	Department of Mechanical Power Engineering	Cairo University Faculty of Engineering	

Course Specifications

Program(s) on which this course is given	Bachelor Degree of Mechanical Power Engineering
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic Level	Third Year
Date	2023-2024
Semester(based on final exam timing)	Spring √ Fall

A- Basic Information

1. Title:	Basics of Hydraulic and Pneumatic Systems				**Code:**	MEP 3001 (New 2018 Bylaws)			
2. Units/Credit hours per week:	Lectures	1	Tutorial	1	Practical	**1**	Total	3	

B- Professional Information

1. Course description:

Overview: This course is designed to study the basic concepts and essentials of Hydraulic and Pneumatic Systems or Circuits which are special practical applications of automatic control of mechanical power & energy systems. The course uses Virtual Lab method by a practical on-line interactive PC program. This control Virtual Lab is E-self-learning software. The software includes large number of examples for hydraulic parts & circuits, 3-D animations, E-learning labs, quizzes..etc. The Virtual Lab along with professional course notes & training sheets provide typical example for modern Blended, self-learning education technique. In this course, it is used for studying and analyzing various aspects related to applications of ON/OFF Hydraulic and Pneumatic Circuits in automatic control of mechanical power and energy systems.

Overall Aims of the Course: To introduce basic definitions of Hydrostatics (i.e., Pressure, work, transportation and magnification of force and moment). To study the Hydraulic Power Transportation through Basic Components of Hydraulic Systems. To investigate some Types of Positive Displacement Pumps (Gear, Vane, and piston pumps)-Types of Hydraulic Actuators (Cylinders, Engines, Semi-rotating Engines)- Pressure control Valves – Directional Control Valves- Flow Control Valves-Non-return Valves–Conditioning of Hydraulic Oils (filters, Heat Exchangers, Tanks)- Oil Piping – Auxiliaries (Accumulators, Manifolds, Flow Meters, Pressure Gauges, Switches). To define different Hydraulic Symbols for Reading Hydraulic Schematics. To examine some applications of Basic Hydraulic Circuits (Direction &Speed Control, cylinders Control, Pumps Curves, Step-displacement diagram, Numbering of Hydraulic Elements).

2. Learning Outcomes of Course (LOs):

1. Recognize different types and applications of practical automatic control systems and to Identify various types of Hydraulic and Pneumatic control circuits.
2. Comprehend and follow present developments of both Hardware and Software of IT & recent modern Computer Applications in practical automatic control systems.
3. Recognize various types and applications of Virtual Lab Techniques used to study automatic control systems.
4. Apply educational and practical training Virtual Lab to understand basics and essentials of Hydraulic and Pneumatic Systems.
5. Understand basic concepts, definitions, and symbols of Hydraulic and Pneumatic Systems.
6. Investigate various components, essential parts and main accessories of Hydraulic and Pneumatic Circuits.
7. Understand hydraulic symbols and schematics for drawing Hydraulic and Pneumatic circuits.
8. Apply engineering standards and practice reading symbol-schematics of hydraulic and Pneumatic circuits.
9. Perform Evaluation and function analysis to select proper parts for circuits with optimum performance.
10. Examine of Maintenance and Troubleshooting of Hydraulic and Pneumatic Systems.

3. Contents

Topic	Total No. of hrs	*Lecture & Practical*	Tutorial
-Introduction for Automatic Control systems, Basics and definitions of Hydrostatics(i.e., work, Pressure, transportation and magnification of force and moment)- -Hydrodynamics (Continuity, Bernoulli's eqn., Energy, types of fluid flow) -Methods of Power transportation -Basic components of Hydraulic Systems-Types of Positive Displacement Pumps (Gear, Vane, and piston pumps)- Types of Hydraulic Actuators (Cylinders, Engines, Semi-	42 hrs	2hrs/week for 14 weeks before The Final Term Exam	1hr/week for 14 weeks before The Final Term Exam

rotating Engines)-Pressure Valves–Directional Valves–Flow Valves-Non-return Valves – Conditioning of Hydraulic Oils (filters, Heat Exchangers, Tanks)- Oil Piping–Auxiliaries (Accumulators, Manifolds, Flow Meters, Pressure Gauges, Switches). -Hydraulic Symbols– Reading Hydraulic Schematics – Basic Hydraulic Circuits (Direction Control, Speed Control, 2-cylinders Control, Pumps Curves, Step-displacement diagram, Numbering of Hydraulic Elements). -Practical applications of automatic control Hydraulic systems/systems in different mechanical power and heat and mass transfer equipments.			
Time for Preparing for the term exam	3	2	1
Total teaching hours in 15 weeks (+ 1 office hr/wk)	**45**	**30**	**15**

4. Teaching and Learning Methods	Lectures (√)	Practical Training/ Virtual Laboratory (√)	Seminar/Workshop (x)
	Class Activity (√)	Case Study/Reports (√)	Projects (x)
	E-learning (√)	Assignments /Homework (√)	Other: Reports

Also for Teaching and Learning: **أنظر أيضاً ملف نظام الدراسة الهجين والتعليم الذاتى للمقرر**

- Lectures and problem solving in tutorial classes.
- Information collection from text material, class notes and the Internet sites.
- Report and research assignments. Three assignment Sheets (1, 2 and 3)
- Group discussions in lectures and tutorial classes.
- Hand-outs materials.

5. Student Assessment Methods:

• **Assessment Schedule**	**Week**
-Assessment 0: Sheet-0 Introduction to Control Systems	Week#2
-Assessment 1; Sheet-1 Fluid Power Physics	Week#3
-Assessment 2; Sheet-2 – Pumps & Sheet-3 Actuators	Week#5
-Assessment 3; Sheet-4–Pressure Control Valves& Sheet-5 Directional Control Valves	Week#7
-Assessment 4; Sheet-6 Flow Control Valves & Sheet-7 Fluid Conditioning	Week#9
-Assessment 5; Sheet-8 Check Valves & Sheet-9 Accessory Components	Week#11
-Assessment 6; Sheet-10 Fluid Conductors & Sheet-11Understanding Schematics	Week#12
-Assessment7; Sheet-12 Basic system Design & Sheet-13 Review General Report	Week#13
Mid-term Exam	Week8
Final Term Exam to assess gains of all completed topics and the entire course LO's.	Endof Term

• **Weighting of Assessments**	
Assignments & class performance	5 pts
Attendance & Written Reports	10 pts
Mid-term Exam	15 pts
Final-term Examination	45 pts
-Total	75 pts

6- List of References (Note that this is a Self-Study Virtual Lab Course):

1- Several Class Notes, Reports, and Self-study Materials prepared by Course Instructor.

2- E-Learning Software and Virtual Lab program by "Interactive Industrial Training, Inc.",
fluidpowerzone.com, a Newport vertical community 1987 north 1120 west Provo, UT 84604

ملاحظة: يوجد عدد كبير من المادة العلمية والأفلام والمراجع للمقررموجودة على موقع معمل التحكم acc-vlab.cu.edu.eg

7. Facilities Required for Teaching and Learning: **Data Show and Laptop Computer**

Course Coordinator:	**Associate Prof. Mohsen S.Soliman**
Head of Department:	**Prof. Dr. Sayed Kaseb**
Date:	**January 2024**