Course Specifications

Program on which this course is given:	**Diploma of Applications of Automatic Control of Mech. Power Systems**
Department offering the program:	**Mechanical Power Engineering Department - ACC control Lab**
Department offering the course:	**Mechanical Power Engineering Department - ACC control Lab**
Academic Level:	**Mandatory Course–2nd Term of the Diploma of Graduate Studies**
Date	**2nd Term 2016/2017**
Semester (based on final exam timing)	☐ Fall √ Spring √ Summer (for 2nd Registration only)

A- Basic Information

1. Title:	**Using PLC and IT in Automatic Control Systems**						**Code:**	**MEP 564**
2. Units/Credit hrs per week:	**Lectures**	**3 Credit hours per week**	**Tutorial**	**--**	**Practical**	**--**	**Total**	**3**

B- Professional Information

1. Course description:

Overall Aims:

This is one of the 6 mandatory core courses of the Diploma. It is designed to help students understand, effectively, basics of process control and applications of industrial PLC systems. It provides students skills and knowledge to all components of PLCs. The objective is to prepare students to implement a PLC system from beginning to end, including planning and design of hardware and soft-ware. This course covers basics of PLCs & related devices/modules used in PLCs. The lectures along with distributed notes, sheets & reports provide professional tool for studying and analyzing various aspects related to using industrial applications of PLC for automatic control of various types of mechanical power systems. Course detailed aims are to:

- **Show differences between continuous control systems or conventional DCS and contemporary discrete/digital control systems which are computer-based programmable controllers (PLCs).**
- **Address the basics and essentials of discrete control systems using common control systems.**
- **Identify major components of industrial PLC systems and describe their control functions.**
- **Identify types of discrete/analog inputs/outputs and describe operation of timers & counters.**
- **Read, understand & write types of basic ladder logic, statement list & Function Block diagrams.**
- **Identify operational and technical differences between various types PLC devices and models.**
- **Identify proper tech. manual to refer to for PLC installation, programming & implementation.**
- **Learn how to select & connect to the PLC all types of simple discrete inputs/outputs, proper expansion module and various types of analog inputs/outputs.**

2. Intended Learning Outcomes of Course (ILOs):

a) Knowledge and Understanding:

Having successfully completed this course, the post-graduate student should have knowledge and understanding of:

- Basics of process sequential control and practical applications of industrial PLC Systems.
-Major functions & various components & expansion modules of different types of PLC systems.
-Types of PLC discrete or analog inputs/outputs signals and operation of PLC timers & counters.
- Structure of PLC languishes for the Ladder logic, statement list, and function block diagrams.
-Basics of programming, running, simulation, diagnostics & trouble-shooting of various PLCs.

b) Intellectual Skills:

Having successfully completed this course, the student should have the ability to do:

-Select and apply appropriate technical and optimum method in doing engineering design and analysis of automatic control problems.
-Searching for scientific/technical information and adopting PLC automatic control capabilities.
-Analyze & compare various PLC components, performance & tech. specifications of different PLCs
-Apply the concept of Ladder logic simulation, PLC diagnostics and the operation of PLC system.
-Compare between practical measurement devices, transducers & methods for signal conditioning, data acquisition and different output displaying/processing systems of PLC systems.

	- Solve practical examples on using PLC systems for automatic control problems. **-Study,describe & compare between different PLC types, models and programming languishes.**
	c) Professional and Practical Skills: **Having successfully completed this course, the student should have the ability to do:** **-Identify various types of field devices (sensors, actuators and final control elements) which are essential for the operation of PLC automatic control systems.** **-Suggest possible alternative sensors, actuators & final control elements for PLC systems.** **-Diagnose all possible operation modes, configuration and diagnostics of PLC systems.** **- Design, select, applyand implement various examples of PLC automatic control systems.** **- Diagnose failure and automatic control problems of industrial PLC automatic control systems.** **- Monitor&evaluate performanceofdifferent parts & components of PLC control systems.** **- Formulate & analyze heat transfer, energy and flow problems related to PLC control systems.**
	d) General and Transferable Skills: **Having successfully completed this course, the student should have the ability to do:** **-Transfer knowledge, Work in group, and Communicate in written & oral forms, in English.** **- Use IT& evolutionary technological tools & PC applications (Excel, Mat lab, Virtual labs, .etc).** **- Prepare&write reports,Manipulate&sort data, Think logically, and continuous self-E-learning.** **- Identify practical problems, compare between different technologies for PLC control systems.** **-Organise & manage time & resources effectively; for short-term and longer-term commitments.**

3. Contents

Topics:	Total hrs	Lectures hours	Tutorial/ Practical hrs
Introduction- Define a PLC system- Differences between continuous control systems or conventional DCS and the contemporary discrete/digital control systems which are computer-based Programmable Logic controllers (PLCs). Types of PLCs- Identifying major and expansion components, functions and applications of industrial PLC system. Basics of electric components in PLC circuits(Sensors,transducers,keys, Relays, Contactors)- Basics and essentials of discrete control systems using common control systems. Types of Analog and Digital Signals-Pneumatic Logical Elements- Types of Memories: ROM, RAM, EPROM and EEPROM -Identify types and describe operation modes of timers & counters. PLC Programming-Read, understand and write types of basic ladder logic, statement list & Function Block diagrams. Identify operational and technical differences between various types PLC devices & models. Identify proper technical manual to refer to for PLC installation, programming & implementation. Expanding of PLCs-Selection &connection for proper expansion modules & various types of PLC analog inputs/outputs.	**42 hrs**	**3hrs/week for 14 weeks before the final term exam**	**---**

4. Teaching and Learning Methods

Lectures (√)	Practical/ Training ( )	Seminar/ Workshop (√)	Class Activity (√)	Case Study (√)	Projects ( )	Laboratory ( )	E-learning (√)	Assignments /Homework (√)	Other: Submitting reports

5. Student Assessment Methods

Assessment Schedule	Week
-Assessment 1; Sheet # 1	**Week # 2**
-Assessment 2; Sheet # 2	**Week # 4**
-Assessment 3; Sheet # 3	**Week # 6**
-Assessment 4; Sheet # 4	**Week # 8**
-Assessment 5; Sheet # 5	**Week # 10**

-Assessment 6; Sheet # 6	Week # 12
-Assessment 7; Sheet # 7	Week # 13
-Assessment 8; Report # 8– General course Report	Week # 14

- **Weighting of Assessments**

-All in-term works, sheets and reports	30%
-Final-term formal, written Examination	70%
-Project	--
-Class Test	--
-Presentation	--
-Total	100%

6. List of References:

1- Several Class Notes and Special Reports, sheets prepared by Associate Professor Dr. Mohsen S. Soliman.
2- Digital Book: "Automating Manufacturing Systems with PLCs", Version 4.2, April, 2003, copyright(c) 1993-2003, Hugh Jack (jackh@gvsu.edu).

7. Facilities Required for Teaching and Learning: Data Show & Laptop Computer to run the Virtual Lab.

Course Coordinator:	Associate Professor Dr. Mohsen S. Soliman
Head of Department:	Professor Sayed Ahmed Kaseb

Date January 2017