operations (arithmetic, load/store) performed by the computer along with sample instruction format
	[SLO : CHW-10-C-04]: Students will be able to explain how different instructions get executed by the computer

Domain D : Memory

Standard : Students will explain the memory hierarchy used in modern computers, the specific purpose of each memory and different types of memory according to physical implementation along with the technologies used to build storage devices .

Grade 9	**Grade 10**
Benchmark : Students will explain the memory hierarchy within modern computers, the specific purpose of each memory and the technologies used to build these memories.	
Student Learning Outcomes	
[SLO : CHW-09-D-01]: Students will be able to identify the memory hierarchy within a computer (registers, cache, RAM-random access memory, hard disk, flash disk).	[SLO : CHW-10-D-01]: Students will be able to explain the memory hierarchy within a computer (registers, cache, RAM-random access memory, hard disk, flash disk) along with the trends in terms of speed and storage capacity.
[SLO : CHW-09-D-02]: Students will be able to identify the role of each memory.	[SLO : CHW-10-D-02]: Students will be able to identify the role of each memory and how data gets moved across various memories within the memory hierarchy.
[SLO : CHW-09-D-03]:	[SLO : CHW-09-D-03]:

Students will be able to distinguish between data memory and instruction memory.	Students will be able to distinguish between data memory and instruction memory and the high level interface to read and write from the memory.
	[SLO : CHW-09-D-04]: Students will be able to explain various technologies used to build memories and storage devices.

Domain E : Input/Output Devices

Standard : Students will explore various input/output devices used in modern computers and how the data is exchanged with these input/output devices.

Grade 9	**Grade 10**
Benchmark : Students will identify a number of input/output devices used in modern computers.	
Student Learning Outcomes	
[SLO : CHW-09-E-01]: Students will be able to explore various input/output devices (mouse, keyboard, monitor, microphone, speaker).	[SLO : CHW-10-E-01]: Students will be able to explore various conventional input/output devices (mouse, keyboard, monitor, microphone, speaker) as well as most recent ones such as haptic devices.

[SLO : CHW-09-E-02]: Students will explain how computers communicate with these devices through software.	[SLO : CHW-10-E-02]: Students will be able to demonstrate how the computer understands the input provided by each input device.
	[SLO : CHW-10-E-03]: Students will be able to demonstrate how the computer sends information to output devices.
	[SLO : CHW-10-E-04]: Students will be able to demonstrate how these input-output devices are accessed through software.

Domain F : Networking Devices
Standard : Students will explain the concepts of networking and different devices used to help network computers.

Grade 9	**Grade 10**
Benchmark : Students will identify and explain the basics of networking, internet and various devices used for networking.	
Student Learning Outcomes	
[SLO : CHW-09-F-01]:	[SLO : CHW-10-F-01]:

Students will explore how to connect computers together (Ethernet).	Students will explore how to connect computers together (Ethernet) along with description about the protocol.
[SLO : CHW-09-F-02]: Students will be able to differentiate various devices to connect computers (switches, routers).	[SLO : CHW-10-F-02]: Students will explore various networking layers.
[SLO : CHW-09-F-03]: Students will explore the working of intranet and the role of various networking devices (Ethernet card, switch).	[SLO : CHW-10-F-03]: Students will differentiate between intranet, internet and the devices used in each case.
	[SLO : CHW-10-F-04]: Students will be able to explain how software and hardware work together in internet access.

Domain G : Emerging Trends in Computer Hardware

Standard : Students will explore latest trends in computer hardware such as multicores, Graphical Processing Units and Quantum Computers.

Grade 9	**Grade 10**
Benchmark :	

Students will explore the latest advancements in computer hardware and typical applications that are driving these advancements.	
Student Learning Outcomes	
[SLO : CHW-09-G-01]: Students will explore emerging computer hardware platforms such as multi-core and GPUs.	[SLO : CHW-10-G-01]: Students will explore emerging computer hardware platforms such as multi-core, GPUs, and Quantum Computers.
[SLO : CHW-09-G-02]: Students will explain the difference between conventional computer and new platforms.	[SLO : CHW-10-G-02]: Students will identify which computer hardware platforms are suitable for a particular application (Artificial Intelligence, Office Automation).

Domain H : Design Project - Build your own Computer
Standard : Students will build a small computer using discrete components

Grade 9	Grade 10
Benchmark : Students will demonstrate the working of computer by building a small computer.	
Student Learning Outcomes	
[SLO : CHW-09-H-01]: Students will build a computer using discrete components such as CPU, Memory, Hard Disk, Power Supply, Motherboard, Keyboard, Mouse, Mounter.	[SLO : CHW-10-H-01]: Students will build a computer using discrete components such as CPU, Memory, Hard Disk, Power Supply, Motherboard, Keyboard, Mouse, Monitor and test it using BIOS.
[SLO : CHW-09-H-02]: Students will be able to identify whether the computer has been built properly or not.	[SLO : CHW-10-H-02]: Students will be able to install Operating System to make it functional.
	[SLO : CHW-10-H-03]: Students will be able to diagnose faults in the computer hardware such as absence of memory.

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