

SYLLABUS: SYSTEM DESIGN

Date / Revision August 22, 2017 / 22.08.17 /MaS
Faculty Engineering
Study Programm Mechatronics

SUBJECT: System Design

1 Basic Information

1.01	Subject Name	System Design
1.02	Semester	5
1.03	Level	1
1.04	SKS	3
1.05	Mandatory / Curriculum	Mandatory / F-15
1.06	Subject Code	SYSD
1.07	Subject Code	ENG-F-SYSD-5115
1.08	Year	2017 (7)
1.09	Quality Control	Final Test, see evaluation
1.10	Limitations	Min 12 and Max 32 students in one class
1.11	Combined with	MEE, ELE
1.12	Perquisite	Mechanical-, Electronics, Microcontroller, Sensor and programming
1.13	Responsible	Dean of Engineering Faculty
1.14	Revision	22-08-2017/MaS

2 Description of Subject

This course is designed to provide basic information and an overview of the telecommunications principle. The course covers the telecommunication principles, standardization and regulation, the evolution of data communications, the data protocols, analog- and digital-modulation and demodulation.

3 Objectives

- Introduces the concept of analog and digital telecommunication
- introduce the communication protocol

4 Competency

After having the course, students are expected have to:

- Apply product design techniques to the development of mechatronic systems
- Explain the role of sensors, actuators, control, and machine intelligence in product performance
- Describe the basic structure of a microcontroller and discuss how to integrate the programmable device in a smart product
- Demonstrate the programming skills needed to write, modify and implement in Arduino microcontroller
- Analyze and evaluate the operational characteristics of electromechanical actuators (solenoids, motors, etc.)
- Design, construct a simple mechatronic product

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Discussion, design a simple mechatronics product, sample problem, group work;
- Student Study Effort: assignment; design and build a system, preparation for examination.

6 Evaluation

5.1	Absence maximum	25%
5.2	Participation in Discussion	05 Points
5.3	Homework / Classwork	05 Points
5.4	Presentation /Simulation	10 Poin
5.5	Daily Quiz	20 Points
5.6	Final Examination	60 Points
	Total	100 Points

7 Text Book and Reference

1	Main Text Book: Bolton W., " <i>Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering - 6th Edition</i> ", Pearson Education - International Edition, 2015, ISBN: 978129207668-3
2	Supplementary Text books: <ul style="list-style-type: none"> • Alciatore, D.G. and Hstand, M.B., " <i>Introduction to Mechatronics and Measurements Systems</i>", McGraw-Hill, 2003 • R. Isermann, " <i>Mechatronische Systeme – Grundlagen</i>", Springer-Verlag, Berlin, 1999

8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1	Introduction <ul style="list-style-type: none"> • What is mechatronics ? • From mechanical to mechatronics system • Several definition of mechatronics • Mechatronics design components • Mechatronics system design approach 	PART I	
2	Sensor and Signal Conditioning Systems <ul style="list-style-type: none"> • Why signal conditioning? • Wheatstone bridge • Interfacing • Signal conditioning process • Op-Amp: Inverting -and noninverting-, summing- amplifier, integrating and differential amplifier • passive and active filter 	PART II	
3	Arduino Microcontroller <ul style="list-style-type: none"> • Programming a Arduino microcontroller using Arduino IDE • Interfacing the Arduino-microcontroller into digital I/O • Interfacing the Arduino-microcontroller into analog I/O, including the signal conditioning • interfacing the Arduino with DC-Motor, and Servo Motor • interfacing the Arduino with LCD Display • Case Study 	Part IV	Quiz-1
4	Modeling of Mechatronics Systems <ul style="list-style-type: none"> • Structure of dynamic models • Mathematical models • Review of mechanical and electrical actuation systems • Review if pneumatic and hydraulic actuation systems • Block diagram representation • Systems transfer function • Control architecture in mechatronics systems 	PART V	Quiz-2
5	Modeling of Mechanical Systems <ul style="list-style-type: none"> • Motion of mechanical elements • Conversion translational and rotational motions • Mechanical building blocks • Building up mechanical systems 	PART V	Quiz-3
6	Modeling of Electromechanical Systems <ul style="list-style-type: none"> • DC motor system • Mathematical model of DC motor system • Servomotor • Block diagram of servomotor • DC generator • Block diagram of DC generator 	PART III PART V	

7	Frequency Response <ul style="list-style-type: none"> • Understanding of frequency response • Frequency response of first order systems • Frequency response of second order systems • Bode plots, Building up Bode plots • Characteristics of second order systems in frequency domain • How to describe the specifications • Understanding about stability, Gain and phase margin • Design of mechanical system in frequency domain 	PART V	
8	MIDTERM SEMESTER BREAK		
9	Preparation of Mechatronics System Design - Project		
10-14	Mechatronics System Design - Project		
15	Presentation of MSD Project		
16	Final Examination		