SYLLABUS

Date/ Revision	21 March 2017 / Rev. 01
Faculty	Engineering
Approval	Dean of Engineering Faculty

SUBJECT : Mechatronics System Design 1

1. Identification of Subject:

Name of Subject	: Mechatronics System Design 1
Code of Subject	: MESD-3001
SKS	: 3
Semester	: 5
Study Program	: MTE
Lecturer	: to be announced.

2. Competency

After taking this course, students are expected to be able 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

3. Description of Subject:

The Mechatronic System Design 1 course provides the student to integrate mechanical, electronic, and computer technologies in order to create “optimal” products and processes. Basic concepts and fundamental principles will be reviewed in this course. Students will develop the knowledge and skills necessary to adopt an interdisciplinary approach to mechatronic system design through the lectures, hands-on laboratory experiments and term project. Specific topics include:

- **An Introduction** to Mechatronic System Design: Intelligent products and processes; systems engineering; components of a mechatronic system; engineering design process; development of design specifications.
- **Microcontrollers**: Microcontroller and interfacing into analog and digital inputs/outputs, converting mechanical designs; programming the ARDUINO microcontroller;
- **Sensors and Actuators**: analog- and digital-signal conditioning; electrical and optical sensors; selection of sensors; electromechanical actuators; servo motors;

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4. Learning Approach

Approach : Combination of Expository - inquiry and colaborative
Method : Discussion, question answer, sample problem, group work
Student Task : Project work, presentation
Media : LCD projector, film.

5. Evaluation

a) Absence maximum < 25%
b) Participation in discussion : 5 points
c) Project Report : 15 Points
d) Presentation, Simulation : 10 points
e) Daily Quiz : 10 points
f) Final Examination : 60 points

Total : 100 points

6. Contents/ Topics of Lecturing:

Week	Content/ Topics of Lecturing	Text Book Chapter	Remark
1	**Introduction** • What is mechatronics ? • From mechanical to mechatronics system • Several defintion of mechatronics • Mechatronics design components • Mechatronics system design approach	PART I	
2	**Sensor and Signal Conditioning Systems** • 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** • 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** • Structure of dynamic models • Mathematical models	PART V	Quiz-2

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	• 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		
5	**Modeling of Mechanical Systems** • 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** • 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** • 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**		

7. Book Reference:

Textbooks:

- Bolton W.,*" Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering - 6th Edition*", Pearson Education - International Edition, 2015, ISBN: 978129207668-3
- Alciatore, D.G. and Histand, M.B., *"Introduction to Mechatronics and Measurements Systems",* McGraw-Hill, 2003
- R. Isermann, „*Mechatronische Systeme – Grundlagen"*, Springer-Verlag, Berlin, 1999

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