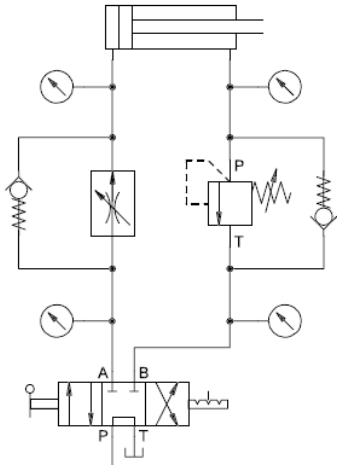


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# ***Hydraulic & Pneumatic Circuits***



**Tanta University**



**Faculty of Engineering  
Mechanical power  
Engineering Dept.**

## ***Lecture (1)*** ***on*** ***Basics of Hydraulic Control***

***By***  
***Dr. Emad M. Saad***

*Industrial Engineering Dept.  
Faculty of Engineering  
Fayoum University*

***2014 - 2015***



# Course Syllabus

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<b>Corse Name:</b>	<b>Hydraulic and Pneumatic Circuits – 4<sup>th</sup> year – Mech. power Engineering Dept.</b>
<b>Course Outline:</b>	<ol style="list-style-type: none"><li><b>1. Basics of hydraulic control.</b></li><li><b>2. Components of hydraulic action and control.</b></li><li><b>3. Basics circuits and sizing hydraulic components .</b></li><li><b>4. Comparison of hydraulics with other control media.</b></li><li><b>5. Conductors and connectors.</b></li><li><b>6. Hydraulic Calculations</b></li><li><b>7. Troubleshooting</b></li><li><b>8. Maintenance of main hydraulic components.</b></li></ol>





# Course Syllabus

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<b>Course prerequisites:</b>	<ol style="list-style-type: none"><li>1. Mechanical Engineering Principles.</li><li>2. Fluid Mechanics</li><li>3. Control Principles.</li></ol>	
<b>Text Books:</b>	Lectures notes	
<b>References:</b>	<ol style="list-style-type: none"><li>1. <b>Esposito, A.</b>, "<i>Fluid Power with Applications</i>", 4<sup>th</sup> Edition, Prentice Hall, Inc., New Jersey, 1997.</li><li>2. <b>Rabie, M.G.</b>, "<i>Fluid Power Engineering</i>", McGraw-Hill, New York, 2009.</li></ol>	
<b>Evaluation:</b>	<ol style="list-style-type: none"><li>1. Homework, attendance and assignments; equivalent <b>20%</b>.</li><li>2. Mid exam; equivalent <b>20%</b>.</li><li>3. Final exam; equivalent <b>60%</b>.</li></ol>	
<b>Professor:</b>	<b>Facebook:</b>	DrEmad Elasad
	<b>Email:</b>	<a href="mailto:ems03@fayoum.edu.eg">ems03@fayoum.edu.eg</a>
	<b>Office Hours:</b>	Sunday <b>10:00 - 12:30</b> or by Appointment

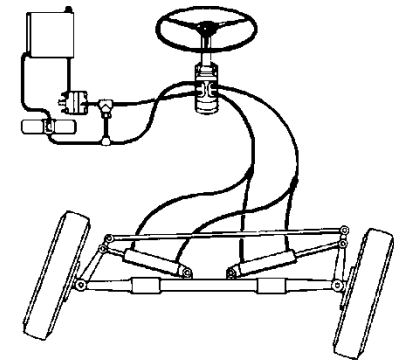




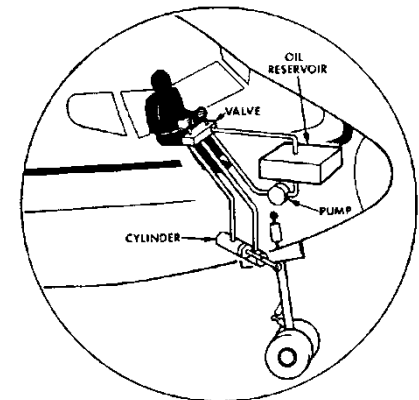
# Applications of Fluid Power: *Mobile Hydraulics*

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1. **Construction machinery**
2. **Tippers, excavators, elevating platforms**
3. **Lifting and conveying devices**
4. **Agricultural machinery**
5. **Power control system for vehicles and aircraft**



Hydraulic operation of aircraft landing gear



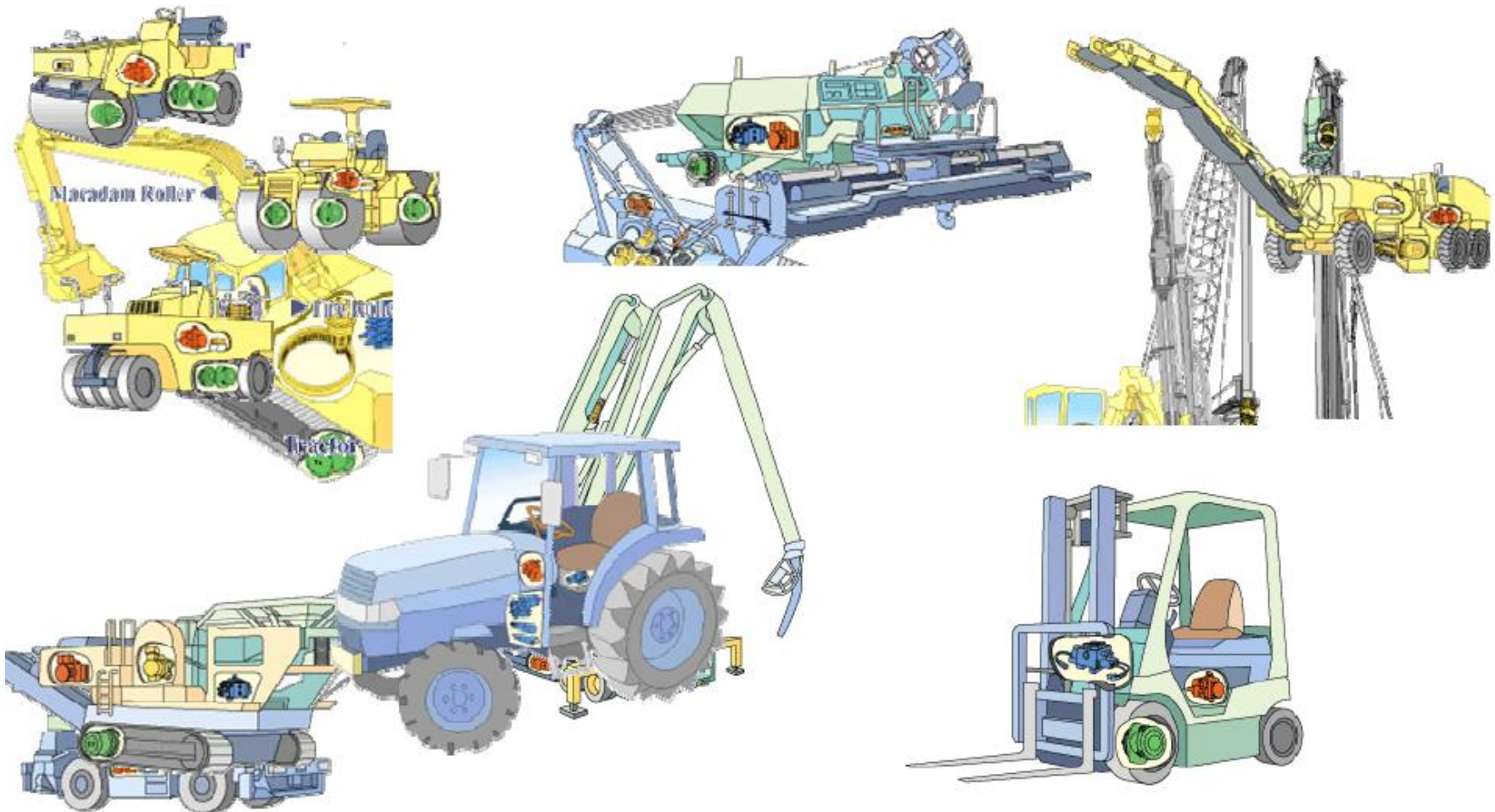
Power steering control system for off-highway vehicles





# Applications of Fluid Power: *Mobile Hydraulics*

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# **Applications of Fluid Power: *Industrial Hydraulics***

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**The following application areas are important for stationary hydraulics:**

- 1. Production and assembly machines of all types**
- 2. Transfer lines**
- 3. Lifting and conveying devices**
- 4. Presses**
- 5. Injection molding machines**
- 6. Rolling lines**
- 7. Lifts**



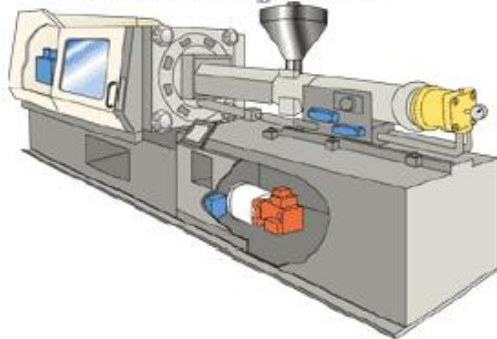




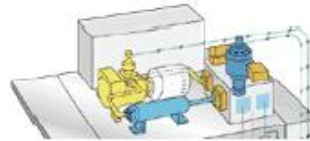
# Applications of Fluid Power: *Industrial Hydraulics*

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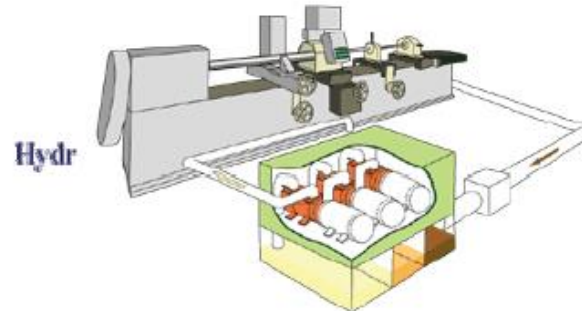
Plastics Molding Machine



Press Machine

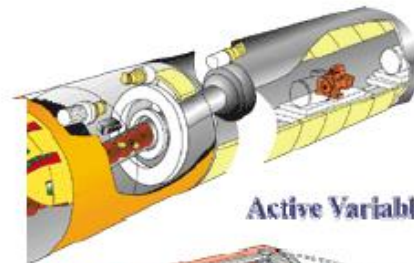


Machine Tool

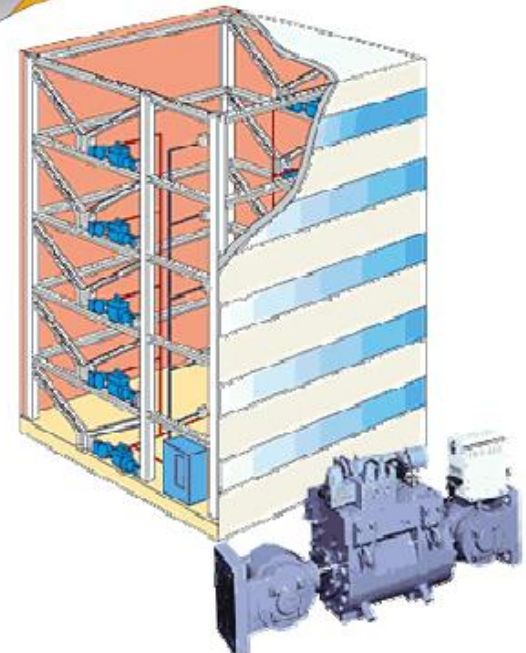


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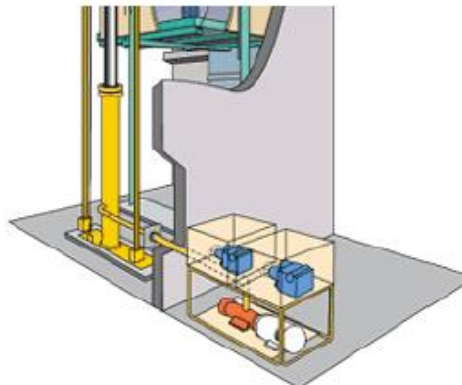
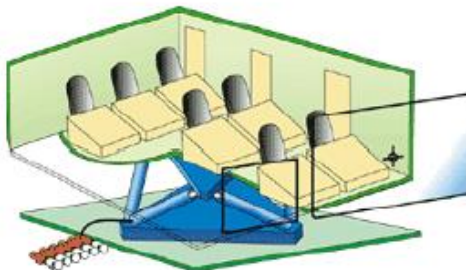
Tunnel Boring Machine



Active Variable Damping System



Amusement Machine







# Fluid Power Theories & Physics

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1. Continuity Equation

2. Power Analogy

3. Bernoulli's Equation

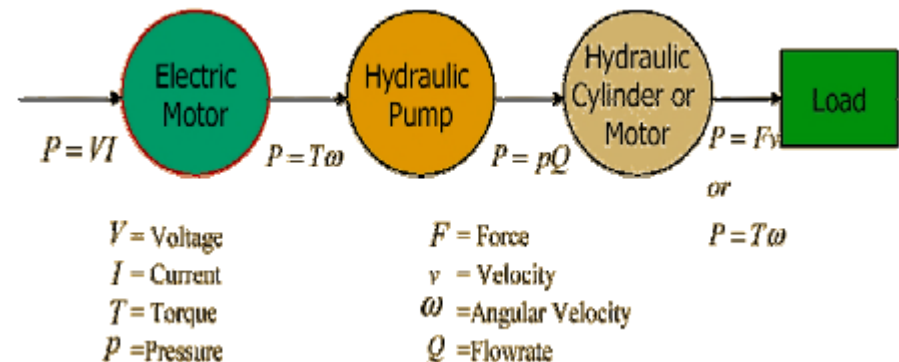
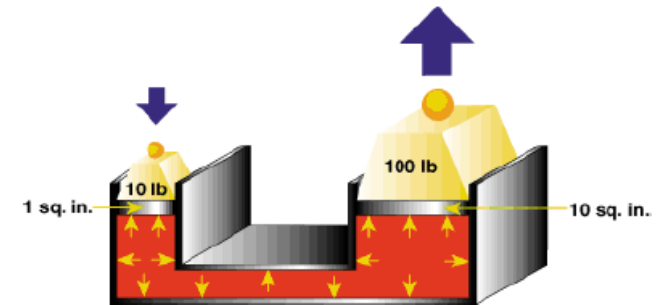
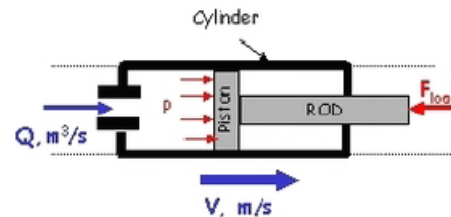
4. Viscosity

5. Atmospheric and Gage Pressures

6. Conversion of fluid pressure . . .

7. Pascal's Law

8. Typical hydraulic system





# Fluid Power Advantages

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hydraulics is concerned with the transmission of force and power by means of the static pressure of a fluid. The tasks are performed by hydraulic systems which, in the market place, are in competition with mechanical, electrical and pneumatic systems.

1. Transmission of high forces within a small space
2. Energy storage capability
3. Stepless variation in motive quantities, such as speeds, forces and torques
4. Easy monitoring of forces
5. Rapid reversal due to low component masses (low inertia)
6. Fast operating response
7. Uniform motion (free from shock and chatter)
8. Wide transmission ratio





# Fluid Power Advantages

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8. Simple conversion from rotary to linear motion or vice versa
9. Design freedom in the arrangement of components
10. Physical separation of drive input and output by pipes or hoses
11. Automatic control of all types of motion by pilot valves and electric signals
12. Easy usage of standard components and sub-assemblies
13. Overload protection
14. Minimum wear rates because hydraulic components are lubricated by the operating medium
15. Long service life
16. Energy recovery capability





# Fluid Power Disadvantages

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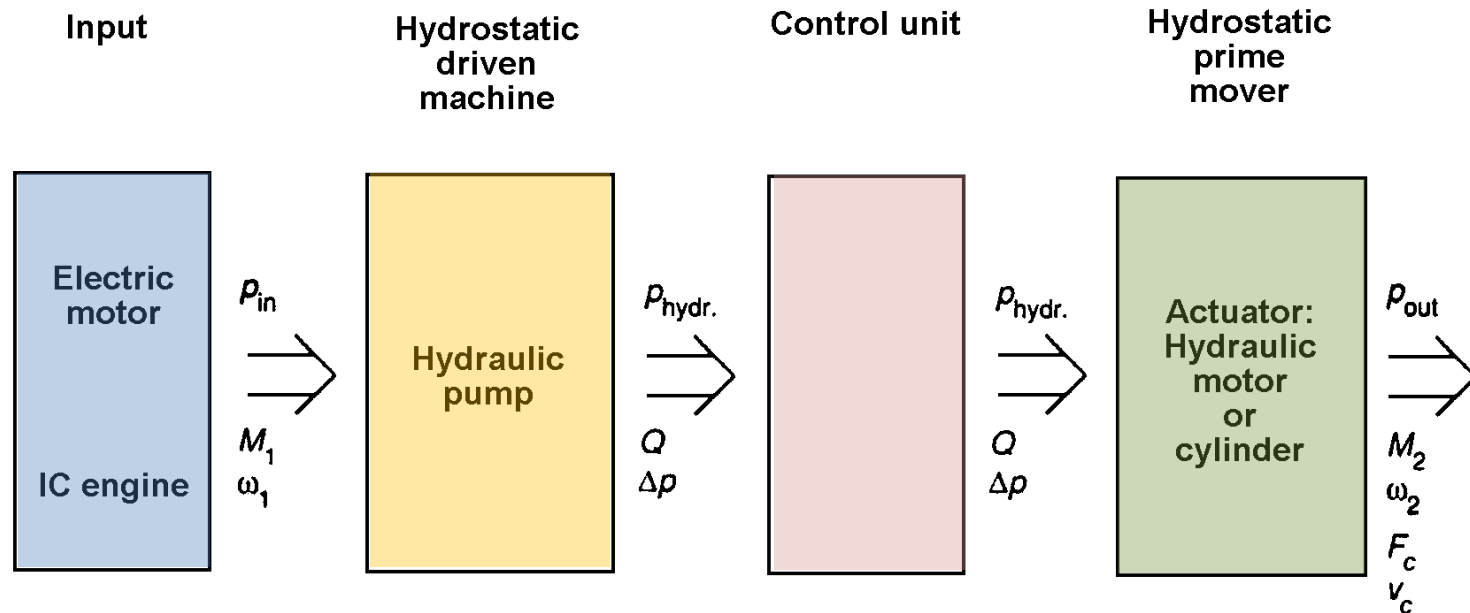
1. Pressure and flow losses in pipes and control devices (fluid friction)
2. Fluid viscosity sensitive to temperature and pressure
3. Leakage problems (external and internal)
4. Compressibility of the hydraulic fluid





# Basic Design of Hydraulic System

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# Basic Design of Hydraulic System

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