Integrated Design Systems

Code: MK5INTRG05GX17_EN

ECTS Credit Points: 5

Evaluation: mid-semester grade

Year, Semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+3

Topics:

In industry, there are several integrated CAD/CAM/CAE solutions. The aim of the course is to introduce the integrated design systems with students and lead on product lifecycle from inception, through engineering design and manufacture. Industry-specific CAD modules (sheet metal part-, welding- and framework design environments). Industrial design, rapid prototype manufacturing. Introduction to surfacing and mechanism design process. Computer aided engineering (CAE). Finite element analysis of engineering parts in integrated design systems (discretization of finite element model, analysis and post-processing). Engineering optimization (target functions, design parameters and design variables). Computer aided manufacturing (CAM) in the integrated design systems. Connection between CAM and NC machines.

Literature:

Compulsory:

- Mankovits, T. (2014): Numerical Analysis of Engineering Structures (Linear Elasticity and the Finite Element Method), University of Debrecen, Debrecen, Hungary, ISBN: 978-963-473-797-1, p. 181.
- P. Hervay, R. Horváth, L. Kátai, I. Madarász, B. Mikó, L. Molnár, I. Nagy, I. Oldal, O. Papp, A. Piros, L. Rabb, I. Szabó, G. N. Tóth, K. Váradi: CAD Book, Typotex Publishing House, 2012, ISBN 978-963-685-7
- Cs. Erdősné Sélley, Gy. Gyurecz, J. Janik, G. Körtélyesi: Engineering Optimization, Typotex Publishing House, 2012, ISBN 978-963-279-686-4
- J. Zheng Li: CAD, 3D Modeling, Engineering Analysis and Prototype Experimentation, Springer International Publishing Switzerland, 2015, ISBN 978-3-319-05920-4, ISBN 978-3-319-05921-1 (eBook)
- M. Fitzpatrick: Machining and CNC Technology, McGraw-Hill, 2014, ISBN 978-0-07-337378-2

Recommended:

- I. Stroud, H. Nagy: Solid Modelling and CAD Systems, Springer-Verlag London, 2011, ISBN 978-0-85729-259-9
- Singiresu S. Rao: Engineering Optimization, John Wiley & Sons, 2009, ISBN 978-0-470-18352-6

Schedule

1st week: Registration week	
2nd week: **Lecture:** Introduction to integrated design systems. Computer aided product development. **Practice:** Sketches, constraints and basic features in parametric CAD system.	**3rd week:** **Lecture:** Product life cycle management. Introduction to top-down, bottom-up and iterative design methods. **Practice:** Assembly design and drafts in parametric CAD system. **Complex design task.**

4th week: **Lecture:** Industry-specific CAD modules. sheet metal part-, weldment- and framework design environments. **Practice:** Sheet metal part design: basic features	**5th week:** **Lecture:** Software solutions for forming, injection molding and casting. **Practice:** Sheet metal part design in parametric CAD system.
6th week: **Lecture:** Industrial design, rapid prototype manufacturing **Practice:** Surfacing using parametric CAD system.	**7th week:** **Lecture:** Analysis of mechanisms. Case studies. **Practice:** Mechanism connections, motion simulation. Kinematic and kinetic analyses and its evaluation.
8th week: 1st drawing week	
9th week: **Lecture:** Features of finite element modules available in integrated design systems. **Practice:** Finite element analysis of engineering parts (discretization of finite element model, analysis and post-processing).	**10th week:** **Lecture:** Special analysis types. Finite element analysis of nonlinear and dynamic problems. **Practice:** Effects of geometry and material modifications on the simulation results.
11th week: **Lecture:** Engineering optimization (target functions, design parameters and design variables). **Practice:** Structural optimization in an integrated design system.	**12th week:** **Lecture:** Computer aided manufacturing (CAM) in the integrated design systems. Specific features of CAM modules available in integrated design systems. **Practice:** Introduction to CAM software user interface. Tool management.
13th week: **Lecture:** Case study for a product lifecycle management within an integrated design system. **Practice:** Machining operations: face milling, roughing, chamfering cycle, creating CNC code. Simulation.	**14th week:** Lecture: End-term test **Practice:** Connection between CAM and NC machines in laboratory practice. Import CNC code generated by CAM software.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attendance at lectures is recommended, but not compulsory.

Participation at practice is compulsory. Students must attend the practice classes and may not miss more than three times 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 make up a practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments to the course with them to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there is a test in the 14th week. Students have to sit for the test. During the semester there is a complex design task.

B, for grade:

The course ends in a mid-semester grade, based on the average of the test and complex design task.

The minimum requirements of the test and the complex design task is respectively 50%. Based on the score of the test and the task separately, the grade for the tests and the task is given according to the following table:

Score	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of test and task is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

An offered grade:

It may be offered for students if the average grade of the end-term test and the complex design task is at least good (4).