

Modelling and Simulation Prototype Technologies II

Code: MK3MOD2R06R117-EN

ECTS Credit Points: 6

Evaluation: exam

Year, Semester: 3rd year, 2nd semester

Its prerequisite(s): Modelling and Simulation Prototype Technologies I

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+4

Topics:

Mechatronics, multi domain, prototype development, using simulation results. Theory and application of mechanical and electrical prototype development. Manufacturing of mechanical parts with additive and subtractive methods. Additional coating. Attachment of commercial mechanical parts: nuts and bolts, drive types, electrotechnical parts.

Printed Circuit Board (PCB) manufacturing with rapid prototyping technologies. Surface Mounted Technology (SMD) and Trough Hole Technology (THT). Heat transfer and cooling of electrical components. Matching and attachment of commercial electrical components: analog matching or digital bus connection.

Validation of electrical circuits with measurement: analysis with periodic and non-periodic excitation signals, measurement of harmonic distortion and transfer function.

CPU and FPGA based digital control and signal processing, using model-driven software development tools, such as LabView from National Instruments.

Realization of simulation results, achieved previous subject, with rapid prototyping technologies.

Literature:

Compulsory:

- 1. Chee Kai Chua, Kah Fai Leong, "3D Printing and Additive Manufacturing, Principles and Applications" 4th ed. 2014, World Scientific Press, ISBN: 978-981-4571-41-8
- 2. Matisoff Bernie "Handbook of Electronics Manufacturing Engineering", 1997, Springer, ISBN-13: 978-0412086113

Schedule

1 st week Registration week	
2nd week: Lecture: Multi-domain simulation development theory. Practice: Prototype development practice.	3rd week: Lecture: Electrical and mechanical prototype development theory. Practice: Electrical and mechanical prototype manufacturing practice.
4th week: Lecture: Production of mechanical parts with subtractive and additive methods. Surface treatment methods. Practice: Mechanical part manufacturing practice.	5th week: Lecture: Design with commercial mechanical components: nuts and bolts, gears, and electromechanical components. Practice: Design practice with commercial components.
6th week: Lecture: Rapid prototyping of printed circuit boards. Modules and	7th week: Lecture: Through hole (THT) and surface mounted technologies for

components.

Practice: Printed circuit design practice.

electrical circuits and boards. Heat dissipation and cooling.

Practice: THT and SMD soldering and testing practice.

8th week: 1st drawing week

9th week:

Lecture: Electrical interfacing to commercial components. Analogue and digital interfacing. Connection to digital bus.

Practice: Electrical interfacing design and manufacturing practice.

11th week:

Lecture: Testing of electrical components and modules: distortion and transfer characteristics.

Practice: Electrical components testing practice.

13th week:

Lecture: Digital control and signal processing with CPU.

Practice: Control and signal processing with CPU practice.

10th week:

Lecture: Testing of electrical components and modules with periodic and non-periodic excitation signals.

Practice: Electrical modules testing practice.

12th week:

Lecture: Model driven software development tools, theory.

Practice: Model driven software development practice.

14th week:

Lecture: Digital control and signal processing with FPGA.

Practice: Control and signal processing with FPGA practice.

15th week: 2nd drawing week

Requirements

A, for a signature:

Participation at practice classes is compulsory. Students must attend practice classes and may not miss more than three occasions during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students can't take part in any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes must be made up for at a later date, being discussed with the tutor.

During the semester there are two tests: the mid-term test on the 8th week and the end-term test on the 15th week. Students must sit for the tests.

B, for a grade:

The course ends in an examination.

The minimum requirement of the mid-term, the end-term test and the teamwork is 50% separately. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

The grade is given according to the following table:

%	Grade
0-49	fail (1)
50-62	pass (2)
63-75	satisfactory (3)
76-89	good (4)
90-100	excellent (5)

If the score of any test is below 50, the student once can take a retake test of the whole semester material.

An offered grade: It may be offered for the students if the average of the mid-term test, end-term tests and the teamwork is at least good (4). The offered grade is the average of them.