Cairo University
Faculty of Engineering
Mech. Power Department

CAIRO UNIVERSITY
FACULTY OF ENGINEERING

ACC
VirtualLabs
Automatic Calculations & Virtual Labs
for Mechanical Power System

دبلوم تطبيقات التحكم الأوتوماتيكى فى نظم القوى الميكانيكية

إستخدام الحاكم المنطقى المبرمج وتكنولوجياالمعلومات فى نظم التحكم PLC Systems & IT Applications MEP 564

Dr. Mohsen Soliman, ACC Manager
Mechanical Power Engineering Department

مكق 564 إستخدام PLC وتكنولوجيا المعلومات فى نظم التحكم الأوتوماتيكى:

يهدف المقررإلى التعرف على كافةتفاصيل ووظائف وتطبيقات أجهزة PLC-Programmable Logic Controller الحاكم المنطقى القابل للبرمجة: مقدمة ضرورية حول المكونات الكهربية الأساسية التى تدخل فى دوائر التحكم الأوتوماتيكى الإلكترونى (المجسات والحساسات، المفاتيح والمرحلات والكونتكتورز)- وظائف وأنواع أجهزة PLC فى نظم التحكم الأوتوماتيكى فى العمليات process control- الأجزاءالرئيسية والهيكل البنائى لوحدات PLC- أنواع الإشارات (التناظرية-الرقمية-الثنائية)-العناصرالنيوماتية المنطقية- أنواع الذاكرات ...ROM, RAM,EPROM, EEPROM- طرق برمجة أجهزة PLC – المخطط السلمى أو الدرجى – Ladder Diagramمخطط الوظيفة Function Chart– قائمة الأوامر Statement List– طرق تخصيص الأطراف للمدخلات والمخرجات- برمجة المؤقتتات والعدادات – وسائل توسيع وزيادة وظائف ومدخلات ومخرجات أجهزة PLC

MEP 564 - Using PLC and IT in Automatic Control Systems:

Contents: **What is a PLC- Identifying Details, functions, Applications of PLC Units- Introduction for Basic Electric Components in Automatic Control Circuits (Sensors, transducers, keys, Relays, Contactors)-Types of PLCs- Types of Analog and Digital Signals-Pneumatic Logical Elements- Types of Memories: ROM, RAM,EPROM, EEPROM…- PLC Programming - Ladder Diagram- Function Chart- Statement List- Setting Inputs and Outputs- Timers and Counters Programming- Expanding of PLCs.**
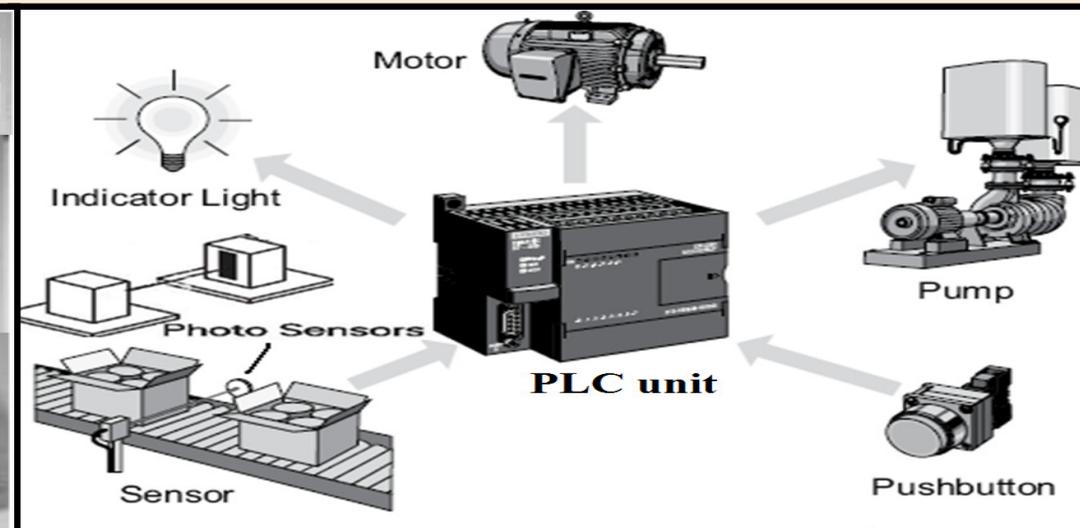
The course is designed to help students understand, effectively Basics of Process Control & Applications of industrial PLC Systems. This course covers Basics of PLCs and many related devices used in PLC systems. **The course should give the participants skills & knowledge to Basic Components of PLC circuits & PLC systems.** Upon completion of the course you should be able to:
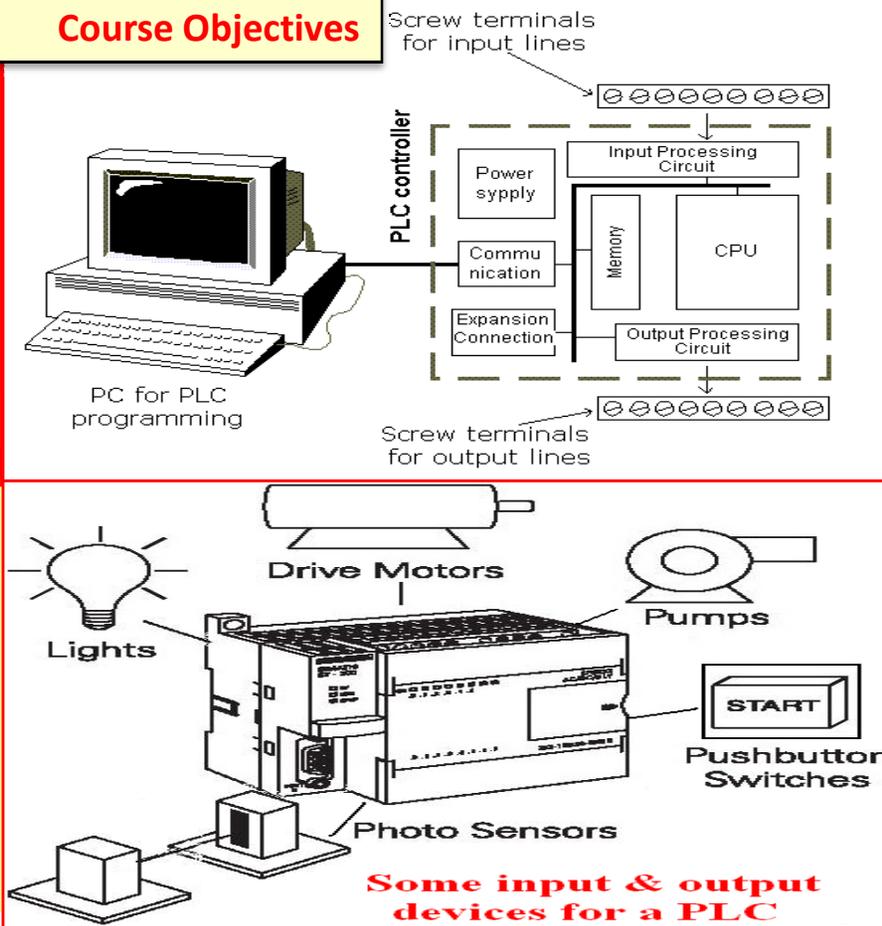
PC for PLC programming

- Identify major components of PLC& describe its functions
- Convert numbers from decimal to binary, BCD & hexadecimal
- Identify typical discrete & analog inputs and outputs
- Read a basic ladder logic diagram and statement list
- Identify operational differences bet. PLC devices & models
- Identify the proper manual to refer to for PLC programming
- Identify the proper manual for installation of a PLC device
- Learn how to connect simple discrete input/output to PLCs
- Select proper expansion module for analog inputs/outputs
- Describe the operation of timers and counters

Some input & output devices for a PLC

Purpose

- Most education focuses on continuous control systems & DCS systems
- In practice most contemporary control systems make use of computers.
- Computer based control is inherently different than continuous systems.
- The purpose of this course is to address discrete control systems using common control systems.
- The objective is to prepare the reader to implement a control system from beginning to end, including planning and design of hardware & soft-ware.

الجدارة: معرفة المكونات الأساسية للوحدات المنطقية ، فوائدها ، وتاريخ تطويرها ، تطبيقاتها .

الأهداف: بعد الانتهاء من هذه الوحدة يكون المتدرب قادرا على:

– أن يصف البدايات والتطور التاريخي لنظم الوحدات المنطقية المبرمجة

– تسمية بعض مجالات استخدامها

– شرح الفرق بين التحكم بالأسلاك والعناصر المادية والتحكم بالبرمجيات والذاكرة

– شرح مصطلحي المكونات المادية و البرمجيات

– شرح الهيكل الإنشائي ونظام التشغل للوحدة المنطقية المبرمجة

– وصف أجزاء الوحدة المنطقية المبرمجة المختلفة

Course Specifications & Basic Information			
1. Title:	**Using PLC Systems and IT in Automatic Control Applications**		**Code:MEP564**
2.Credit hrs per week	**Lectures= 3 hours per week**	**Tutorial= 0.0**	**Practical= 0.0**	**Total=3 Cr.Hrs**

B- Professional Information

1. Course description: Overall Aims:

This is one of 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 PLC components. The objective is to prepare students to implement a PLC system from beginning to end, including planning & design of hardware and soft-ware. This course covers basics of PLCs & related devices/modules used in PLCs. The lectures, the distributed notes, sheets& reports provide professional tool for studying & 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.

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.

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, apply and implement various examples of PLC automatic control systems.

- Diagnose failure and automatic control problems of industrial PLC automatic control systems.

- Monitor & evaluate performance of different parts & components of PLC control systems.

d) General and Transferable Skills:

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

-Perform engineering calculations, draw feed-back control circuits, block diagrams, graphical presentation of experimental data, and perform data-regression analysis.

-Transfer knowledge, Work in group, & 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 measurement systems.

-Organise & manage time & resources effectively; for short-term and longer-term commitments.