University of Texas at El Paso
Course Syllabus

COURSE DESCRIPTION

Dept., Number	CS3432	Course Title	Computer Organization
Approval Date	Sept 2021	Systems Committee	Freudenthal, Moore, Tosh, Ward

CATALOG DESCRIPTION

Compile and assembly processes; machine organization; fetch/decode/execute process; symbolic coding of instructions and data, including instruction types, formats, and addressing modes; implementation of data and control structures, subroutines, and linkage; and input/output handling at the assembly level, including memory-mapped I/O and interrupt and exception handling.

TEXT BOOKS

Kerningham, Brian W & Ritchie, Dennis M. "The C Programming Language, Second edition," Prentice Hall, ISBN: 0-13-115817-1.
David A. Patterson and John L. Hennessy. Computer Organization and Design RISC-V Edition: The Hardware Software Interface, Second edition, Morgan Kaufmann, ISBN: 978-0128203316 OR Instructor notes.

COURSE OUTCOMES

Subject Areas (and abbreviations):
- Hardware/software interface (HSI)
- Architecture (A)
- Numeric Representation (NR)
- Linearization (L)
- Tools (T)

Level 1

HSI-1. Define and explain the purpose of an instruction set architecture (ISA).
HSI-2. Explain the relationship and differences between a high-level programming language, assembly language, and machine language.
HSI-3. Describe the fetch-execute cycle in terms of the hardware-software interface between machine instructions and processor components.
NR-1. Explain the relationship between a high-level language basic data type (e.g., signed or unsigned integer, floating point number) and its representation as a bit pattern inside the computer.
A-1. Describe the basic components of a processor (e.g., register file, special-purpose registers, control unit, memory) and how they interact with one another.
HSI-4. Explain how procedures are supported by processor hardware.
HSI-5. Explain exception/interrupt handling in terms of the hardware-software interface.
HSI-6. Explain various ways an operand can be addressed in an assembly language instruction.
HSI-7. Describe the process of compiling/assembling, linking, loading, and executing a program.

Level 2

NR-2. Convert between different integer data representations (e.g., decimal, binary, hexadecimal, octal).

NR-3. Interpret the bit representation of a floating-point number.

NR-4. Perform addition and subtraction on two's complement representation of integers.

NR-5. Use bitwise operators to access and manipulate values stored in a subset of bits within a byte or word.

NR-6. Determine range and precision (if applicable) of numbers that can be stored for a given data type and determine whether an integer operation will result in overflow.

HSI-8. Convert between machine and assembly language representations of instructions – i.e., encode and decode instructions.

HSI-9. Trace the datapath through the processor for a given class of instructions (e.g., arithmetic-logical, memory access, conditional branch)

HSI-10. Trace the execution of an assembly language program with procedure calls in terms of allocation and deallocation of stack frames and register and memory contents.

L-1. Translate expressions and assignment statements from C to assembly language.

L-2. Translate Boolean logic and control flow constructs (decisions, loops) from C to assembly language.

L-3. Translate operations on arrays, structs, and pointers from C to assembly language.

Level 3

HSI-11. Implement/debug simple imperative programs in assembly/machine language.

HSI-12. Write or call a procedure with local variables, parameters, and return value in assembly language.

HSI-13. Implement a simple interrupt or exception handler.

T-1. Compose, compile/assemble, execute, and debug simple programs in a command-line environment, using appropriate modularization and multiple files.

ABET STUDENT OUTCOMES MAPPING

Course outcomes	Student outcome
NR1-6	1
L1-3, HSI4, HSI11-13	2 (ABET 1)
L1-3, HSI11-13	3 (ABET 2)
HSI11, T1	6 (ABET 3)
T1	9
L1-3	10 (ABET 6)

PREREQUISITES BY TOPIC

(CS 2302 w/C or better AND EE 2169 w/C or better AND EE 2369 w/C or better AND MATH 2300 w/C or better) OR (CS 2401 w/B or better AND EE 2169 w/B or better AND EE 2369 w/B or better AND MATH 2300 w/B or better)