Ministry of Higher Education and Scientific Research

University of Science and Technology of Oran Mohammed Boudiaf (USTO-MB)

Hydraulics & Pneumatics

Course : Licence
Speciality: Electromechanical
Year: 2022-2023

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1- Content of the subject:

- **Chapter 1: Introduction to Fluid Mechanics** (1 week)
  1-Definitions: Perfect Fluid, Real Fluid, Incompressible Fluid, Compressible Fluid).
  2-Physical characteristics: (Density, Density, Density, Viscosity)
- **Chapter 2: Fluid Statics** (2 weeks)
  1-Introduction. 2-Notion of pressure at a point of a fluid. 3-Fundamental relationship of hydrostatics . 4- Pascal's theorem. 5- Push of a fluid on a vertical wall. 6-Archimedes' theorem.
- **Chapter 3: Dynamics of Perfect Incompressible Fluids** (2 weeks)
  1-Introduction. 2-Permanent flow. 3-Equation of Continuity. 4-Notion of Flow. 5- Bernoulli's theorem (Case of a flow without exchange of work). 6-Bernoulli's theorem (Case of a flow with exchange of work)
- **Chapter 4: Real Incompressible Fluid Dynamics** (3 weeks)
  1- Introduction. 2- Real fluids. 3- Flow regimes (Reynolds number). 4-Head losses : Definition , Singular head losses, Linear head losses. 5-Bernoulli's theorem applied to a real fluid .
- **Chapter 5: General information on hydraulic and pneumatic circuits** (4 weeks)
  1-General information on hydraulic fluids: Different hydraulic types (mineral oil, synthetic oil), Influence of temperature on viscosity, Influence of pressure on viscosity. 2-Filtration. 3-The organs of a hydraulic circuit (The single and double-acting cylinder, The distributors, Limitation and regulation of flow , Limitation and regulation of pressure, Pumps)
- **Chapter 6: General information on pneumatic circuits** (3 weeks)
  1. General. 2-Production of compressed air . 3-Power treatment: (Compressed air treatment, Compressed air filtration level). 4-The packaging modules: (The different components, Principle of operation - filters, pressure regulators, lubricators, soft starters- 5- The main power units. 6-The distributors.

2- Target audience :

- This course is designed in response to the official curriculum requirements of the Ministry of Higher Education and Scientific Research .
- This course has been developed for **second- year LMD Electromechanical** students , in the field of Sciences and Techniques of universities and engineering schools.
- It aims to introduce electromechanical students to the fundamental principles of fluid mechanics.

3- Prerequisites:

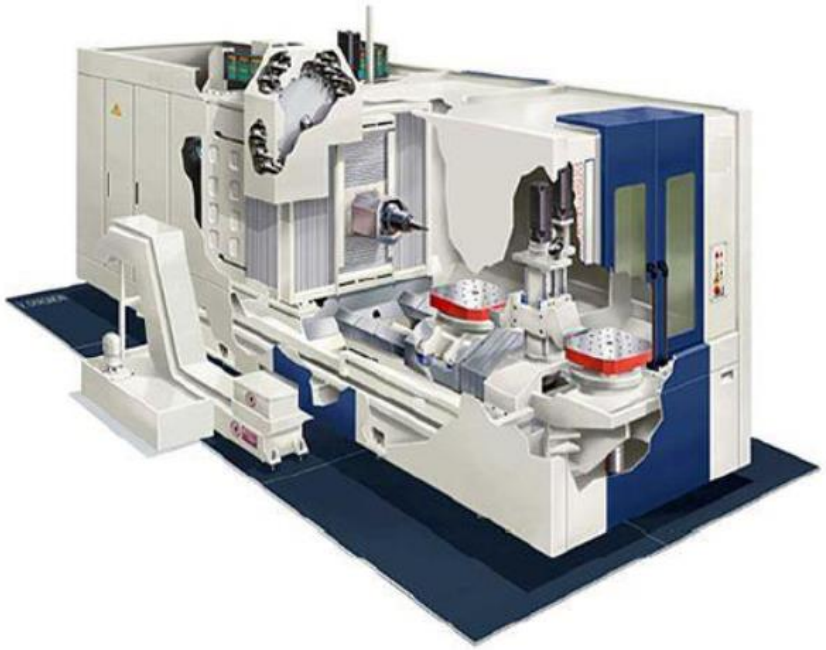
- **Math knowledge :** It is important to have a solid understanding of mathematical concepts such as differential and integral calculus, differential equations, vectors, matrices and vector operations.
- **Notions of physics:** An understanding of basic principles of physics, such as kinematics, particle and solid dynamics, conservation laws (such as conservation of mass, energy, and momentum), is essential.
- **Understanding Differential Equations:** Fluid mechanics uses differential equations to describe the motions and behaviors of fluids. A knowledge of ordinary and partial differential equations is therefore necessary.
- **Knowledge of basic mechanical concepts:** Basic knowledge of mechanics, including fluid statics, fluid dynamics, thermodynamics, heat transfer, and thermals, is important to understanding the fundamentals of fluid mechanics.

4- Introduction to fluid mechanics :

- Fluid mechanics is a branch of physics that studies the behavior of fluids in motion. Fluids can be liquids or gases, and their movement can be caused by external forces such as gravity or pressure.
- The main concepts of fluid mechanics include laminar and turbulent flow, viscosity, pressure, and density. These concepts are used to understand natural phenomena such as ocean currents, blood flow in the human body, and air movement in the atmosphere.
- Its results are essential to most industries (aeronautics, automotive, hydraulics, chemicals, etc.). In the same way as blood; the veins and the heart are the origin of life, the transport and circulation of fluids are the origin of many processes and many achievements.
- There are two main families of fluids: liquids (including powders or pulverulent products) and gases. **Liquids have the property of being incompressible, while gases are compressible.**

5 - Areas of application:

- All sectors of activity are concerned: automotive, aeronautics, marine, agri-food industries, oil industries, civil engineering, buildings and public works, mechanical industry, machine tools, medicine, dental equipment, etc.



6- Definitions and general information:

- **The hydraulics:**

Hydraulics has its root in the Greek word " hudor " (water). A hydraulic system is a system that uses water or any liquid for its operation.

In industry, hydraulics means the transmission and control of forces by a liquid (hydraulic fluid).

Hydraulics is a simple way of transmitting power from one point to another, just like mechanics and electricity.

- **The pneumatics:**

The term pneumatic comes from the Greek: "pneumos" which means "breath". Pneumatics is the branch of physics that studies the transmission of force by a compressed gas.

The use of pneumatic energy makes it possible to create automation with simple and robust components, particularly in hostile environments: high temperatures, explosive environments, humid environments, etc.