

Fluid Power Systems

- 1. Course number and name:** 0200FPES4 Fluid Power Systems
- 2. Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours per week
- 3. Name(s) of instructor(s) or course coordinator(s):** Bassam Riachi
- 4. Instructional Materials:** Fluid Power with Applications, Anthony Esposito, 7th edition, Pearson. ISBN-13 978-0135136904.
- 5. Specific course information**
 - a. Catalog description:**

This course provides an overview of the latest technologies and developments in fluid power systems, as well as the diversity of their applications. It aims to make students aware of the potentials and specificities of the application of different systems and components in the engineering world, from aviation to industrial machinery. The covered topics are: technology, operation, maintenance, troubleshooting, design and analysis of different fluid power systems and their components, such as positive displacement pumps and motors, hydraulic actuators and servomechanisms, different types of valves (pressure and flow regulating valves), selector valves, servo-valves, different filtration and fluid conditioning systems, electric and automatic control components and sensors for different fluid power systems.
 - b. Prerequisites:** Computer Assisted Drawing (020DAMCI4 or 020DAMNI4) and Hydraulics (020HYDES3).
 - c. Selected Elective** for ME students.
- 6. Educational objectives for the course**
 - a. Specific outcomes of instruction:**

By the end of the course, the students will be able to:

 - List and describe different types of PDP, PDM and LHA.
 - Apply fundamental theories and equations to solve fluid power engineering problems.
 - Analyze the performance of hydraulic components and their operating modes.
 - Design and model pumps, actuators, motors, different types of valves and other fluid power components.
 - Design fluid powers system and circuits.
 - Analyze the performance of servomechanisms and proportional valves.

b. PI addressed by the course:

PI	1.1	1.2	1.3	2.3
Covered	x	x	x	x
Assessed				

7. Brief list of topics to be covered

- **Introduction:** the fluid power industry, components of fluid power systems, types of fluid power control systems, ISO hydraulic symbols (1 Lecture)
- **Part A: Hydraulic fluids:** Hydraulic fluid physical properties, weight, density, and specific gravity, thermal expansion, bulk modulus, viscosity, viscosity index, and viscometers, flash point, pour point, mineral and synthetic fluids (1 Lecture)
- **Part B: Positive displacement pumps PDP:** types of PDP: gear, screw, vane, and piston pumps, principle of operation, pump displacement, flow rate, torque, power and efficiencies, characteristics, pressure relief valves and their characteristics, case study: aircraft hydraulic pumps. (2 Lectures)
- **Part C: Fluid power actuators:** Mechanics of Linear hydraulic actuators LHA (cylinders), limited rotation hydraulic actuators, positive displacement motors PDM (gear, screw, piston, vane...), design and performance of LHA and PDM, hydrostatic transmissions, electro-hydraulic stepping motors, low-speed and high-torque motors (3 Lectures)
- **Part D: Pipes, reservoirs, and fluid conditioning systems:** Pipe and tubing design and selection, flexible hoses and quick disconnectors, types of reservoirs and the principle of pressurization, types of filters and filtration systems, heat exchangers and coolers. (1 Lecture)
- **Part E: Control components:** Technology, operation and design principles of: Directional (selector), pressure and flow control valves. Servo-valves, cartridge valves, hydraulic fuses, pressure and temperature switches (4 Lectures)
- **Part F: Hydraulic circuit design and analysis:** Control of single and double acting cylinders, regenerative circuit, pump-unloading circuit, double-pump circuits, pressure intensifiers, counterbalance valve applications, sequencing and synchronizing circuits, fail-safe circuits, pilot check valves, motor torque and speed controls, accumulators and their applications, servo-mechanisms, fundamentals of proportional control, introduction to logic control, system / circuit maintenance and troubleshooting strategies (12 Lectures)