



دبلوم تطبيقات التحكم الأوتوماتيكي في نظم القوى الميكانيكية

MEP 565 Using Pneumatic Circuits in Automatic Control Systems

Dr. Mohsen Soliman, ACC Manager
Mechanical Power Engineering Department

اسم المقرر - **مق 565 استخدام الدوائر النيووماتية في نظم التحكم الأوتوماتيكي:**

المحتوى والأهداف: طرق تصميم وتحليل النظم الأوتوماتيكية-تحديد مزايا النظم النيووماتية وعيوبها- وصف طرق تحضير الهواء المضغوط- وصف كيفية حساب قطر المواسير بمعلومية طول المواسير ومعدل التدفق والضغط وأقصى تفاوت في قيمة الضغط وأنواع توصيلات الضغوط الهوائية- تحديد عناصر التشغيل (الأسطوانات، المحركات، المحركات نصف الدورانية)- طرق التحكم المباشر في الأسطوانات النيووماتية مفردة ومزدوجة الفعل- وصف عناصر التحكم في الطاقة النيووماتية (صمامات التحكم في الضغط، صمامات التحكم الإتجاهية، صمامات التحكم في السريان وتنظيم التدفق، الصمامات اللارجعية)- خطوط نقل الهواء في الدوائر النيووماتية- المكونات الإضافية (المركم، نقط تجميع التوصيلات، أجهزة قياس التدفق، عدادات قياس الضغط، مفاتيح فصل الضغط)- تحديد الرموز القياسية لمكونات الدوائر النيووماتية- طرق قراءة وفهم وتحليل الدوائر النيووماتية المركبة.

MEP 565 - Using Pneumatic Circuits in Automatic Control Systems:

Contents: 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.

Course Objectives to give participants skills & knowledge to:

1- Basic Components of Pneumatic Circuits and Pneumatic systems.

2- Air properties, and air preparation parts

3- Examination of Air Pumps&Types of compressors

4- Types of Pneumatic Actuators (Motors&Cylinders)

5-Understand basic types of various control valves (pressure control, direction control, flow control). This include functions, materials, sizes, geometry considerations and essential flow characteristics .

6- Examine various types of Pneumatic Accessories.

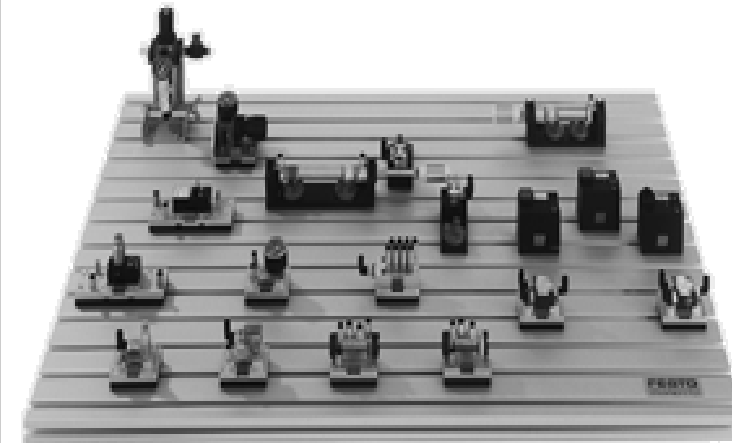
7-Applications of Reading Pneumatic Schematics.

8- Practical Training for Basic System Design.

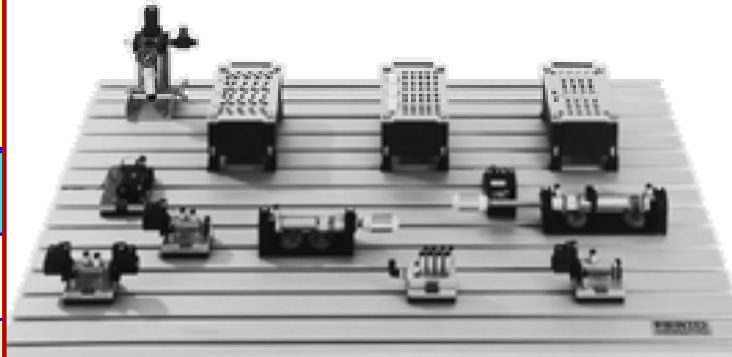
9- Examination of Maintenance and Troubleshooting

Important Note: Each lecture will be followed by a very comprehensive interactive and computer based virtual and multi-media training lab. Each lab will include also animations, 3-D models and on-line quizzes

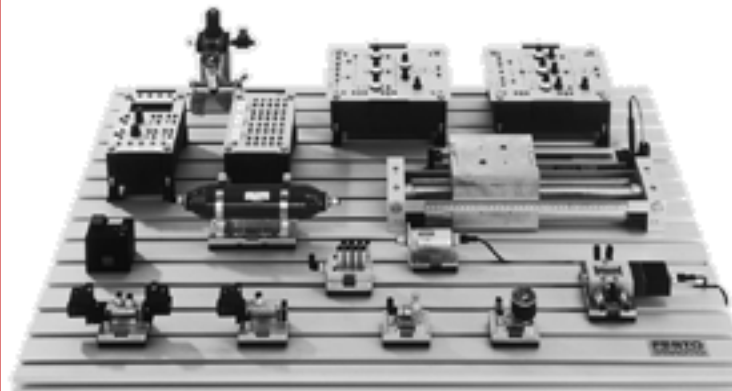
Pneumatics Equipment Set



Electropneumatics Equipment Set

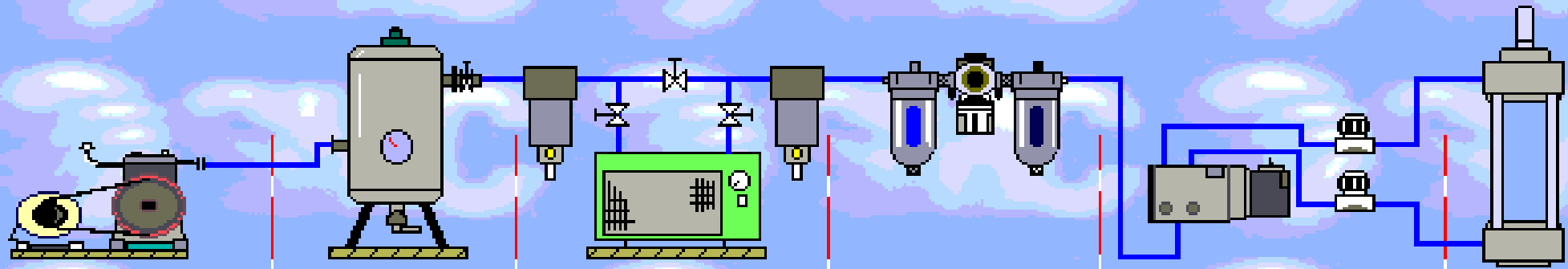


Control Pneumatics Equipment Set



What is Pneumatics? is branch of science concerned with using compressed inert gas (air or N_2) to perform mech. work. Pneumatic systems are extensively used in industry, where factories are commonly plumbed with compressed air which is very cheap fluid. This is because a centrally-located and electrically-powered compressor that powers cylinders and other pneumatic actuators through directional solenoid valves is able to provide motive power in cheaper, safer, more flexible & more reliable way than large number of electric motors & actuators. Pneumatics also has applications in dentistry, construction & mining areas .

Pneumatic System



Compressed air generating section

Air storage section

Air cleaning section

Air conditioning section

Controlling section

Operating section

Compressor

Air tank

Main line filter

Filter

Directional control valve

Actuator

Air dryer

Regulator

Speed controller

Mist-separator

Lubricator

Course Specifications & Basic Information

1. Title:	Using Pneumatic Circuits in Automatic Control Systems			Code:MEP565
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 an elective courses designed to help students understand, effectively, basics of Pneumatic Circuits in control systems. It provides students skills and knowledge to all Pneumatic circuit components. The objective is to prepare students to implement them from the beginning to the end, including planning and design of hardware and soft-ware. Course detailed aims are to give participants skills and knowledge to Basic Components of Pneumatic Circuits and Pneumatic systems: Air properties and air preparation parts; Examination of Air Pumps & Types of compressors; Types of Pneumatic Actuators (Motors & Cylinders); Understand basic types of various control valves (pressure control, direction control, flow control). This include functions, materials, sizes, geometry considerations and essential flow characteristics; Examine various types of Pneumatic Accessories; Applications of Reading Pneumatic Schematics; Practical Training for Basic System Design; Examination of Maintenance and Troubleshooting. Important Note: Each lecture will be followed by a very comprehensive interactive and computer based virtual and multi-media training lab. Each lab will include also animations, 3-D models and on-line quizzes

2. Intended Learning Outcomes of Course (ILOs):

a) Knowledge and Understanding:

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

- Understand and apply knowledge of basic physics laws and fluid mechanics concepts as they apply to Pneumatic power and to solution of automatic control problems using Pneumatic systems.
- Understand and apply knowledge of thermo-fluid characteristics of standard Air and various types of gas conducting methods and the proper materials used for each one.
- Understand and apply knowledge of Principles of Pneumatic System design including 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 and identify system components & design function as well.
- Understand and 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:

- a) Identify, select, describe, and draw the main various components in typical Pneumatic schematics and to recognize and comprehend how these components function and interact with each other.
- b) Follow and participate in a comprehensive interactive & computer-based virtual and multi-media training labs which include system animations, 3-D models and on-line multiple choices quizzes.
- c) Identify, formulate and solve main basic automatic control problems using Pneumatic power.
- d) Design Pneumatic circuit, component & schematics to meet required needs within realistic constraints.
- e) Select appropriate components for modeling and analyzing typical Pneumatic Control problems.
- f) Select appropriate solutions for various multiple choices quiz problems based on analytical thinking.
- g) Assess and evaluate the characteristics and performance of Air-pumps, pneumatic actuators, various control valves and accessory components in a typical pneumatic system and process control design.
- h) Use virtual 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:

- a) Integrate knowledge of basic physics laws, fluid mechanics concepts, information technology, design, and engineering practice to solve engineering problems of Pneumatic Control Systems.
- b) Employ drawing & professional skills to design & analyse schematics of pneumatic systems & control circuits.
- c) Use a wide range of computer applications, technical tools & techniques including pertinent virtual labs software.
- d) Implement comprehensive knowledge, understanding, and intellectual skills in solving on-line virtual training labs, exercises, and MCQ problems.
- e) Prepare and 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 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.