Additive Manufacturing: Tools, Materials and Methods

Additiv tillverkning: verktyg, material och metoder
6 credits

Programme course

TFYA88

Valid from: 2024 Spring semester

Determined by	**Main field of study**	
Board of Studies for Electrical Engineering, Physics and Mathematics	Applied Physics, Physics	
Date determined	**Course level**	**Progressive specialisation**
2023-08-31	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Technology	
Revision date	**Subject group**	
	Physics	
Offered first time	**Offered for the last time**	
Autumn semester 2016	Autumn semester 2025	
Department	**Replaced by**	
Institutionen för fysik, kemi och biologi		

Specific information

Cannot be included in a degree at the same time as TMKO05.

Course offered for

- Master of Science in Biomedical Engineering
- Master of Science in Applied Physics and Electrical Engineering
- Master of Science in Applied Physics and Electrical Engineering - International
- Master's Programme in Biomedical Engineering
- Bachelor of Science in Applied Physics

Prerequisites

Thermodynamics at the level provided in a basic course in chemistry, physics, or materials science. Familiarity with material physics, as provided in a course such as modern physics, is beneficial but not required, as is familiarity with at least one CAD program. (CAD instruction will be offered as a brief supplemental course for those who lack training/experience.) Basic laboratory skills. This will be a relatively fast-paced course. Students who are unfamiliar with at least one of the pre-requisites (physics/chemistry/materials science or CAD) may struggle.

Intended learning outcomes

This course will provide a general understanding of additive manufacturing (3D-printing), and detailed understanding of:

- the physics and chemistry involved with the various printing methods, including the material requirements,
- the types of materials appropriate for various printing methods,
- various printing methods, their advantages and disadvantages,
- current and future applications of additive manufacturing.

After completing this course, students will be able to:

- describe several types of 3D printers, their mode of operation, and their strengths and limitations,
- determine which type of printer is most suitable for fabricating a part based on the requirements of the desired product (choice of material, tolerances, etc.), or whether 3D printing is at all a viable option,
- prepare 3D CAD models for creating printed devices (including editing for printer limitations, etc.), and
- confidently produce 3D-printed devices with at least two kinds of 3D printers (after hands-on work in the labs).

Course content

Material properties in the solid, liquid, and other (gel, glass) states. Phase-change processes and chemical reactions, including photo-initiated chemistry. Introduction to digital control of mechanical systems (stepper motors, etc.) Introduction to fluid mechanics, as applied to additive manufacturing. Introduction to surface science, as applied to additive manufacturing. Applications, strengths, and weaknesses of various forms of additive manufacturing including: Mechanical applications (prototypes, mechanical components), chemical and life-science applications (prosthetics, artificial organs, lab-on-a-chip devices, etc.). An introduction to 3D CAD. An introduction to planning/slicing software. Hands-on design, fabrication, and evaluation of fabricated parts.

Teaching and working methods

This course includes lectures, hands-on labs, a student-defined project and a field trip.

Examination

LAB1	Laboratory work	1 credits	U, G
TEN1	Written examination	3 credits	U, 3, 4, 5
PRA2	Student project and presentation	2 credits	U, G

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.

Other

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

The course is campus-based at the location specified for the course, unless otherwise stated under “Teaching and working methods”. Please note, in a campus-based course occasional remote sessions could be included.