# FTKE Skill Sets for Students (and staff?)

This is a plan to ensure FTKE program graduates are equipped with a particular set of skills that are thought to be fundamental for a electronics engineering background. At the moment, the plan covers only fundamental skills that covers all four FTKE programs (RY40,RY41,RY43,RY44).

After a lengthy faculty (FTKE academic staffs) discussion, followed by another discussion among the assigned panel members, a number of **six (6)** skills have been identified to initiate this plan. The rest of the skills that has been suggested will be put on hold and may be considered in the future.

A short training module will be developed for each identified skill - each module should only take 2-3 sessions (about 2-3 hour sessions). The session length will be finalized when the modules are ready. The modules should be standalone and can be offered at any time for our students or external parties.

## Selected Fundamental Skills

The fundamental skills that have been selected are based on common expectations and our ability to conduct related training sessions for the students. An overview of the selected skills is shown in the table below.

| # | Skill | Basic Description | Target Implementation |
|---|---|---|---|
| **1** | Operate Basic Instruments | Covers basic Instruments usually available at an electronic workbench: a power supply, a function generator (signal sources), a multi-meter and an oscilloscope (signal measurements). The expected outcome:<br>•<br>power supply<br>  ◦<br>knowledge of its function (powering circuits, current/voltage supply, etc.)<br>  ◦<br>basic operations (setting desired output voltage, insufficient current scenario, etc.)<br>•<br>function generator<br>  ◦<br>knowledge of its function (generating test signals, etc.)<br>  ◦<br>basic operations (setting desired function at specified frequency/period, etc.)<br>•<br>multi-meter<br>  ◦<br>knowledge of its function (measurement of scalar voltage/current)<br>  ◦<br>basic operations (setting range, measurement type, difference in analog/digital measurement devices)<br>•<br>oscilloscope<br>  ◦<br>knowledge of its function (measurement of time-varying voltage signals, etc.)<br>  ◦<br>basic operations (basic settings, internal calibrations, setting voltage/time scales, etc.) | Since this is a very fundamental skill and is required by most courses in their respective laboratory sessions, it is best to insert the module in a course offered in the first semester. At the moment, the target course is PGT101 - Electric Circuit Principles.<br>However, for the first four cohorts (2012,2013,2014,2015 enrollments) this will be done either off-semester or sometime during the weekends (for 2012 enrollment cohort?). |
| **2** | Conduct Numeric Simulation | Usage of numeric simulation software (e.g. Matlab, Scilab), which is usually required for analysis work. The expected outcome:<br>•<br>being familiar with such software, including its purpose<br>•<br>basic coding skill for simple analysis | The target course is PGT205 - Signals and Systems. This course already covers basic usage and should be sufficient.<br>*Note: Need to check with Hafizi on contents and taking it out as a standalone module.* |

| # | Skill | Basic Description | Target Implementation |
|---|---|---|---|
| **3** | Computer Programming | Basic understanding of a computer program (C programming language). The expected outcome:<br>•<br>being familiar with the process of coding, compilation and linking (and the required tools)<br>•<br>basic understanding of presented source codes (in C) | The target course is PGT106 - Computer Programming. This course has fulfilled the basic requirements.<br>*Note: Need to reconsider on contents and taking it out as a standalone module. (2-3 sessions???)* |
| **4** | Circuit Simulation | Basic knowledge of using a circuit simulation software (e.g. SPICE). The expected outcome:<br>•<br>being familiar with the process of simulating a circuit (and the required tools)<br>•<br>basic understanding of general system simulation cycle - entry, simulation, analysis (maybe offer variants as well, like logic simulation, etc.) | No suitable course can be identified. Therefore, it is planned to have this module being offered to the students during the long holiday after semester 2. |
| **5** | Circuit Prototyping | Mostly psycho-motor skills. The expected outcome:<br>•<br>being familiar with normal equipment/components available in an electronic toolkit (students will be asked to equip themselves)<br>•<br>circuit building on breadboards<br>•<br>wire-wrapping circuits<br>•<br>basic soldering skill (may include SMT component soldering - at least knowledge of it) | Some elements may/can be covered in PCT111 - Engineering Skills. But, it has been decided that this module will be offered to the students during the long holiday after semester 2 (along with previous module). |
| **6** | Schematic Design and PCB Layout | A complete PCB-based design cycle. However, this module should concentrate on the psycho-motor part. The expected outcome:<br>•<br>being familiar with the processes and tools (e.g. OrCAD, Protel, Eagle) required<br>•<br>constructing schematic for a simple circuit<br>•<br>constructing PCB layout for a given circuit schematic | The obvious target course is PCT111 - Engineering Skills. This course has fulfilled the basic requirements. However, the schematic entry portion may overlapped with circuit simulation skill mentioned earlier (need to finalize this).<br>*Note: Need to reconsider on contents and taking it out as a standalone module. (2-3 sessions???)* |

# Skills Kept in View

These will be put on hold for future considerations:

- advance operations of instruments
  - parallel/series connection of power supply
  - transistor identification (parameter measurement?) using multimeters
  - X-Y measurement, phase measurement on oscilloscope
  - calibration of equipments
- identifying electronic components
  - extracting information from datasheets
  - component packaging technology
- general circuit design (???)
- design/circuit troubleshooting (???)
- low-level programming
- safety issues
  - attire, conduct, lab rules

# The Next Step

Things to decide:

1. The respective modules have to be developed (or at least revised) to comply with our requirements (e.g. 2-3 sessions per module requirement)
2. Person to be assigned with the task
3. Training the trainer (who will be involved at the early stage?). Later stages can be done with senior students as co-trainers.

# Update 20150930

### Express Plan for RY43 Intake 2012

#### Summary

Out of the six listed skills, three have been covered in the official courses. We need three modules URGENTLY.

#### Immediate Action Required

- prepare 3 express modules (need not be perfect, can be continuously improved) - assign person in charge to conduct / execute the module

**Current Status**

- Module 1- Operate Basic Instrument
  - PM Rahman has found a few online reference that may be usable - with a little work, this can be done within a week tops
- Module 4 - Circuit Simulation
  - Some element of SPICE has been covered, but we need a module that gives compact overall view. Need discussion.
- Module 5 - Circuit Prototyping
  - Existing module from PCT may be usable, but may need fine tuning.

**Decisions**

- Module 1 is assigned to Pn Hazila, Module 4 (Azman) and Module 5 (En Hallis).
- Try to finish before the semester ends, but worst-case scenario is to have them run AFTER the exams (before going for practical training).
- Multimeters for module 1 is based on what electrical department has (GW?)
- Oscilloscope needs content on manual scale measurement (NOT from auto measurement)
- Power supply needs content on undervoltage (maybe something to highlight supply voltage will drop if there are not enough current - scenario at the lab)

# Update 20160905

Summary: No progress has been made on this. This is simply due to inability of the respective lecturers to find time to finalize this.

Proposal: I am proposing a change in module 4 from *Circuit Simulation* to something more specific, like, *Digital Circuit Simulation using Verilog and ModelSim*. This module is currently available as a 3-day course, based on lab modules used in PGT206 (Academic Session 2015/2016 Semester 2).

# Update 20170412

Still no progress since last update. This is simply due to inability of the respective lecturers to find time to finalize this.

Based on what I have proposed previously, I would like to outline a new skillset cluster.

| # | Skill | Basic Description | Target Implementation |
|---|---|---|---|
| **1** | Operate Basic Instruments | Covers basic Instruments usually available at an electronic workbench: a power supply, a function generator (signal sources), a multi-meter and an oscilloscope (signal measurements). May also need to know basic connectivity to/from a breadboard (i.e. bus strips and terminal strips).<br>The expected outcome:<br>• power supply<br>  ◦ knowledge of its function (powering circuits, current/voltage supply, etc.)<br>  ◦ basic operations (setting desired output voltage, insufficient current scenario, etc.)<br>• function generator<br>  ◦ knowledge of its function (generating test signals, etc.)<br>  ◦ basic operations (setting desired function at specified frequency/period, etc.)<br>• multi-meter<br>  ◦ knowledge of its function (measurement of scalar voltage/current)<br>  ◦ basic operations (setting range, measurement type, difference in analog/digital measurement devices)<br>• oscilloscope<br>  ◦ knowledge of its function (measurement of time-varying voltage signals, etc.)<br>  ◦ basic operations (basic settings, internal calibrations, setting voltage/time scales, etc.) | Target implementation: Semester 1<br>Status: Materials available - need to be compiled. |

| # | Skill | Basic Description | Target Implementation |
|---|---|---|---|
| **2** | Build and Test Basic Circuit | Mostly psycho-motor skills. The expected outcome:<br>•<br>being familiar with normal equipment/components available in an electronic toolkit (students will be asked to equip themselves)<br>•<br>circuit building on breadboards<br>•<br>wire-wrapping circuits<br>•<br>basic soldering skill (may include SMT component soldering - at least knowledge of it)<br>•<br>basic troubleshooting | Target implementation: Semester 2<br>Status: No progress. |
| **3** | Write and Create Basic Computer Program | Basic understanding of a computer program (C programming language). The expected outcome:<br>•<br>being familiar with the process of coding, compilation and linking (and the required tools)<br>•<br>basic understanding of presented source codes (in C) | Target implementation: Semester 1/2<br>Status: Materials available (from PGT106) - need to be compiled (compressed?) into sessions for 2-3 days. |
| **4** | Implement and Simulate Digital Logic | Objectives:<br>•<br>Understand the basic requirements in implementing digital design using HDL<br>•<br>Create and implement a simple digital logic design using Verilog<br>•<br>Test and verify a simple digital logic design using ModelSim | Target implementation: Semester 2/3<br>Status: **Completed** - taken from our internal training module. |
| **5** | Construct PCB Schematic and Layout | A complete PCB design cycle (excluding the fabrication part - done in PCT111?). The expected outcome:<br>•<br>being familiar with the processes and tools (e.g. OrCAD, Protel, Eagle) required<br>•<br>constructing schematic for a simple circuit<br>•<br>constructing PCB layout for a given circuit schematic | Target implementation: Semester 2/3<br>Status: Materials available (from PCT111?) - need to be compiled (compressed?) into sessions for 2-3 days. |

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