



# Engineering Program

Specialty	Electro-pneumatic and Electro-hydraulic Control
Course Number	20308223
Course Title	Pneumatic and Hydraulic Drives
Credit Hours	3
Theoretical Hours	3
Practical Hours	0



**Brief Course Description:**

- ❖ Introduction to fluid mechanics. Properties of hydraulics and pneumatics. Structure of pneumatic and hydraulic systems. Components of pneumatic and hydraulic systems: Execution final elements, Control valves, Timers, Limit switches, Reed switches, Proximity sensors. Symbols and schematic standards, numbering system and identification of pneumatic and hydraulic components. Basic pneumatic and hydraulic drives

**Course Objectives:**

- ❖ The main objective of the course is to provide the necessary background information which will allow the student to build solid understanding of common industrial pneumatic and hydraulic drives. The student will be able to specify, select, install, troubleshoot and run industrial pneumatic and hydraulic drive systems



**Detailed Course Description:**

Unite number	Unite name	Unite content	Time Needed
1.	Introduction to pneumatic and hydraulic drives, and their basic components. Definition of pneumatic drives, control devices, distribution devices, actuators and transmission mechanisms. Examples		(1 week)
2.	Cylinders: single acting and double acting cylinders. Diaphragm cylinders, impact cylinders, cushioned cylinders, special types of cylinders. Standard cylinder sizes. Specifications of cylinders. Cylinder air consumption. Piston velocity considerations		(1 week)
3.	Pneumatic and hydraulic motors. Vane-type motors, piston-type motors (axial and radial), rotary actuators. Ratings of motors. Factors defining selection criteria of motors		(1 week)
4.	Valves: classification of valves. Reading schematics of valves. Directional control valves. Pressure control valves. Flow control valves. Check valves. Shuttle valves. Double cut-off valves. Quick exhaust valves. Nozzle valves. Flapper valves. Valves applications and structures		(2 weeks)
5.	Timers, proximity sensors and amplifiers. ON-delay timer, OFF-delay timer, one-shot timer. Back-pressure proximity sensors, reflex proximity sensors, air barriers. Pneumatic and hydraulic amplifiers and intensifiers		(2 weeks)
6.	Piping, fittings and accessories. Service units, pressure regulators (reducers), chocks, fittings and connectors, types of connectors. Pipes and hoses		(1 week)
7.	Control of single acting and double acting cylinder. Control of unidirectional and bidirectional motors, influencing rotational speed, influencing torque and force. Stopping of cylinders, and various circuit combinations. Examples		(2 weeks)

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8.	Solenoid valves. Principle of operation. Electro-pneumatic and electro-hydraulic directional valves. Electro-magnetic relays, connection diagrams. Electrical limit switches		(1 week)
9.	ON-OFF electro-pneumatic and electro-hydraulic drives. Examples on using electromagnetic relays and the control device to control industrial processes. Examples include the pneumatic-hydraulic circuits and the electrical circuits also. Examples on using PLCs to drive power cylinders or motors		(2 weeks)
10.	Introduction to proportional control. Proportional directional control valves. Pressure proportional control valves. Flow proportional control valves. Comparison between ON-OFF drives and proportional drives		(2 weeks)

**Evaluation Strategies:**

Exams		Percentage	Date
Exams	First Exam	20%	--/--/----
	Second Exam	20%	--/--/----
	Final Exam	50%	--/--/----
Homework and Projects		10%	
Discussions and lecture Presentations			

**Teaching Methodology:**

- ❖ Lectures

**Text Books & References:**

1. Basic pneumatics. Ing. Buro. J.P. Hasebrink. Editor: Mannesmann Roxroth Pneumatik. GmbH. Schlenungdruck GmbH. 1977, Germany.
2. القيادة الكهرومائية والكهروهيدروليكية، د. محمد عالية، م. زيد بولص حجازين، مكتبة المجتمع العربي للنشر والتوزيع، 2005، الأردن

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# Engineering Program

Specialty	Electro-pneumatic and Electro-hydraulic Control
Course Number	20308224
Course Title	Pneumatic and Hydraulic Drives Lab
Credit Hours	1
Theoretical Hours	0
Practical Hours	3



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**Brief Course Description:**

- ❖ The course covers the major activities related to industrial pneumatic and hydraulic drives, such as actuator positioning, speed control, event driven controls and realizing different sequential operations

**Course Objectives:**

- ❖ The objectives of the course are to provide the student with the practical skills related to managing pneumatic and hydraulic drive systems. The student is supposed to analyze the task, write the control algorithm, assemble the circuit and run it



**Detailed Course Description:**

Unit number	Lab name	Lab content	Time Needed
1.	Translation of real industrial processes to a programmed sequence of logical operations by using traditional electrical control and by using PLCs, limit switches, counters, timers and PLC registers		(3 weeks)
2.	Realization of pneumatic out-stroking and in-stroking and controlling the drive velocity by using quick-exhaust valves		(1 week)
3.	Realization of pneumatic sequential control of a cylinder motion by using pressure switch and pneumatic timers		(1 week)
4.	Control of the cylinder velocity of a hydraulic system by using check-chock assembly and traditional electrical circuit		(2 weeks)
5.	Operate and carry out the required adjustments of a PLC driven electro-pneumatic testing station		(1 week)
6.	Operate and carry out the required adjustments of a PLC driven electro-pneumatic storage station		(1 week)
7.	Using the PLC and directional control valves and proximity switches in order to realize the required control sequence of motion of a pneumatic manipulator		(1 week)

**Evaluation Strategies:**

Exams		Percentage	Date
Exams	Reports	30%	--/--/----
	Midterm Exam	20%	--/--/----
	Final Exam	50%	--/--/----

**Teaching Methodology:**

- ❖ Laboratory

**References:**

Manuals existing at the laboratory and the laboratory sheets prepared by the instructors

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