

WILLIAM PATERSON UNIVERSITY OF NEW JERSEY
COLLEGE OF SCIENCE AND HEALTH
Computer Science Department Course Outline

1. Title of Course, Course Number, and Credits:

Fundamentals of Computer Hardware, CS235, 3 credits

2. Description of the Course Consistent With the WPUNJ catalog

This course is intended for non-CS major students with an interest in computer hardware. The course presents the fundamentals of modern computer systems in terms of structure and function. Hands-on experience will complement lectures. Major topics are: hardware components (chips, CPU, BIOS, and chipsets technologies, motherboard/expansion board design basics, peripherals, busses, ports, magnetic and optical storage devices, I/O); system configuration, partitioning, formatting, and hardware aspects and support in Windows and Linux; booting; hardware; management/maintenance; performance assessment and improvement; troubleshooting problems. This course encompasses the A+ certification material in hardware.

3. Course Prerequisites

CS201 or CS215..

4. Course Objectives

The main objective of this course is to learn the principles of computer hardware as they apply to system planning, design, configuration, installation, maintenance, operations and troubleshooting. In conjunction with theory are practical aspects of hardware, best learned in lab exercises, simulations, and project work. The emphasis will be on professional supervisory, technician-oriented, and operational levels of exposition, understanding, problem resolution, and hands-on practical experience / abilities-development for the hardware aspects of computer systems.

5. Student Learning Outcomes

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

- design a microcomputer system from boards, peripherals, and other components made available by present industries
- explain the structure and function of all components in that system.
- successfully complete the A+ Certification Examination. Measure: actual A+ Certification Examination practice question sets, simulation exercises, and test collections will be used
- configure computer systems for stand-alone operation and as a single point in a networked (wired and wireless) context, both in Windows and Linux

- demonstrate professional reasoning, problem-solving, and best practices in system configuration, integration, upgrade, operations, and system maintenance.
- diagnose, treat/recover from, and conduct prevention activities for hardware failure, degradation, and other problems.
- determine how to plan, implement and assess computer systems in corporations, education institutions, government organizations, and home/small business settings under specified constraints.
- recognize and articulate how hardware can positively benefit as well as negatively impact society. Support devices for disabilities and their usage. Appreciate ethical and legal issues in the usage of hardware such as video cameras, surveillance input devices,
- stay current with new standards and trends

Additionally, students are also expected to achieve in the context of the above topics the following university-wide student learning outcomes through lectures; classroom discussions; homework, essay and project assignments; and oral presentations.

- Demonstrate the ability to think critically via design and implementation of computer systems. Decision making and most notably trouble-shooting requires logical thinking, consideration of alternatives, and problems solving, often under pressure. Practical hands-on exercises, simulations, and lab experience will both develop abilities to address this outcomes and effective measure/assess them.
- Demonstrate ability to locate and use information on these topics via Internet and library article searches to augment class work. Staying current in this discipline requires keeping up with new hardware, trends, and software downloads which change rapidly, even daily. The Internet and several periodicals served a vital role in this respect. Lists of special web-sites will be distributed and used in manufacturer support and information acquisition to address technical problems. Such knowledge is often not available in print. Students will be asked to collect information on and document particular trends and or new hardware from multiple sources, which also can address the next outcome below.
- Demonstrate ability to integrate knowledge and ideas in a coherent and meaningful manner by planning, designing, constructing, and deploying a computer system from theory to actual design.
- Effectively express themselves in written and oral form through homework presentation in class as well as written report on their projects assignments.

6. Topical Outline of the Course Content

Topics covered in the course will be taken from but not necessarily limited to the following:

- Fundamental components of computer systems

- Program execution, processes and booting from the hardware perspective
- Electronic components of the system box (motherboard, expansion cards, and other components), their function and interconnection (in terms of busses (general, FSB, USB, and others), ports, and interfaces)
- CPU, BIOS, and chip-sets
- Memories type characteristics, engineering, and evolution
- Memory hierarchies & caches L1, L2, and L3
- Magnetic and optical storage devices (fixed, removable, media based, external). CD and DVD formats and technologies past, present, and future.
- Disk encoding models, controllers, and interfaces: MFM, RLL, ESDI, the many worlds of SCSI, IDE, EIDE, ATA, UDMA, SATA
- Compatibility and capacity issues based on BIOS and Operating System Constraints; Modes of disk I/O: PIO versus DMA
- Disk Arrays and RAID 0, 1, 2, 3, 4, 5, 6, 0+1, 10, and briefly, 7, S, 50...
- General and Manufacturer disk support procedures and utilities
- Software level support for hardware configurations in Windows and Linux, device drivers (esp. upgrading to latest builds), and utilities
- Booting phases, plug-and-play model, and multi-boot
- Fault-tolerance, redundancy, security, and management of disks
- Hot swapping and dynamic device drivers / hardware augmentation
- I/O devices (mice, digitizers, video-cams, scanners, light-pens, LCD's, ...) theory, mechanisms, and decision-making
- Graphics Subsystems (ISA, VLB vs PCI, AGP, PCI-E), Standards (CGA, EGA, VGA, SVGA, ...), and Coprocessor categories
- Real-time Output Display technologies: CRT, Passive vs. Active LCD, Projector categories, decision-making, and optical logistics in their selection, settings, and operation.
- Communication industry and major service providers
- Issues related to the planning and designing a network
- I/O Devices supporting disabilities and special environments
- Server versus client hardware configurations and performance/reliability considerations
- Social impact and hardware
- Computer lab design and ergonomic concerns.
- System configuration, integration, maintenance, fault and performance diagnosis and correction, crash prevention, backup-recovery and other professional practices,
- Keeping current with the explosion in new hardware devices and standards and prepare for upcoming ones.

7. Guidelines/Suggestions for Teaching Methods and Student Learning Activities

Lecture with demonstrations
 Hands-on activities, simulations, and physical hardware experimentation
 Problem solving sessions