Course syllabus

Tillämpad mekatronik
Applied Mechatronics

EIEN65, 15 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED E
Date of Decision: 2023-04-11

General Information

Elective for: D4-is, D4-hs, E4-ra, F4, M4-me, MD4
Language of instruction: The course will be given in English on demand

Aim

The development of the products of today and tomorrow is more and more often demanding an optimised combination of electromechanical solutions and embedded systems (integrated electronics and software). The aim of the course is that the student should use the knowledge and skills achieved from earlier courses and independently seek and find solutions for complex mechatronic assignments. The course has two parts. The first one is the development of a concept based on a set of technical and functional specifications from a real problem in industry. The concept can be implemented into a working industrial prototype in another optional course (EIEN70 Mechatronics, industrial product design). This task is solved in groups composed by at least one E-student and at least one M-student to form a mechatronic team with various competences. The other part of the course is an individual assignment to construct a complete mechatronic system aimed at controlling a DC motor from a PC interface, including computer communication, electronic design also on the circuit board, microprocessor programming, sensor technology, and automatic control strategies. The system is built in a lab open 24/7, where cooperation is encouraged but still the final examination is individual.

The course is aiming at giving

- deeper competence/detailed knowledge within specific fields as mechanical engineering (including mechanical design, choice of materials, and machine parts), electromechanical energy conversion, electronics, and software engineering,

- understanding of the problems of adjacent disciplines, ie what can and cannot be achieved and what kind of expertise is demanded for solving various types of problems in group and individually,
- ability to cooperate over and within borders of engineering fields including knowledge of industrial product design methodology (from demand to concept, considering the entire product life cycle),
- insightful respect for what is demanded to accomplish a robustly functioning system including key components as well as overall system aspects.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to recognize the various phases in a product development project and apply the principles for product development to mechatronic development projects, machines, and electronics,
- understand the principles for programming embedded systems and communication in integrated control systems,
- have insight into the basic principles and methods of mechatronics including the combination of computer science, electrical engineering and mechanics that is needed to design functional and effective products.

Competences and skills
For a passing grade the student must

be able to

- use applicable methods for product development in a mechatronic team,
- formulate and judge real-time requirements for integrated control systems,
- make a specification for suitable materials, production methods, control electronics, and the power electronics and electromagnetic energy converters of a certain product,
- independently conceive, build and debug a complete mechatronic system, with given components, data sheets and other information search,
- independently describe the structure and subfunctions in a complex mechatronic system of one's own design with regard to hardware and software,
- systematically debug the system of one's own design and its parts and by individual work be able to restore the functionality.

Judgement and approach
For a passing grade the student must

- have the understanding and judgement to respect and demand all the various competences that are necessary for mechatronic constructive design,
- have the confidence to debug and operate a mechatronic system.

Contents

Introduction to the prerequisites of the participants from other engineering programmes than one's own, e.g. real time programming and product design methodology, followed by deeper theory of: Product development and design methodology. Practical automatic control. Analogue electronics. Simulation of electronics and mechanics. Debugging. EMC, protection and security. Environmentally friendly electronic prototype development. Microprocessors and programming of embedded systems. Interface to PC. Device drivers. Computer communication. Sensors. Actuators. Electromechanical energy conversion. Mechanical prototype development. Search/interpretation of technical documentation.

Examination details

Grading scale: UG - (U,G) - (Fail, Pass)
Assessment: Examination is done in two steps, for a project group of students and indiviually: For the project group examination, the approved assignments, an approved written report and an approved oral presentation of the industrial concept evaluation are needed, For the individual examination, the student shall explain and run her/his selfmade mechatronic system, the teacher will then introduce a number of faults which need to be detected and repaired by the student for approval. Both examinations should be approved to get the grade G (pass).

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0123. **Name:** Concept Development.
Credits: 7,5. **Grading scale:** UG. **Assessment:** Approved report on concept development gives the grade G.
Code: 0223. **Name:** Project Work.
Credits: 7,5. **Grading scale:** UG. **Assessment:** Approved practical project work gives the grade G.

Admission

Assumed prior knowledge: Approved basic courses in programming, automatic control and electronics/electrical engineering.
The number of participants is limited to: 72
Selection: Credits awarded or credited within the study programme
The course overlaps following course/s: EIEN45, EIEN01

Reading list

- Literature is encompassed in the set of tools and material that will be sold by the Department.
- W. Bolton: Electronic control systems in Mechanical and Electrical Engineering. Data sheets and other searchable information are needed. Mechatronics – Electronic control systems in Mechanical and Electrical Engineering (W. Bolton) is optional as a reference.

Contact and other information

Course coordinator: Francisco Marquez Fernandez, fran.marquez@iea.lth.se
Course homepage: https://www.lth.se/iea/english/education/optional-courses-in-lund/applied-mechatronics/