The University of Jordan
School of Engineering

Department	Course Name	Course Number	Semester
Mechanical Engineering	Design of Hydraulic and Pneumatic Systems	0914537	

2005 Course Catalog Description

The objective of this course is to familiarize student with fluid power systems design control and operation. It covers the fundamentals of fluid flow, modeling and n-port concepts, fluid power modulation, static and dynamic modeling of pumps, motor, control valves, transmission lines and fluid drives. It also deals with design control and operation of mechanical and electrical hydraulic servo drives with feedback. Emphasis is placed on linear hydraulic systems behavior.

Instructors

Name	E-mail	Sec	Office Hours		Lecture Time	

Text Books

	Text book 1	Text book 2
Title	Fluid Power with Applications	Handouts
Author(s)	Anthony Esposito	-
Publisher, Year, Edition	Prentice Hall. [Latest edition]	

References

Books	• Basic Hydraulics Laboratory Manual, LabVolt [Reference Book] • Basic Pneumatics Laboratory Manual, Botsch [Reference Book]
Journals	
Internet links	The UoJ ELearning: elearning.ju.edu.jo

Prerequisites

Prerequisites by topic	Basic theory of fluid mechanics, basic theory of control, system dynamics, solutions to differential equation, and Linearization techniques
Prerequisites by course	System Dynamics and Control 0904418 or Fluid Mechanics I 0904361
Co-requisites by course	-
Prerequisite for	None, elective course for Mechanical Engineering and Mechatronics students

Topics Covered

Week	Topics	Chapter in Text	Sections
1	Introduction to Fluid Powers and Terminologies and notations Hydraulic fluid properties and Fluid dynamics	Chapter 1+2	
2	Energy and Power in Fluid Systems	Chapter 3	
3	Frictional losses in Hydraulic Pipelines	Chapter 4	
2-3	Hydrostatic pumps and motors	Chapter 5+7	
4-5	Hydraulic actuators and Valves	Chapter 6+8	
6-7	Hydraulic system steady-state performance analysis and dynamic analysis	Handout	
8-10	Applications and Circuit analysis	Chapter 9+14	
11-12	Pneumatic and Hydraulic System Modeling and Fluidics	Chapter 16	
13-15	Pneumatic and Hydraulic Servos and Electro-Hydraulic systems and sequence control	Chapter 15	

Mapping of Course Outcomes to ABET Student Outcomes

SOs	Course Outcomes
1	1. Apply Fluid and Control knowledge in analysis and design 2. Ability to analyze pneumatic and hydraulic systems 3. Ability to read pneumatic and Hydraulic schematics 4. Understand the different types of valves used in fluid power 5. Design and analyze fluid power sequence control
2	6. Understand the different types of actuators and motors that are used in fluid power 7. Use simulating software by Automation studio for design and analysis 8. Ability to perform Pneumatic and Hydraulic basic circuits design
6	9. Perform steady state and dynamical analysis for hydraulics systems
7	10. Know about PID pneumatic based controllers

Evaluation

Assessment Tools	Expected Due Date	Weight
Homework & Quizzes		10%
Lab and Reports		10%
Midterm Exam		20%
Project		10%
Final Exam		50 %

Contribution of Course to Meet the Professional Components

The course contributes to build the fundamentals in using Pneumatic and Hydraulic (Fluid Power) in mechanical and industrial systems. The students build knowledge and skill needed whenever they are encountered with such systems in industrial factories and plants.

Relationship to Student Outcomes

SOs	1	2	3	4	5	6	7
Availability	X	X				X	X

Relationship to Mechanical Engineering Program Objectives (MEPOs)

MEPO1	MEPO2	MEPO3	MEPO4	MEPO5

ABET Student Outcomes (SOs)

1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	An ability to communicate effectively with a range of audiences
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated by ABET Committee, 2024