Module Description

Mechatronics for production and logistic

General Information

Number of ECTS Credits

3

Abbreviation

TSM_Mechatr

Version

26.08.2016

Responsible of module

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Language

	Lausanne	Bern	Zürich	Manno/Lugano
Instruction	☐ E ☒ F	☐ D ☐ E ☐ F	☐ D ☒ E	☐ E
Documentation	☒ E ☒ F	☐ D ☐ E ☐ F	☐ D ☒ E	☐ E
Examination	☒ E ☒ F	☐ D ☐ E ☐ F	☐ D ☒ E	☐ E

Module category

☐ Fundamental theoretical principles
☒ Technical/scientific specialization module
☐ Context module

Lessons

☒ 2 lecture periods and 1 tutorial period per week
☐ 2 lecture periods per week

Brief course description of module objectives and content

Virtually all consumer and utility goods today are produced in high volumes in highly automated factories and then delivered to the customer via equally automated logistics and distribution centers. From the technological viewpoint, the entire production system is based on controlled drives which connect the automation control systems and sensor devices, which nowadays are software-based systems, to the mechanical machinery elements. These complex systems can be designed and described through a combination of IT, electronic and mechanical systems known as *mechatronics*.

Despite the fact that production machines are often highly specialized, there is a level at which commonalities can be found among mechatronic solutions in different machines, separately considering their principal tasks (e.g.: conveying, lifting, positioning, winding) and can then be classified and described in a non-industry specific manner. On the basis of this analysis, requirements can be defined for the configuration of the components (motor, inverter, gearbox) as well as for the software functions to allow a quick and reliable design and implementation.

Even the rising productive paradigms that use alternative approaches to traditional mass production (e.g.: additive manufacturing systems, networked factories) are implemented through highly automated systems and can be analyzed, by one side, as combinations of the same types of basic physical task and, by the other, as an even more tight and organic combination of IT and mechanics (often indicated as *cyber physical systems*). On this perspective, the course offers an insight of some key elements of the *Industrie 2025* initiative as well as of other related approaches (*Industrie 4.0*, *Factory of the Future*, *Smart Factory*…)

Aims, content, methods

Learning objectives and acquired competencies

- to design automated plants with a mechatronic approach
- to implement methods and tools for a consistent modeling and design of manufacturing systems
- to practically carry out programming, maintenance and changing main tasks on an existing, small scale production plant

Contents of module with emphasis on teaching content

- How production and logistics systems are structured
- Machines in production and logistics
- General concepts of mechatronic systems
- Mechatronic drive and sensor elements
- Reliability issues of mechatronic systems
- Conveyors and lifting machineries
- Drive for non controlled, open loop systems
- Positioning systems and sensors for travelling systems
- Electronic cams and multi-axis systems
- Drive for forming processes
- Choose and dimension drive systems for machining tools (e.g.: lathe, milling, grinding…)
- Additive manufacturing systems
- Redesign a component of a transport system and the realization of a prototype
- Design a mechanical component with embedded sensors (e.g.: a bearing with temperature sensor or accelerometer to implement preventive maintenance operations)

Teaching and learning methods

Classes and exercises.

Prerequisites, previous knowledge, entrance competencies

Modeling of simple mechanical systems, mechanical and electrical components, programming fundamentals.

Literature

- E. Kiel (Ed.), Drive Solutions – Mechatronics for Production and Logistics, Springer, ISBN 978-3-540-76705-3
- G. Pelz, Mechatronics systems, Wiley ISBN 0-470-84979-7
- M. Nakamura and Oth., Mechatronic Servo System Control, Springer, ISBN 3-540-21096-2

Assessment

Certification requirements for final examinations (conditions for attestation)

Positive evaluation in written examination

Written module examination

Duration of exam :	120 minutes
Permissible aids:	None