Virtual Product Design and Simulation

International Semester in Mechanical and Automotive Engineering

Courses:
- Product Design, Robustness and Usability 5 ECTS
- Advanced 3D-Modeling and Optimization, 5 ECTS
- Hybrid and Electric Vehicles, 5 ECTS
- Structural Analysis and FEM, 5 ECTS
- Innovation Project (in Groups), 10 ECTS
- Finnish for Exchange Students (optional), 3 ECTS

Product Design, Robustness and Usability 5 ECTS

Learning Outcomes:
The student shall understand product usability, can interpret and create instructions needed in design, manufacturing, testing, service, and customer operation.

Contents:
Practical approach into the following subjects:
- Robust design
- Design for usability
- Design for testing
- Product testing
- Service manuals
- Operating instructions
- Safety instructions
- Continuous improvement
- Machine directive

Implementation methods:
- Lectures
- Problem based learning
- Group work
- Workshops
- Company visits
Advanced 3D-Modeling and Optimization, 5 ECTS

Learning Outcomes:
The student shall understand advanced modeling techniques of CATIA software for virtual product design and Digital Mock-Up (DMU).

Contents:
- Solid modelling techniques and Part Design
- Assembly Design and Technical Drawings
- Digital Simulation of Mechanics
- Sheet Metal Design

Hybrid and Electric Vehicles, 5 ECTS

Learning Outcomes:
Student shall understand the architecture and function of a HEV/EV vehicle electric powertrain components and necessary subsystems.
Student shall be able to utilize suitable E/E design software to build an architectural design, schematic and harness drawing for an HEV/EV vehicle.

Contents:
System engineering, component design, integration, manufacturing engineering and product quality. Used software will be Zuken: E3.
- Hybrid vehicle powertrain solutions and electric systems
- Vehicle energy consumption, energy reserves and li-ion chemistries
- High voltage battery construction, functionality and BMS construction
- Battery repair actions and diagnostics
- Hybric vehicle powertrain control methods
- Insulation resistance and HV-circuit precharging
- Inverter, DCDC and charging unit construction
- Electric motor types and functionality

Structural Analysis and FEM, 5 ECTS

Learning Outcomes:
On completion of the course, the student will be familiar with the basics of the finite element method, and is able to perform linear static, dynamic, and buckling analyses using commercial finite element software.

Contents:
- Matrix calculus
- Introduction to the finite element method
- Structural elements
- Solving for displacements, computing reaction forces and element forces
- Usage of a finite element software
Innovation Project (in Groups), 10 ECTS

Learning Outcomes:
Virtual product design techniques in a real industrial project.

Contents:
- Solve problems in close co-operation with a industrial company or research organization
- Idea is to apply the studied subjects to the task given
- Students work in groups or possibly get an individual assignment (not recommended)

Finnish for Exchange Students, 3 ECTS

Learning Outcomes:
- Familiar with the basic features of the Finnish language and cope with brief everyday expressions
- Recognize public notices and signs and know the fundamentals of the Finnish history, culture, customs, traditions, and social life

Contents:
- Greetings, introductions, shopping, ordering food in a restaurant, asking for help, telling the time, numerals, etc.
- Basic pronunciation and oral exercises, short writing tasks presentations, discussions and reading assignments on Finnish history, culture, customs, traditions, and social life

Further information:
Curriculum of the Automotive Engineering degree programme
Curriculum of the Mechanical Engineering degree programme
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