# Course Specification

## — (Bachelor)

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|---|---|
| **Course Title**: | Computer Organization & Architecture |
| **Course Code**: | 211 CNET-3 |
| **Program**: | Bachelor in Computer and Network Engineering |
| **Department**: | Electrical and Electronics Engineering |
| **College**: | College of Engineering and Computer Science |
| **Institution**: | Jazan University |
| **Version**: | 13 |
| **Last Revision Date**: | 22 May 2024 |

## Table of Contents

## A. General information about the course:

### 1. Course Identification

### 1. Credit hours: (3)

### 2. Course type

| A. | □ University | □ College | ☒ Department | □ Track | □ Others |
|----|-------------|-----------|-------------|---------|----------|
| B. | ☒ Required | | □ Elective | | |

### 3. Level/year at which this course is offered: ( Level 3 /Year 2)

### 4. Course General Description:

This course is about the structure and basic function of computers. Its purpose is to present, as clearly and completely as possible, the nature and characteristics of modern-day computer systems. This course covers all aspects of computer, from the underlying integrated circuit technology used to construct computer components, to the increasing use of parallel organization concepts. This course also focuses on different elements of Computer Organization and Major components which include processor, memory, I/O, control unit, registers, ALU, discussion of cloud computing and instruction execution unit. This course will introduce the core concepts of operating systems, such as processes and threads, scheduling, synchronization, memory management, file systems, input and output device management and security.

### 5. Pre-requirements for this course (if any):

None

### 6. Co-requisites for this course (if any):

None

### 7. Course Main Objective(s):

1.  Analyze and understand the architecture and organization of computing systems and electronic computer.
2.  Provide an introduction to computer processor and memory architectures, and to the design of personal computer systems
3.  Describe basics of cloud computing and point-to-point interconnection.
4.  Examine the major components of a computer and their interconnections, with both each other and the outside world.
5.  Differentiate different types of newer Non-Volatile Solid state memories.

6.  Study the program execution, instruction format and instruction cycle.
7.  Measure various internal architectures and organizations of the processor.
8.  Provide an understanding of the architectural features of modern high performance computers.

9. Understand the fundamentals of Operating Systems and the main components of an OS & their functions.
10. Understand the working of an OS as a resource manager, file system manager, Process manager, memory manager and I/O manager and methods used to implement the different parts of OS.

## 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|----|---------------------|---------------|------------|
| 1 | Traditional classroom | 60 | 100% |
| 2 | E-learning | - | - |
| 3 | Hybrid <br> ● Traditional classroom <br> ● E-learning | - | - |
| 4 | Distance learning | - | - |

## 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|----|----------|---------------|
| 1. | **Lectures** | 26 |
| 2. | **Laboratory/Studio** | 26 |
| 3. | **Field** | - |
| 4. | **Tutorial** | - |
| 5. | **Others (specify)** | 8 |
| **Total** | | 60 |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of PLOs aligned with the program | Teaching Strategies | Assessment Methods |
|------|--------------------------|---------------------------------------|---------------------|--------------------|
| **1.0** | **Knowledge and understanding** | | | |
| 1.1 | **Explain** the various concepts related with evolution of computers and technologies involved. | K1 | Visual &Verbal <br> [Lectures / Presentations] | Assignment -1 <br> Midterm Exam <br> Final Exam |
| 1.2 | **Explain** various designing concepts and criteria for performance evaluation for processors. | K2 | Visual &Verbal <br> [Lectures / Presentations] | Assignment -1 <br> Midterm Exam <br> Final Exam |

| Code | Course Learning Outcomes | Code of PLOs aligned with the program | Teaching Strategies | Assessment Methods |
|------|--------------------------|---------------------------------------|---------------------|--------------------|
| 1.3 | **Describe** various components, functions and interconnection structure and I/O module techniques of a computer system based on latest trends. | K3 | Visual &Verbal [Lectures / Presentations] | Midterm Exam Assignment -2 Final Exam |
| **2.0** | **Skills** | | | |
| 2.1 | **Analyze** various memory storage and access techniques based on performance criteria. | S5 | Visual &Verbal [Lectures / Presentations] | Assignment -2 Final Exam |
| 2.2 | **Demonstrate** different page replacement algorithms based on page fault calculations. | S2 | Visual &Verbal [Lectures / Presentations] | Assignment -2 Final Exam |
| 2.3 | **Apply** programs based on various microprocessor concepts in Assembly language. | S2 | Visual &Verbal [Lectures / Presentations] | Assignment -2 Final Exam |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | **Function** to work as a team member and take responsibility for successful completion of group assignment. | V1 | Visual & Practical Presentations | Lab Exam |

## C. Course Content

| No | List of Topics | Contact Hours |
|----|----------------|---------------|
| 1. | **Chapter1-Introduction To Computer Organization & Architecture**<br><br>● Introduction to computer Organization and Architecture<br>● Structure and function<br>● Structural components of computer<br>● History and generations of computers<br>● Moore's Law and consequences of it.<br>● General and Expanded structure of computers<br>● IAS Memory formats and structure of IAS computer<br>● Cloud Computing ( Basic concepts, Cloud Services (SaaS,IaaS,PaaS) | 4T + 4P |
| 2. | **Chapter 2-Computer functions and interconnections**<br><br>● Computer components<br>● Instruction fetch and execute<br>● Interrupts | 6T + 6P |

| | | |
|---|---|---|
| | ● Multiple Interrupts<br>● Interrupt Instruction Cycle<br>● Interconnection building<br>● Bus Interconnection<br>● QPI<br>● Point-to-point interconnect | |
| 3. | **Chapter3 -Cache memory**<br><br>● Computer Memory System<br>● Characteristics of memory system<br>● Memory hierarchy<br>● Characteristics of memory hierarchy<br>● Cache memory principles<br>● Elements of cache design<br>● Cache memory Mapping<br>● Replacement algorithms<br>● High performance computing<br>● Cache organization | 6T + 6P |
| 4. | **Chapter-4- Internal memory**<br><br>● Semiconductor main memory<br>● Semiconductor main memory<br>● Main Memory Cell Organization<br>● Semiconductor memory types<br>● RAM<br>● DRAM and SRAM<br>● ROM<br>● Types of ROM<br>  DDR DRAM<br>● Newer Non-Volatile Solid state memory | 4T + 4P |
| 5. | **Chapter 5-External memory**<br><br>● Magnetic disc<br>● Data organization and formatting<br>● Disk performances<br>● Raid<br>● Different RAID levels<br>● RAID comparison<br>● Optical storages<br>● Solid state drives | 2T + 2P |
| 6. | **Chapter6- Input-output**<br><br>● Peripheral devices<br>● Input-Output Technique<br>● Programmed I/O<br>● Interrupt driven I/O<br>● Direct memory access<br>● DMA Operation | 4T + 4P |

| | | |
|---|---|---|
| | ● I/O modules<br>● External Interconnection standards | |
| 7. | Final Exam | 4T+4P |
| **Total** | | **60** |

## Study Topics

- History  and generations of computers
- General and Expanded structure of  computers
- Interrupts
- QPI
- Computer Memory System
- Replacement algorithms
- Semiconductor memory types
- Disk performances
- Input –output Techniques
- I/O hardware, Application I/O interface.
- Wireless Network Protocols and Implementing security defenses.
- Basics of network services associated with windows server operating systems.

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Assignment-1 | 5th week | 10% |
| 2. | Midterm Exam | 7th -8th  week | 20% |
| 3. | Assignment-2 | 11th  week | 10% |
| 4. | Lab Exam | 13th  week | 20% |
| 5. | Final Exam | 14th  week | 40% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

## 1. References and Learning Resources

| **Essential References** | William Stallings, **"Computer Organization and Architecture-Designing for Performance", Pearson** Publication, 10th edition, 2016, ISBN-13 978-: 0134101613 |
|---|---|
| **Supportive References** | M. Morris R. Mano, "Computer System - Modern Computer Architecture and Organization Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers" by Jim ledin, Edition (April 30, 2020), Packt Publication. |
| **Electronic Materials** | http://williamstallings.com/ComputerOrganization/ |

| Other Learning Materials | Emulator emu8086 |
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## 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities**<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Classroom and Lab equipped with workstation Computers and Seating Capacity for 30-40 students along with projectors. |
| **Technology equipment**<br>(projector, smart board, software) | The practical should be placed in a lab with the following requirements:<br>● Computer connected to projector.<br>● 30-40workstations<br>● emu8086 software |
| **Other equipment**<br>(depending on the nature of the specialty) | -- |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Students | Course evaluation survey form |
| Effectiveness of Students assessment | Students | Course evaluation survey form |
| Quality of learning resources | Track leaders | Review meetings and star rating with suggestions for further modification and improvements |
| The extent to which CLOs have been achieved | Course Teachers / QAU | CLO assessment template that is further verified at course |
| Other | | |

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

| COUNCIL /COMMITTEE | **DEPARTMENT COUNCIL** |
|---|---|
| **REFERENCE NO.** | **ENGCSEEE2411** |
| **DATE** | **10/10/24** |