

CPS206

COMPUTER HARDWARE

(2UNITS)

LECTURER

MRS ABDULSALAMI

Preamble

Hardware is the various physical components that comprise a computer system, as opposed to the non-tangible software elements. Most of these physical components are physically separated from the peripheral to the main circuitry that does the arithmetical and logical processing, but they are the most familiar bits of a computer.

COMPUTER DEVICES(1)

- A computer consists of several interconnected devices or components. They are five basic components, namely, central processing unit, primary storage, secondary storage, input devices, and output devices. This physical equipment that make up a computer is called hardware.
- Secondary storage, input and output devices are often called peripheral equipment.
- The CPU and primary storage contain electronic circuits that store and process data or program instruction. The circuits are formed from plate of silicon which is non-metal element.
- A piece of silicon containing electronic circuits is called an integrated circuit or a chip.

COMPUTER DEVICES(2)

- The computer chips for the CPU is called processor chips.
- In microcomputer, the entire CPU contains only one-processor chips and is called microprocessor.
- In mini computer, mainframe computer or super computer, the CPU may require several processor chips.
- Primary storage is composed of many chips for example; a microcomputer may have more than sixteen chips. Each chip is called memory chip and is capable of storing a certain amount of data.

COMPUTER DEVICES(3)

- The amount of data stored depends on different types of chips. All the memory chips are made up primary storage (RAM).
- In microcomputers, the microprocessor and the memory chips are mounted on one board, called the Motherboard or mainboard.
- The chips in the CPU and primary storage are connected by a set of wires called a bus. Data is sent back and forth between components over the bus

COMPUTER DEVICES(4)

- There are some other chips that are needed to control input/output devices and secondary storage. Some of these chips are built-in Mainboard or are in a separate board. They are called **add-on-boards** or **cards**, and are plugged into sockets on the mainboard.
- These **sockets which are called expansion slots** are connected to the other components by the bus.
- The combination of all these chips on or outside motherboard form computer devices

Course Outline

This course is comprised of the following three (3) modules with a total of 10 units.

Module 1: Fundamentals of Computer design.

This module comprises of Four(4) units:

- Unit 1: History/Evolution of Computer Technology.
- Unit 2: Computer Circuits: Integrated Circuits, VLSI Technology.
- Unit 3: Fundamentals of Digital Logic Design I: Binary Arithmetic, Basic Logic gates, Boolean algebra, Truth table.
- Unit 4: Fundamentals of Digital Logic Design II: Logical equations: Circuit, Design, Karnaugh Maps.

Module 2: Computer Hardware Components

- Unit 5: How the computer works
- Unit 6: Components of the Computer System Unit.
- Unit 7: Central Processing Unit (CPU).
- Unit 8: Input /Output Devices
- Unit 9: Computer Memory

Module 3: Analog/Digital Computers

- Unit 10: Analog-to-digital converters(ADC) and Digital- to-analog converters

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

- Understand the history and evolution of computer hardware.
- Outline the major technologies and uses of computer peripherals for input, output, and storage.
- Identify the computer systems and peripherals you would acquire or recommend for a business of your choice, and explain the reasons for your selections.
- Have an idea about the processor generations used in PCs starting from the first Intel generations to current CPU families
- Learn the skills to troubleshoot system related problems.
- Familiarize themselves with PC memories such as RAM and ROM devices. This includes RAM types, RAM upgrading, ROM BIOS, and the CMOS chip.
- Describe the process of carrying out digital system design
- Describe the evolution of physical components used to implement Boolean logic in the design of computers.

COURSE REQUIREMENTS

- Online participation is compulsory for all registrants for the course.
- To be qualified to write the examination for the course, a minimum of 70% attendance must be obtained by a student.
- A midterm evaluation as part of the Continuous Assessment is mandatory.
- Assignments must be submitted at scheduled dates.
- Every student is required to submit their assignments online.
- Every student is required to download the course material online

COURSEWORK

- Class Participation(Class Attendance) 10%
- Assignments (Reading assignments and problem sets)
 - Approximately weekly 10%
- Continuous Assessment 20%
- Final Exam 60%

WEEKLY SCHEDULE OF LESSONS

WEEK I: INTRODUCTION TO THE COURSE/UNIT 1

- Students will be introduced to the course, the course outline and the learning outcomes will be discussed with the students. in addition with unit 1 of the course outline.

UNIT 1: HISTORY/EVOLUTION OF COMPUTER TECHNOLOGY.

- In this week, students will learn about the different generations of computer. The evolution of computer electronics: the era of vacuum tubes, how it was replaced by transistors; the first solid state devices (SSD) invented. How integrated circuits were invented due to the requirement for additional features in electronic devices and more computation power; and so on.

WEEK II: UNIT 2 (COMPUTER CIRCUITS)

- You will be introduced to the fundamentals of computer circuits, Integrated circuits (ICs). What an IC is, the knowledge behind ICs, ICs fabrication, Different categories of ICs, VLSI technology, how microprocessor is an integrated circuit that processes all information in the computer, how it keeps track of what keys are pressed and if the mouse has been moved, and so on.

WEEK III: UNIT 3(FUNDAMENTALS OF DIGITAL LOGIC DESIGN I)

- In this week, we shall look into the overview of digital computer components, identifying the building blocks of digital logic. You will learn computer hardware design principles, applicable to any type of design, in particular to computer hardware system design. We will build on that foundation by learning Binary Arithmetic, Basic Logic gates, the basic combination of logic gates and its Boolean algebra, and writing truth tables.

WEEK IV: UNIT 4(FUNDAMENTALS OF DIGITAL LOGIC DESIGN II)

- This unit serves as a completion of lessons in unit 3. Logical equations: Approaches to Circuit Design, Circuit simplification methods, Karnaugh Maps, and so on will be taught in this unit. This unit serves as background information for the processor design techniques we learn in later units.

WEEK V: UNIT 5(HOW THE COMPUTER WORKS)

- In this week, you will learn how the computer works, the working principle of the computer system; Input, Processing, Output and storage. How all the computer components interact together, to make a complete functional system. Illustration of this through a functional block diagram will be shown to the students.

WEEK VI: UNIT 6(COMPONENTS OF THE COMPUTER SYSTEM UNIT)

- In this week , we shall be looking into the different components of the Computer System Unit, Motherboard, Adaptor cards, Disk drives, Power supply unit, Memory, Processor etc., and, types /casing.

WEEK VII: MID-SEMESTER ASSESSMENT

- In this week, You will be examined in the areas that have so far been covered in the Semester. This will afford students an opportunity of a revision of all topics that have already been taken. 5

WEEK VIII: UNIT 7 (CENTRAL PROCESSING UNIT)

- This week, you will be introduced to the CPU terminologies: Data bus; Address bus; Registers, Compatibility (Sockets), Cooling system (Heat sink, fan), Make-up of the processor/Types/generations, Performance in terms of speed, and so on.

WEEK IX: UNIT 8 (INPUT /OUTPUT DEVICES)

- In this unit, students will learn and understand the definition of input and output devices in the context of any computer based system, details about various kinds of input and output devices such as: keyboards, pointing devices, printers, CRTs, etc. , their basic functions/uses, advantages and disadvantages, and Interaction with other system components.

WEEK X: UNIT 9 (COMPUTER MEMORY)

- We shall look into the primary and secondary memory devices, Types of Storage Devices: magnetic disks, magnetic tapes, automated tape libraries, CDs, DVDs, and flash memories; Characteristics, Buses.

WEEK XI & XII : UNIT 10 (ANALOG AND DIGITAL COMPUTERS)

- In this unit, students will learn basic analog and digital computers, including properties, operational amplifiers, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques.

WEEK XIII: REVISION

- Students will be taken through the summary of all the topics that have so far been covered in the Semester. This will afford an opportunity of a revision of all topics that have already been taken.

COURSE MATERIALS

- The primary learning materials for this course are readings, lectures (in powerpoint slides), video tutorials(the links are given), and other online resources.
- These course materials can be downloaded on the LMS platform.

Recommended texts for further reading

- PC Hardware: A beginner's guide by Judith L. Gersting, Seventh edition.
- Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance by James K. L.
- Microprocessor Architecture, Programming, and Applications with the 8085" by R Gaonkar
- Microprocessors: Principles and Applications" by A Pal
- Principles of computer Hardware, Fourth edition by Alan Clement.

Online Resources

- Introduction to digital logic and Hardware architecture
 1. <https://ce.uci.edu/courses/sectiondetail.aspx?year=2013&term=Winter&sid=00100>
- Basic computer hardware notes
 1. <https://testbook.com/blog/basic-computer-hardware-notes-pdf/>
 2. <https://www.cs.indiana.edu/classes/a111/lecture2.html>
<https://learn.saylor.org/mod/url/view.php?id=11965>
- Input/output devices and interaction
 1. <http://www.cs.tufts.edu/~jacob/papers/crc2.pdf>