# ECE 452: Computer Organization and Architecture

## Concepts:
- Overview of computer organization
- Hardware technology: CMOS, clock, timing
- Microarchitecture design for supporting instructions
- Instruction set architecture (datapath, control path)
- Pipelined processor design
  - Basic solutions for handling data, structural, and control hazards
  - Basic branch prediction techniques
  - Basic exception and interrupt handling techniques
  - Overview of extensions of these concepts in modern superscalar and VLIW processors
- Memory system
  - Memory hierarchy
  - Cache memory design and performance
  - Secondary memory (magnetic disks, Flash/SSD)
  - Virtual memory: paging, swapping
- I/O systems
  - I/O organization
  - On-chip bus and network-on-chip architectures
  - Off-chip bus architectures (e.g., PCI-E)
- Multicore, multiprocessor, and cluster systems
  - Basic concepts of multithreading
  - Basic concepts of GPUs
  - Basic concepts of grid and cluster computing

## Applications:
- Case studies of processor core architectures, including multicore CPUs and GPUs

## Tools:
- Assembler and runtime simulator for a contemporary instruction set architecture
- Architectural simulator for processor-memory system design and exploration

## Logic-level Hardware
- Evaluate logic level hardware characteristics that would affect system performance

## Datapaths
- Design simple datapaths for processors

## Control Paths
- Design control paths using hardwired logic or microprogramming

## Parallelism and Pipelining
- Exploit instruction level parallelism with pipelining to accelerate executions; plus hazard handling and branch prediction techniques

## Memory
- Determine effective memory access latencies under a hierarchical memory system
- Architect and analyze cache hierarchies

## Network-on-Chip, I/O Systems
- Analyze on-chip networks and I/O system performance
- Design to latency and bandwidth constraints

## Multicore/Parallel Computing
- Analyze and exploit core and node level parallelism to improve performance and energy efficiency

## IN

### Microprocessors
- Understand basic structure of a microprocessor

### Addressing Modes
- Understand different addressing modes for operands in instructions

### Assembly and C Language
- Program in assembly and C language

### Memory and I/O
- Understand basic microprocessor memory and I/O system organization

### Pre-requisites
- ECE 251 with a C or higher

## OUT

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