SYLLABUS

Date/ Revision	30 March 2017 / Rev. 01
Faculty	Engineering
Approval	Dean of Engineering Faculty

SUBJECT : PROGRAMMABLE LOGIC CONTROLLER

1. Identification of Subject:

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Name of Subject    : Programmable Logic Controller
Code of Subject    : IPLC-3000
SKS                : 3
Semester           : 5 / Elective Subject 1
Study Program      : MTE
Lecturer           : to be announced.
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2. Competency

After taking this course, students are expected to be able to:
- Apply product design techniques to the development of mechatronic systems;
- Design and build a simple mechatronic product using the correct method and tools;
- Manage a mechatronic-engineering project, from a scratch into the product;
- write the documentation of the project;
- Demonstrate the presentation skills in front of the class to explain the project-product;

3. Description of Subject:

Programmable Logic Controllers (PLCs) were first introduced in late sixty's as a means of automating manufacturing process. Since then, PLCs have evolved into sophisticated and sometimes complex pieces of equipment. Nevertheless, their use and flexibility has reached a point where they are no longer discretionary pieces of equipment, but necessities. Today, lot of industries employs PLCs in their automation system. The relatively rapid integration of the PLC into the manufacturing sector has been called the second industrial revolution, and the revolution is far from over.

A successful engineer who is involved in nearly any manufacturing business needs a basic knowledge of the way in which PLCs are used. This course is established under the response of this demand for knowledge about PLCs. In addition to the PLC's programming languages and hardware configurations, its typical applications in the manufacturing industry are also introduced. A hand-on design project is designed for the students to understand the typical PLC implementation process in industry.

4. Learning Approach

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Approach        : Combination of Expository - inquiry and colaborative
Method          : Discussion, Lab- work
Student Task    : Writing PLC Program and simulation, Laboratory work, presentation
Media           : Workshop, laboratory, LCD projector, film.
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5. Evaluation

a) Absence maximum   < 25%
b) Participation in discussion   :   5 points
c) Project result and Report   :   45 Points
d) Presentation, Simulation   :   10 points
e) Final Examination   :   40 points
           Total   : 100 points

6. Contents/ Topics of Lecturing:

Week	Content/ Topics of Lecturing	Text Book Chapter	Remark
1	**Introduction to Hardwire control and PLCs** • Principle of Operation • PLCs versus Other Type of Controls • Typical Areas of PLC Applications • The Benefits of Using PLCs		
2	**Hardwire Control** • Hardwire control using relays and contactors • DC Motor control, CW-, and CCW-Direction control • Three phase AC Motor CW-, and CCW-Direction control • Star (Y) / Delta (Δ) control using contactor • Electro-pneumatics control		
3	**Review of Number System and Digital Logic Concepts** • Number System and Number Conversion • Principles of Boolean Algebra and Logic • PLC Circuits and Logic Contact Symbology		
4	**Hardware Components of PLC and Siemens Totally Integrated Automation (TIA) Software:** • Processors, The Power Supply, and Programming Devices • Memory Systems and I/O Interaction • Digital I/O Systems • Analog I/O Systems • Special Function I/O, Networking, and Serial Communication Interfacing • Siemens TIA Portal V13 – Software start-up.		
5	**Implementing and Programming the PLC System (1)** • Simatic S7-Hardware Configuration • Types of PLC Instructions • Ladder Diagram (LAD), Function Block Diagram (FBD), and Statement List (STL) with Simatic Step-7 • Bit Logic Instruction • Simulating with S7-PLCSim		
6	**Implementing and Programming the PLC System (2)** • Timers and counters instruction		

	• Comparison instructions • Data Type conversion instructions		
7	**Implementing and Programming the PLC System (3)** • Working with Analog I/O • Organization Block (OB), Function (FC), Function Block (FB) , and Data Block (DB) • Structured Programming • Linear Programming vs. Structured Programming		
8	**MIDTERM SEMESTER BREAK**		
9	**Statement List (STL) Programming, Logic and Mathematics Instruction** • Bit Logic-, Timer-, Counter-, Conversion-, and Comparison-instruction using STL. • Mathematics Instruction, Floating Point Number		
10-11	**Case Study: Example Industrial Automation** • Three phase Motor Control : CW-/CCW-direction control • Three phase Motor Control : Y/Δ–control • Controlling single one pneumatic cylinder, and two pneumatic cylinders • Traffic Light • Elevator / Lift • An electrical drive is controlled with frequency converter • PLC is connected through I/Os with the frequency converter		
12	**Data Communication and Industrial Fieldbus** • Profibus DP and Profibus PA • ProfiNet – Bus • Distributed I/O • Applications: Some I/Os are detached from main PLC and placed somewhere else (near to controllable equipment)		

13	**Operator Panel and WinCC**
	• Operator panel is used to control automated application with
	    – START application
	    – STOP application
	    – Parameter changes
	    – Fault message presentation, …		

14	**Applications of PLC in Industrial Automation** • Remote Monitoring, Data Acquisition, and Control of a Substation • Power Plant Monitoring and Control • Applications on the Process Control		
15	**Wrap-up the whole semester, Review, and discussion**		
16	**FINAL EXAMINATION**		

7. Book Reference:

Textbooks:

• Siemens electronic Manual Books:

    a. S7-PLCSIM - Interface of S7ProSim – Manual

- "Industrial Process Automation Systems: Design and Implementation", **Author**: B. R. Mehta and Y. J. Reddy, **Publisher**: Elsevier Inc, 2015, **ISBN**: 978-0-12-800939-0

- "Fieldbus and Networking in Process Automation", **Author**: Sunit Kumar Sen, **Publisher**: CRC Press - Taylor & Francis Group, 2014, **ISBN**: 978-1-4665-8677-2

- "Automating with Simatic, revised 2Ed", **Author**: Hans Berger, **Publisher**: Siemens AG Germany, 2003, **ISBN**: 3-89578-223-8

[Subject to Change / MaS /Rev.01]