University of Texas at El Paso
Course Syllabus

COURSE DESCRIPTION

<table>
<thead>
<tr>
<th>Dept., Number</th>
<th>Course Title</th>
<th>Computer Organization</th>
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</thead>
<tbody>
<tr>
<td>CS3432</td>
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</table>

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


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-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.
<table>
<thead>
<tr>
<th>Course outcomes</th>
<th>Student outcome</th>
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<tbody>
<tr>
<td>NR1-6</td>
<td>1</td>
</tr>
<tr>
<td>L1-3, HSI4, HSI11-13</td>
<td>2 (ABET 1)</td>
</tr>
<tr>
<td>L1-3, HSI11-13</td>
<td>3 (ABET 2)</td>
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<tr>
<td>HSI11, T1</td>
<td>6 (ABET 3)</td>
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<tr>
<td>T1</td>
<td>9</td>
</tr>
<tr>
<td>L1-3</td>
<td>10 (ABET 6)</td>
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**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)