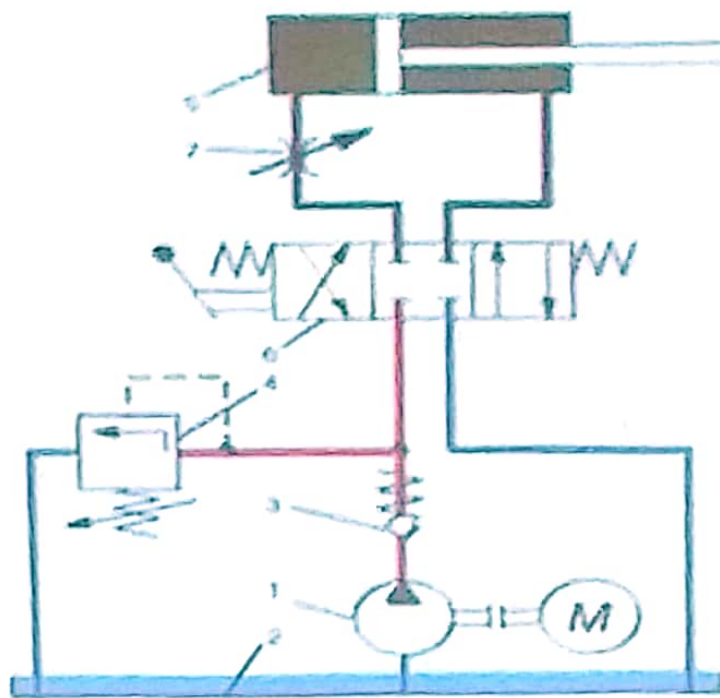


# Systems Applications III (ACE-414)



Minoufia University

Faculty of Electronic Engineering



# Introduction

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## ➤ Introduction

➤ In the industry we use three methods for transmitting power from one point to another.

1. Mechanical transmission is through shafts, gears, chains, belts
2. Electrical transmission is through wires, transformers
3. Fluid power is through liquids or gas in a confined space

# Fluid Power and Its Scope

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## ➤ Fluid power

➤ Fluid power is the technology that deals with the generation, control and transmission of forces and movement of mechanical element or system with the use of pressurized fluids in a confined system.

➤ Both liquids and gases are considered fluids.



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## ➤ Fluid power system

- Fluid power system includes
- a hydraulic system (hydra meaning water in Greek) and a pneumatic system (pneuma meaning air in Greek).
- Oil hydraulic employs pressurized liquid petroleum oils and synthetic oils,
- and pneumatic employs compressed air that is released to the atmosphere after performing the work.

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## ➤ Fluid power system

### ➤ Fluid power system includes

- water has certain drawbacks in the transmission of hydraulic power in machine operation and control.
- Commercially, pure water contains various chemicals and also foreign matter, and unless special precautions are taken when it is used,
- it is nearly impossible to maintain valves and working surfaces in satisfactory condition.



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➤ Fluid power applications can be classified into two major segments:

- Stationary hydraulics.
- Mobile hydraulics.

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## ➤ Stationary hydraulics.

### ✓ Stationary hydraulics:

Stationary hydraulic systems remain firmly fixed in one position.

- ✓ The characteristic feature of stationary hydraulics is that valves are mainly solenoid operated.



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## ➤ Stationary hydraulics.

✓ The applications of stationary hydraulics are as follows:

1. Machine tools and transfer lines.
2. Lifting and conveying devices.
3. Metal-forming presses.
4. Plastic machinery such as injection-molding machines.
5. Rolling machines.
6. Lifts.
7. Food processing machinery.
8. Automatic handling equipment and robots.



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## ➤ Mobile hydraulics.

✓ Mobile hydraulic systems move on wheels or tracks such as a tower crane or excavator truck to operate in many different locations or while moving.

✓ A characteristic feature of mobile hydraulics is that the valves are frequently manually operated.

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## ➤ Mobile hydraulics.

✓ The applications of mobile hydraulics are as follows:

1. Automobiles, tractors, aeroplanes, missile, boats, etc.
2. Construction machinery.
3. Tippers, excavators and elevating platforms.
4. Lifting and conveying devices.
5. Agricultural machinery.



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➤ The following are the two types of hydraulic systems:

1. Fluid transport systems
2. Fluid power systems

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➤ The following are the two types of hydraulic systems:

- ✓ Fluid transport systems: Their sole objective is the delivery of a fluid from one location to another to accomplish some useful purpose.
- ✓ Examples include pumping stations for pumping water to homes, cross-country gas lines, etc.



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➤ The following are the two types of hydraulic systems:

✓ Fluid power systems: These are designed to perform work. In fluid power systems, work is obtained by pressurized fluid acting directly on a fluid cylinder or a fluid motor.

✓ A cylinder produces a force resulting in linear motion, whereas a fluid motor produces a torque resulting in rotary motion.

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➤ The fluid power system can be categorized as follows:

1. Based on the control system.
2. Based on the type of control .



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➤ Based on the control system.

## 1. Open-loop system:

- ✓ There is no feedback in the open system and performance is based on the characteristics of the individual components of the system.
- ✓ The open-loop system is not accurate and error can be reduced by proper calibration and control.

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➤ Based on the control system.

## 2. Closed-loop system:

- ✓ This system uses feedback. The output of the system is fed back to a comparator by a measuring element.
- ✓ The comparator compares the actual output to the desired output and gives an error signal to the control element.
- ✓ The error is used to change the actual output and bring it closer to the desired value.
- ✓ A simple closed-loop system uses servo valves and an advanced system uses digital electronics.

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## ➤ Based on the type of control

✓ **Fluid logic control:** This type of system is controlled by hydraulic oil or air. The system employs fluid logic devices such as AND, NAND, OR, NOR, etc.

✓ **Electrical control:** This type of system is controlled by electrical devices. Four basic electrical devices are used for controlling the fluid power systems: switches, relays, timers and solenoids.

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## ➤ Based on the type of control

- **Electronic control**: This type of system is controlled by microelectronic devices. The electronic brain is used to control the fluid power muscles for doing work. This system uses the most advanced type of electronic hardware including programmable logic control (PLC) or microprocessor ( $\mu P$ ).



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1. Fluid power systems are simple, easy to operate and can be controlled accurately.
2. Multiplication and variation of forces
3. Multifunction control
4. Low-speed torque
5. Constant force or torque.
6. Economical
7. Low weight to power ratio
8. Fluid power systems can be used where safety is of vital importance

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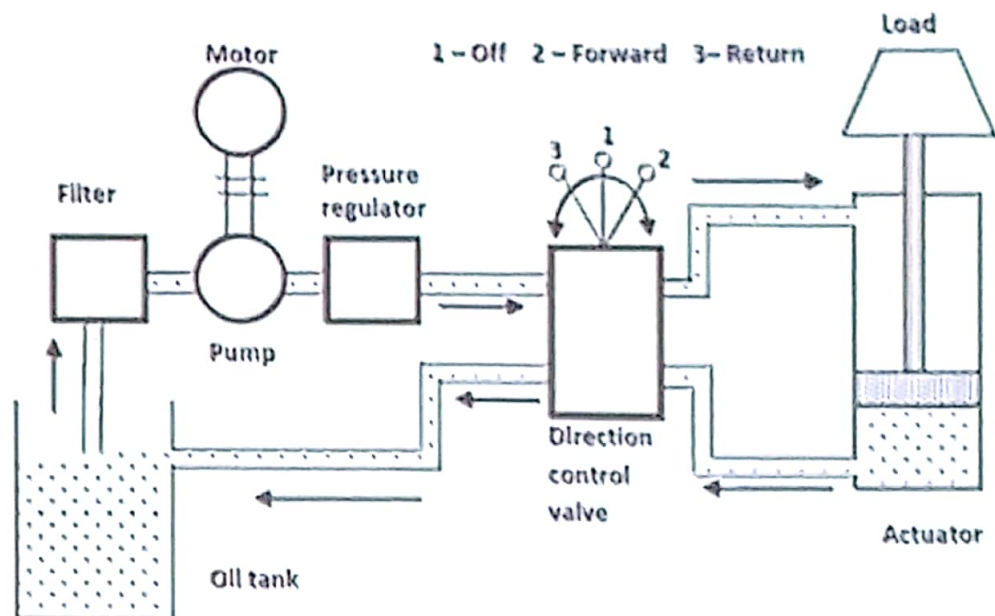
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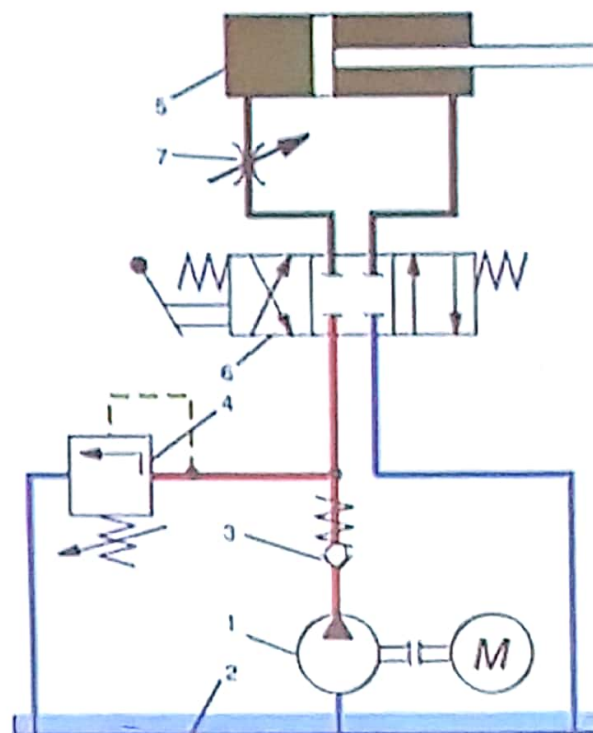
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1 – pump

2 – oil tank

3 – flow control valve

4 – pressure relief valve

5 – hydraulic cylinder

6 – directional control valve

7 – throttle valve

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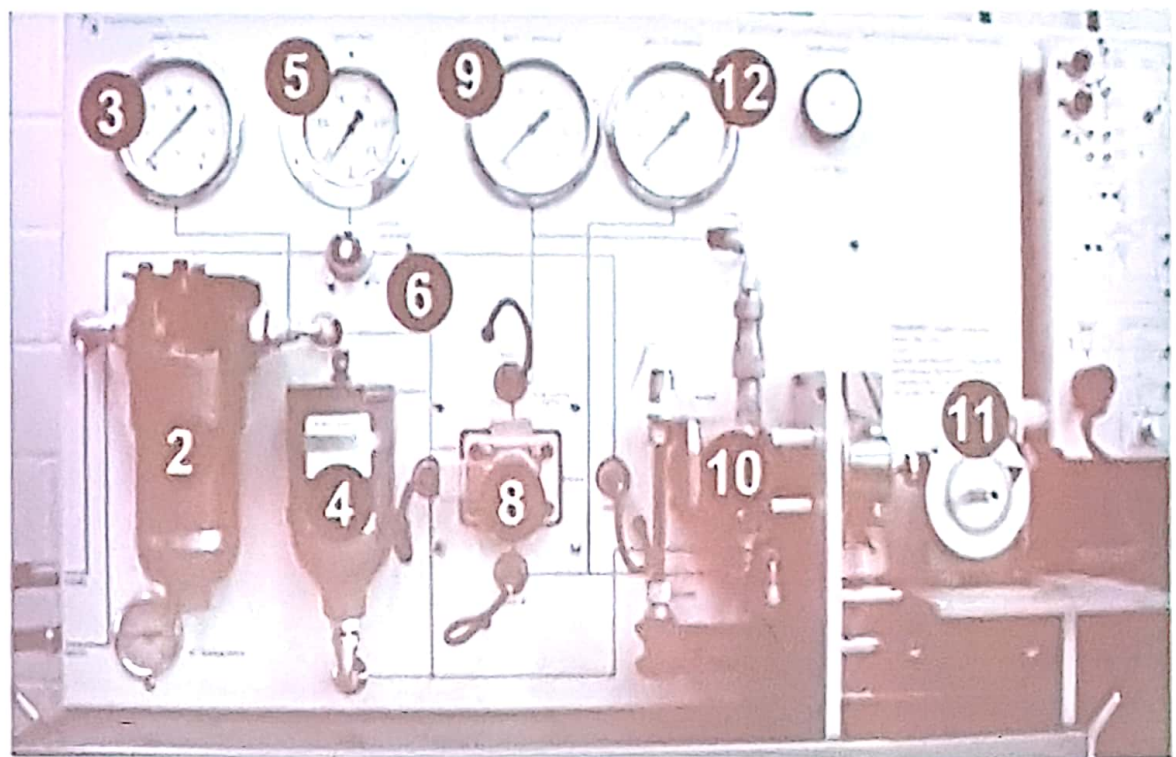
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Model Control system EHS 160