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:	**Elective Course- 1st or 2nd Term of the Diploma of Graduate Studies**
Date	**January 2017**
Semester (based on final exam timing) (there is no Course Report for MEP 565)	☐ Fall ☐ Spring ☐Summer

A- Basic Information

1. Title:	**Using Pneumatic Circuits in Automatic Control Systems**						**Code:**	**MEP 565**	
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 an elective course as one of the 4 elective courses requirements of the Diploma. This course is designed to give the students more skills & additional knowledge relevant to Using Pneumatic circuits in automatic control systems used in several practical and industrial mechanical power engineering applications. This is done through using various types of examples and virtual labs applications. Course aims are to introduce & define Pneumatics, elements of a basic compressed air Pneumatic System, Pneumatic circuits, Using Pneumatics for logic systems and various types of Pneumatic applications in mechanical power systems. A practical, on-line interactive virtual lab is also used as part of the examples of this course.

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:

-Basic physics laws and fluid mechanics concepts as they apply to Pneumatic power and to solution of automatic control problems using Pneumatic systems.

-Thermo-fluid characteristics of standard Air and various types of gas conducting methods and the proper materials used for each one.

-Basics and essential Components of Industrial and practical Pneumatic Control Systems.

- Analogy & Difference between essential components, operation & functions of Pneumatic circuits.

-Basics of Pneumatic logic circuits and Pneumatic control processes and using of an advance and applied virtual labs to study & analyze the performance of various pneumatic control circuits.

-Principles of Pneumatic System design, types of air-pumps, pneumatic actuators, various control valves and accessory components in a typical pneumatic system and process control design.

-Understand reading pneumatic schematics & identify system components & design function as well.

-Understand & apply knowledge of Maintenance & Troubleshooting of Pneumatic Control Systems.

Understand current engineering technologies related to Pneumatic Automatic Control Systems.

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 Pneumatic automatic control problems.

-Searching for scientific information and adopting automatic control self-E-learning capabilities.

-Analyze and compare the component effects, performance, and efficiency of different types of Pneumatic on-off automatic control systems.

-Apply the concept of software simulation for analysis, diagnostics & operation of various types of Hydraulic and Pneumatic systems.

	-Compare between various types of Pneumatic components, and complete systems. -Apply scientific and engineering analysis for Pneumatic circuits/systems. -Identify, select, describe & draw the main various components in typical Pneumatic schematics and to recognize and comprehend how these components function and interact with each other. -Follow and participate in a comprehensive interactive &computer-based virtual & multi-media training labs which include system animations, 3-D models and on-line multiple choices quizzes. -Identify, formulate and solve main basic automatic control problems using Pneumatic power. -Design Pneumatic circuit components & schematics to meet required needs within realistic constraints. -Select appropriate components for modeling and analyzing typical Pneumatic Control problems. -Select appropriate solutions for various MCQ problems based on analytical thinking. -Assess and evaluate characteristics & performance of Air-pumps, pneumatic actuators, various control valves & accessory components in a typical pneumatic system & process control design. -Use virt.lab tools & software packages pertaining to pneumatic systems & process control design.
	c) Professional and Practical Skills: Having successfully completed this course, the student should have the ability to do: -Identify several types of on-off Pneumatics automatic control problems which are essential for the design and operation of mechanical power systems and energy transfer processes. -Perform professional design and modelling for different Pneumatics automatic control systems. -Suggest possible alternative solutions for various types of Pneumatics components. -Diagnose efficiency and performance of different types of Pneumatics control circuits/systems. - Analyze different types of Pneumatic processes on virtual labs. - Integrate knowledge of basic physics laws, fluid mechanics concepts, information technology, design, and engineering practice to solve engineering problems of Pneumatic Control Systems. -Employ drawing & professional skills to design & analyse schematics of pneumatic systems & process control circuits. -Use a wide range of computer applications, technical tools, and techniques including pertinent virtual labs software. -Implement comprehensive knowledge, understanding, and intellectual skills in solving on-line virtual training labs, exercises, and MCQ problems. -Prepare & present technical reports and schematics of pneumatic circuits and control systems.
	d) General and Transferable Skills: Having successfully completed this course, the student should have the ability to do: -Perform eng. assembly of different Pneumatic components in one control system. -Transfer knowledge, Work in group and Communicate in written and 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 Pneumatic automatic control systems. -Organise & manage time & resources effectively; for short-term and longer-term commitments. -Collaborate and Communicate effectively within a lab group/team. - Work in stressful class and lab environment and within time constraints. - Demonstrate efficient IT capabilities. - Manage tasks and lab resources efficiently. - Search for information and adopt self learning. - Refer to relevant literature effectively
3. Contents	

Topics:	Total hrs	Lectures hours	Tutorial/ Practical hrs
Design and Analysis of Automatic Systems (Objective/Method)- Advantages and Disadvantages of Pneumatic Systems- Methods of Preparation of Compressed Air-Calculations of air piping system using operation Parameters (length, Pressure, flow rate, Pressure-drop)- Air Pressure Ratings-Types of Actuators (Cylinders, Engines, Semi-rotating Engines)- Direct Control of Single and Double Acting Cylinder- Pressure Control Valves – Directional Control Valves – Flow Control Valves- Non-return Valves –Auxiliaries (Accumulators, Manifolds, Flow Meters, Pressure Gauges & Switches)- Symbols –Reading & Analysis of Pneumatic Circuits Schematics.-Analogy & Difference bet. components, operation, and functions of Hydraulic and Pneumatic circuits – Examine Basics of Pneumatic logic circuits and processes and using of virtual labs for analysis of pneumatic control circuits -	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; Report # A	Week # 1
-Assessment 2; Report # B	Week # 2
-Assessment 3; Report # C	Week # 4
-Assessment 4; Report # 1	Week # 6
-Assessment 5; Report # 2	Week # 8
-Assessment 6; Report # 3	Week # 10
-Assessment 7; Report # 4	Week # 12
-Assessment 8; Report # 5	Week # 13
-Assessment 9; – 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, presentations & Special Reports prepared by Assoc. Professor Dr. Mohsen S. Soliman.
2-Virtual Lab program by "NEW-TRONIC S.r.l.–Via Thures", 36– 10142 TORINO (ITALY)- Tel.: 0039-4.68 – Fax: 411.09.39

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