Cairo University
Faculty of Engineering
Mech. Power Department

دبلوم تطبيقات التحكم الأوتوماتيكى فى نظم القوى الميكانيكية

MEP 568 Advanced Applications of Pneumatic Circuits in Automatic Control Systems

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إسم المقرر- مكق 568 تطبيقات متقدمة للدوائرالنيوماتية فى نظم التحكم الأوتوماتيكى:

المحتوى والأهداف: يتضمن المقرر تطبيقات متقدمة على الحاسب الآلى لدراسة الدوائرالنيوماتية الصناعية تتضمن معامل إفتراضية ونماذج محاكاة تفاعلية لعدة دوائرنيوماتيكية مختلفة ويتضمن كذلك مراجعة شاملة لأكبرعدد من المكونات والأجهزة والمعدات الفعلية المستخدمة فى نظم التحكم النيوماتيكى المتنوعة. يهدف المقررإلى توضيح الأشكال والطرق التطبيقية والمخرجات المتوقعة من عدد أربعة دراسات حالة لمعامل إفتراضية ونماذج محاكاة تفاعلية لعدة دوائرنيوماتيكية صناعية تستخدم فى المجالات الصناعية والنظم الميكانيكية المختلفة. وتسمى هذه الدوائر((Q cycle, L cycle, U cycle, & the 3-cylinders cycle وتعمل جميعها بنظم cascade & mechanical stroke end techniquesويتم دراسة تفاصيل ومكونات كل دائرة وطريقة تشغيلها والمخرجات التى تقوم بها .يهدف المقررإلى تدريب الطلاب على ممارسة ما يتم من تطبيق القوانين المختلفة والحسابات المعقدة فى عمليات التحكم الفعلية للدوائر النيوماتية للوصول للنتائج المنتظرة من عملية التحكم. كما يهدف المقرركذلك إلى التأكد من مصداقية هذه البرامج وعمل معايرة علمية لمخرجاتها من خلال التحقق من القوانين والحسابات الداخلية التى تتم فى هذه البرامج وإجراء عمليات مقارنة بينها وبين الحسابات التقليدية الموازية للوصول لنفس المخرجات والنتائج العملية .

MEP 568 - Advanced Applications of Pneumatic Circuits in Automatic Control Systems:

Contents: Advanced Applications on PC for Industrial Pneumatic Circuits including Virtual Labs and Interactive Simulations for Different Circuits (Q cycle, L cycle, U cycle, & the 3-cylinders cycle).These pneumatic automation cycles, are largely used in the industry (e.g., for automatic feeding of work pieces). The 4-circuits layouts are carried out with cascade & mechanical stroke end techniques. It is possible to run only single manually controlled sequence, to use every time you want to repeat cycle, or can run automatically until the deposit depletion (i.e., end of all 5-work pieces to be fed).The literal sequence has been divided in 2 or more groups, so that, the energy transmission, to the air distribution lines, is carried out by means of bi-stable 5/2 valves, driven by signals of impulsive kind (i.e., cam or mechanical actuation type). When the plant is started the air flow are visible and you can follow any selected cycle both on the pneumatic circuit and also be seen on the “stroke-pitch diagram” that characterizes the sequence. The button Exit closes the entire program and thus returns you to Windows.

Course Objectives: to use the 16-different pneumatic components(& more) those of Hydr-1 in four different practical Pneumatic control Circuits . This will give the participants the skills and the knowledge to:

1-Identifyall different components of practical circuits and identify their different design functions as well.

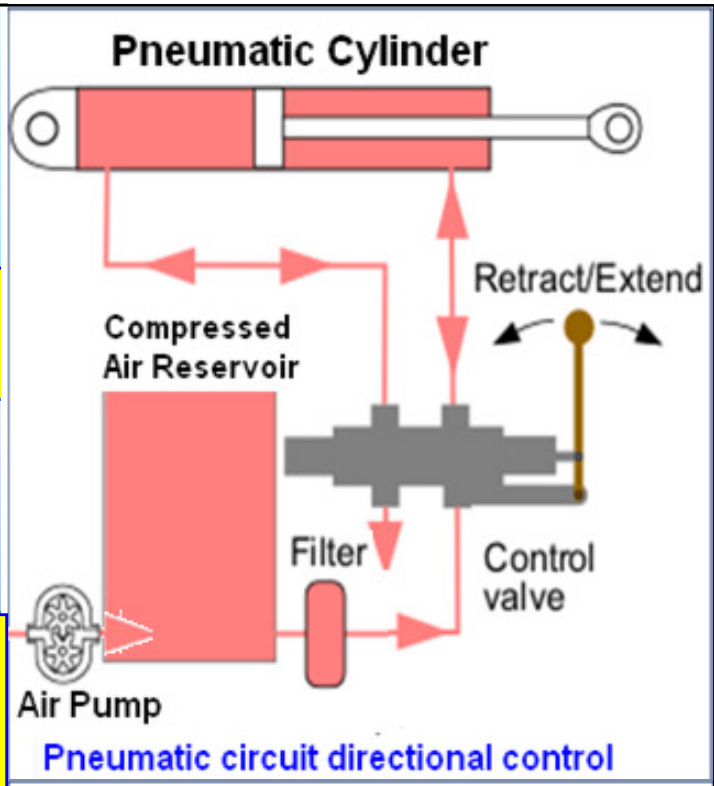
2-Throughcircuit examinationof performance and how to read and understand different practical pneumatic schematic drawings.

3- Understand and apply knowledge of Principles of Pneumatic System design including various types of actuators, directional and pressure control valves and accessory components in a typical pneumatic system and process control design.

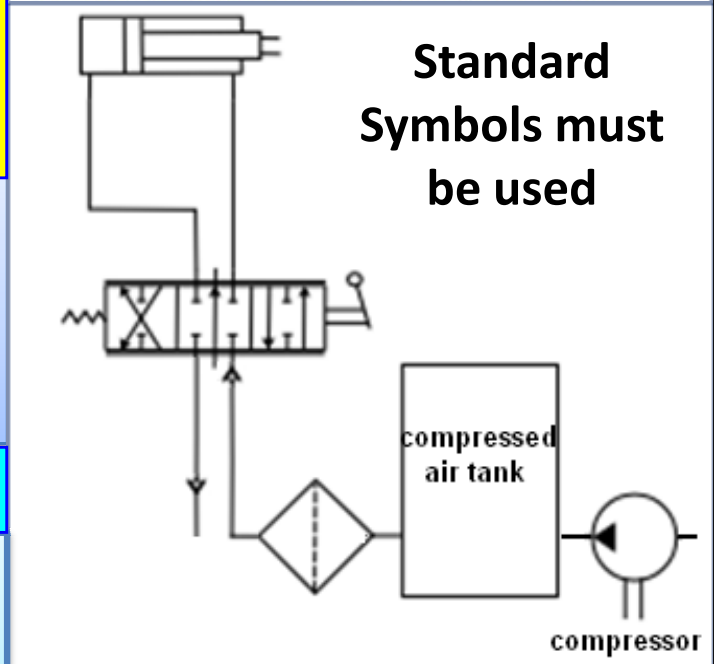
4- Follow and participate in a comprehensive interactive &computer-based virtual and multi-media training labs which include system animations, 3-D models and on-line multiple choices quizzes.

5- Examination of Maintenance and Troubleshooting

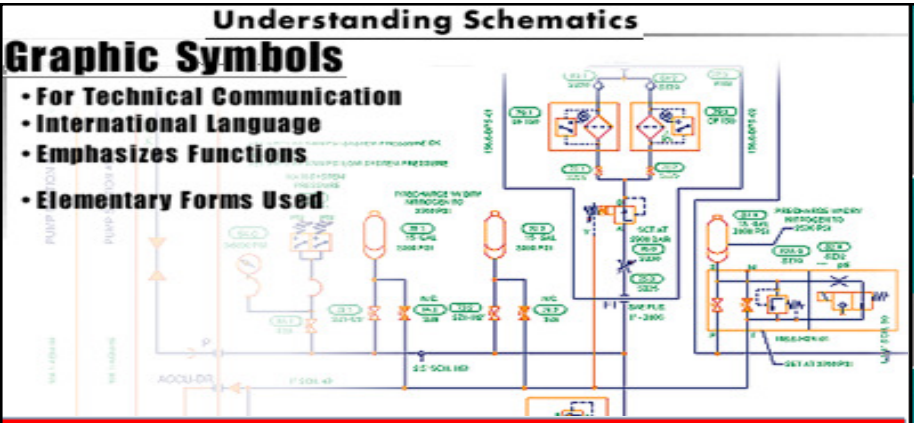
Note: Lecture will be followed by very comprehensive interactive and computer based virtual & multi-media training lab. Each lab will include also animations, 3-D models and on-line quizzes

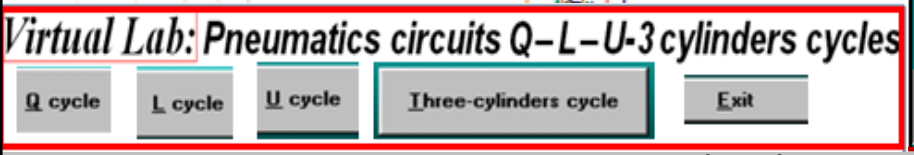


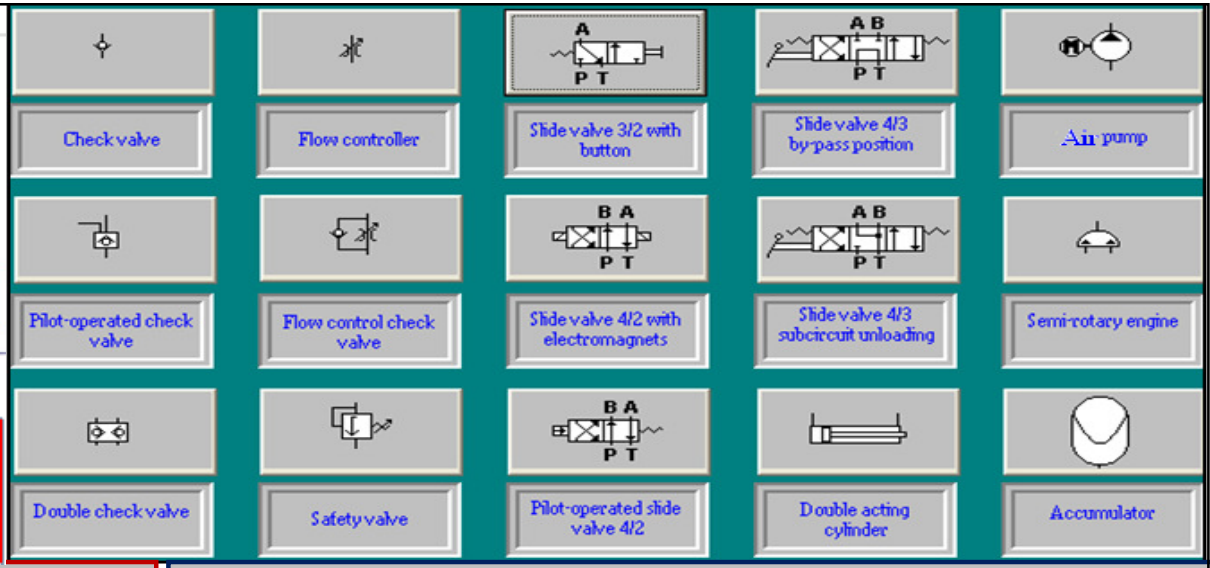
Pneumatic circuit directional control

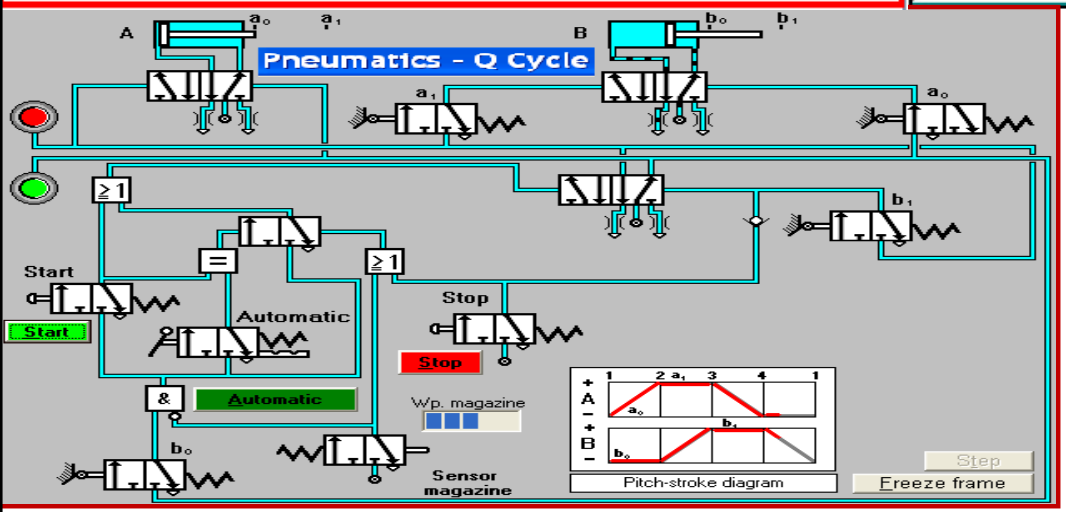


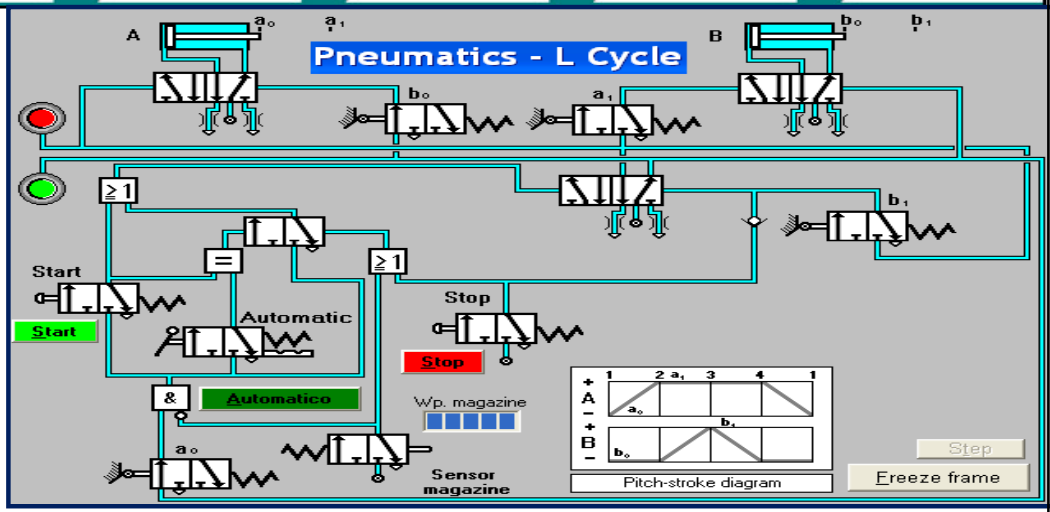
Pneumatic circuit schematic directional control

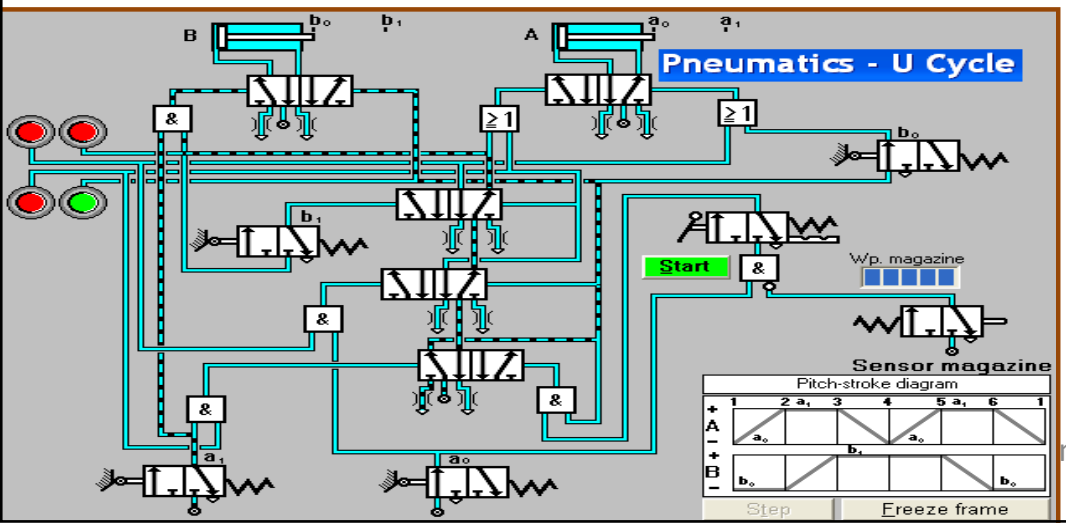

Understanding Schematics
Graphic Symbols
• For Technical Communication
• International Language
• Emphasizes Functions
• Elementary Forms Used

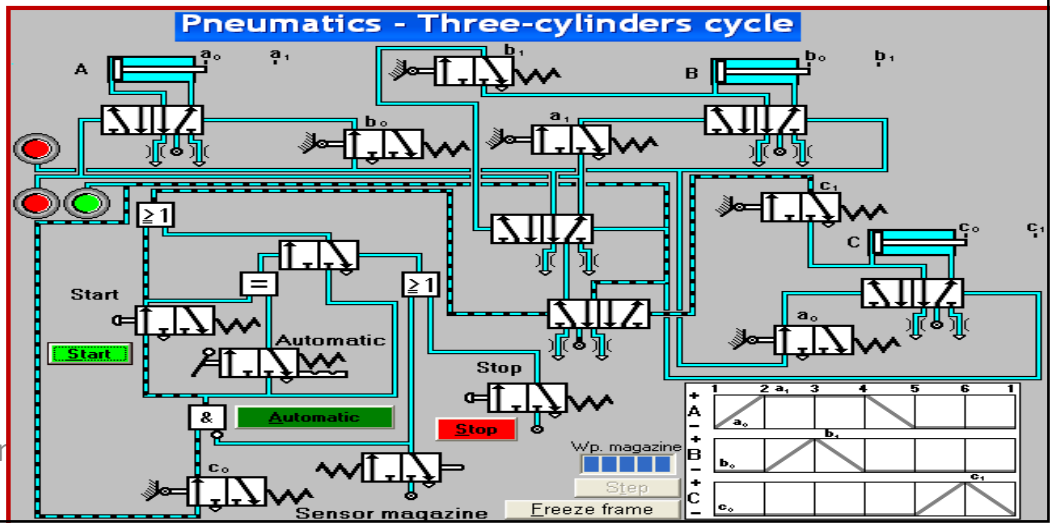

Virtual Lab: Pneumatics circuits Q–L–U-3 cylinders cycles
Q cycle
L cycle
U cycle
Three-cylinders cycle
Exit


Check valve
Flow controller
Slide valve 3/2 with button
Slide valve 4/3 by-pass position
Air pump
Pilot-operated check valve
Flow control check valve
Slide valve 4/2 with electromagnets
Slide valve 4/3 subcircuit unloading
Semi-rotary engine
Double check valve
Safety valve
Pilot-operated slide valve 4/2
Double acting cylinder
Accumulator


Pneumatics - Q Cycle
Start
Automatic
Stop
Wp. magazine
Sensor magazine
Pitch-stroke diagram
Step
Freeze frame


Pneumatics - L Cycle
Start
Automatic
Stop
Wp. magazine
Sensor magazine
Pitch-stroke diagram
Step
Freeze frame


Pneumatics - U Cycle
Start
Wp. magazine
Sensor magazine
Pitch-stroke diagram
Step
Freeze frame


Pneumatics - Three-cylinders cycle
Start
Automatic
Stop
Wp. magazine
Sensor magazine
Step
Freeze frame

Course Specifications & Basic Information

1. Title:	Advanced Applications of Pneumatic Circuits in Automatic Control Systems			Code:MEP568
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 and Overall Aims:

This is an elective course designed to help students understand, effectively, advanced applications of pneumatic circuits in automatic control systems. Course Objectives are to use the 16-different pneumatic components (and more) those of Hydr-1 in four different practical Pneumatic control Circuits . This will give the participants the skills and the knowledge to: Identify all different components of practical circuits and identify their different design functions as well; Through circuit examination of performance and how to read and understand different practical pneumatic schematic drawings; Understand and apply knowledge of Principles of Pneumatic System design including various types of actuators, directional and pressure control valves and accessory components in a typical pneumatic system and process control design; 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; Examination of Maintenance and Troubleshooting. Note: Lectures will be followed by very comprehensive interactive and computer based virtual & 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, post-graduate student should have knowledge &understanding of:

a)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 advanced types of Pneumatic systems.

b)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.

c)Understand and apply knowledge of Principles of advanced 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.

d)Understand reading advanced pneumatic schematics, identify system components &design function as well.

e)Understand &apply knowledge of Maintenance &Troubleshooting of advanced Pneumatic Control Systems.

f)Understand current engineering technologies related to advanced 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 advanced 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 advanced Pneumatic power.

d) Design advanced Pneumatic circuit, component & schematics to meet required needs within realistic constraints.

e) Select appropriate components for modeling and analyzing typical advanced 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 advanced pneumatic system and process control design.

h) Use virtual lab tools & software packages pertaining to advanced 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 advanced Pneumatic Control Systems.

b) Employ drawing and professional skills to design and analyse schematics of advanced pneumatic 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 advanced 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.