

# NMK206 - Computer Architecture

This course is *Computer Architecture*, offered by the Faculty of Electronics Engineering & Technology (FKTEN) for Electronic Engineering Technology programs.

Download [ModelSim 20.1.1.720 \(Intel FPGA Starter Edition\) setup \(SHA-1 checksum\)](#). Linux users can try [this \(SHA-1 checksum\)](#).

## Video Guide(s)

[YouTube Playlist](#)

<p>ModelSim: Installation  <b>Note:</b> Available on <a href="#">YouTube</a>.  <b>Note:</b> Local copy available.</p>	 <h3>ModelSim Installation</h3>
<p>ModelSim: Create Project  <b>Note:</b> Available on <a href="#">YouTube</a>.  <b>Note:</b> Local copy available.</p>	 <h3>ModelSim: Create New Project</h3>
<p>ModelSim: Simulate Logic Circuit  <b>Note:</b> Available on <a href="#">YouTube</a>.  <b>Note:</b> Local copy available.</p>	 <h3>ModelSim: Simulate Logic Circuit</h3>

## Announcements

[20250323] Welcome to NMK206 info page (for 007 lab sessions only)!

[20250424] Soft reminder: Lab Assessment 1 @202500420-0800!

## Lab Session

I am using [Takahashi Method](#) for these slides (Actually, I broke that method by adding diagrams and long codes because I think my students need them). You will find them hard to understand if you do

not attend my sessions. So, that is the 'advantage' I gave to those who actually listen in class 😎

- Lab Briefing
  - Slides
- Intro to CAD Tools and HDL
  - Slides
  - Online Session (Video)
- Verilog Basics
  - Slides
  - Online Session (Video)
  - [Extra]
    - Online Session (Video) (Partial... was stopped due to low number of students)
- Combinational Logic
  - Slides (P1)
  - Slides (P2)
  - Slides (P3)
  - Slides (P4)
  - Slides (P5)
- Sequential Logic
  - Slides (P1)
  - Slides (P2)

**note:** these are from 202324s2 academic session. they should be very similar this semester, but some details may be added or removed. i usually post an updated version at the end of the week.

- State Machine
  - Slides
- Simple Digital System
  - Slides

## Verilog Coding Rule

This is the coding rule that I impose on my students. You will be penalized during assessments if it is not adhered to.

1. One file for one module
  - **RULE:** 1 file 1 module
2. **File name must be the same as module name**
  - **RULE:** file name === module name (.v)
3. All circuit (module) must have a testbench (tb)
  - tb is a also module (so, separate file)
  - **RULE:** All module **MUST** have a testbench
  - **RULE:** Tb name === module name + \_tb
4. Use Verilog95 module declaration

- Port list contain names only (separate input/output declaration)
  - Port connection(s) MUST BE specified using ordered list
  - **RULE:** Port connection(s) by ordered list ONLY!
5. Modules for combinational logic should only use wire/assign statements
    - reg/always reserved for sequential logic and testbench modules
    - **RULE:** comb. logic use assign/wire only!
  6. Only basic logic gates are allowed
    - Can only use AND/OR/INV in your logic implementation
    - XOR logic is allowed for **lab project only**
    - **RULE:** allowed operators AND, OR, INV
  7. Assign statements can only have ONE binary operator
    - Multiple bitwise inverts (~) are ok (they are unary operators)
    - **RULE:** 2-input logic gates ONLY
  8. ALL nets (wire/reg) MUST BE declared.
    - some compiler may allow using without declaration
    - for my assessments, they MUST BE declared
    - **RULE:** All signals @wire must be declared!

## Lab Project (202425s2) Requirements

This is also shared in Google Doc format (link available in Google Classroom).

[nmk206-202425s2\\_labproject.txt](#)

```
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LAB PROJECT
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```

You are required to implement a soft-processor core (HDL-based) with the

following minimum requirements:

- 8-bit microprocessor (instruction size, register size, etc.)
- 8 general purpose registers
- 8 ALU functions
- basic instruction set
  - = move data between registers
  - = perform basic ALU operations
  - = load register with immediate value

These requirements are necessary for submission and minimum grade B. More functionality means better grades:

- 16-bit/32-bit microprocessor
- carry circuit for adder (>8b)
- integer multiply/divide circuit (structural code - NOT behavior)
- bit-level manipulation (towards microcontroller)
- instruction fetch unit and memory interface

Note#1: Auto-0 for downloaded codes!

Note#2: This is a group assignment, but marks will be evaluated

individually.

#### Assessment deliverables:

##### 1) Verilog source files in a single ZIP file

- make sure only Verilog files are included in the file
- make sure all modules have each a proper testbench
- must be self-checking testbenches

##### 2) Technical Document (Specifications)

- not more than 10 pages, no cover page (only list of members' names)
- content:
  - = short summary of features
  - = block diagram of design
  - = list of instructions (description and op-code)

##### 3) An online demonstration / Q&A

- not more than 20 minutes
- content:
  - = short summary of what has been implemented
  - = if completed, demonstrate running the top-level testbench
  - = if NOT completed, demonstrate running component-level testbenches

PROJECT DUE: Lab Session@W14/14 (Item 1&2). Item 3 TBD.

#### Extra Info:

- each student may email in a contribution percentage information:
  - = list all group members (specify project contribution percentage of each)
  - = percentage values should total up to 100% (may use fraction e.g. 1/3)

Note: this is optional, but if a member decides to do this, please advise

the others in group to do the same

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