

LECTURE 1- INTRODUCTION TO HYDRAULICS AND PNEUMATICS

FREQUENTLY ASKED QUESTIONS

1. Define the term fluid power.

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

2. Differentiate between fluid transport and fluid power systems

Fluid transport systems have their sole objective 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.

Fluid power systems are designed to perform work. In fluid power systems, Work is obtained by pressurized fluid acting directly on fluid cylinder or fluid motor. A cylinder produces a force resulting in linear motion, whereas a fluid motor produces a torque resulting in rotary motion

3. Differentiate between hydraulics and pneumatics

Oil hydraulics employs pressurized liquid petroleum oils and synthetic oils, and pneumatics employs compressed air which is exhausted to the atmosphere after performing the work.

3. List the six basic components used in a hydraulic systems

i) Reservoir ii) Pump iii) Prime mover iv) Valves v) actuators vi) Piping

4. List the six basic components used in a pneumatic systems

i) Compressed air tank ii) compressor iii) Prime mover iv) Valves v) actuators vi) piping

5. List ten applications of fluid power in the automotive industry

1. Power brakes, 2. Power steering, 3.Shock absorbers 4.Air conditioning 5.Automobile transmission. 6. Agriculture 7. Aviation, 8.Fabrication industry 9.Machine tools 10. Oil industry and Pharmaceuticals

6. Name five hydraulic applications and five pneumatic applications

Hydraulic applications	Pneumatic applications
Automobile power steering, brakes, aircraft landing gear, lift trucks, front end loaders	Packaging machinery, Bottle filling Industry, artificial heart, logic control systems and robotic materials handling devices.

7. List five advantages and five disadvantages of hydraulics

Advantages of Hydraulic system

1. Large load capacity with almost high accuracy and precision.
2. Smooth movement.
3. Automatic lubricating provision to reduce to wear.
4. Division and distribution of hydraulic force are easily performed.
5. Limiting and balancing of hydraulic forces are easily performed.

Disadvantages of Hydraulic system

1. A hydraulic element needs to be machined to a high degree of precision.
2. Leakage of hydraulic oil poses a problem to hydraulic operators.
3. Special treatment is needed to protect them from rust, corrosion, dirt etc.,
4. Hydraulic oil may pose problems if it disintegrates due to aging and chemical deterioration.
5. Hydraulic oils are messy and almost highly flammable.

8. List five advantages and five disadvantages of pneumatics

Advantages of Pneumatic system

1. Low inertia effect of pneumatic components due to light density of air.
2. System is light in weight.
3. Comparatively easy operations of valves.
4. Power losses and leakages are less in pneumatic systems.
5. Low cost.
6. Cylinder cushioning is not required
7. Leakage does not influence the systems and is not harmful

Disadvantages of Pneumatic systems

1. Suitable only for low pressure and hence low force applications
2. Availability of the assembly components is doubtful.
3. Generation of the compressed air is expensive compared to electricity
4. Exhaust air noise is unpleasant and silence has to be used.
5. Rigidity of the system is poor
6. Weight to pressure ratio is large
7. Less precise

9. List the main components of Fluid power system and their function

Pump	To convert mechanical power to fluid power
Cylinder/motor	To convert fluid power to linear or rotary mechanical power
Valves	To control direction , pressure and flow
Filters and regulators	To condition the fluid
Hose tube and couplings	To conduct fluid
Seals	To contain the fluid
Accumulators	To store the fluid
Measuring instruments such as Pressure switch, Flow meter, Temperature transducers	To monitor the performance of fluid power system and maintain it

10. Compare different Power Systems used in industry

Property	Mechanical	Electrical	Pneumatic	Hydraulic
Input Energy source	I C Engines Electric motor	I C Engines Water/Gas Turbines	I C Engines Pressure Tank	I C Engines Electric Motor Air Turbine
Energy Transfer Element	Levers, Gears, Shafts	Electrical Cables and Magnetic field	Pipes and hoses	Pipes and hoses
Energy Carrier	Rigid and elastic Objects	Flow of electrons	Air	Hydraulic liquids
Power to weight ratio	Poor	Fair	Best	Best
Torque/Inertia	Poor	Fair	Good	Best
Stiffness	Good	Poor	Fair	Best
Response speed	Fair	Best	Fair	Good
Dirt Sensitivity	Best	Best	Fair	Fair
Relative cost	Best	Best	Good	Fair
Control	Fair	Best	Good	Good
Motion Type	Mainly Rotary	Mainly Rotary	Linear or Rotary	Linear or Rotary

11. What is the main difference between a open loop and closed loop fluid power system

i) Open loop system: there is no feedback in the open system and performance is based on characteristics of individual components of system, Open loop system is not accurate and error can be reduced by proper calibration and control.

ii) Closed loop system: This system uses feedback. The output of the system is fed back by a measuring element to a comparator. The comparator compares the actual output to the desired and gives a error signal to the control element. The error is used to change the actual output and bring it closer to the desired value. Simple closed loop system uses servo valves and advanced system uses digital electronics

12. List five major manufactures of fluid power equipments and systems in India.

1. Hycom Engineering (India) Pvt Ltd;
2. Hannover Milano Fairs India Pvt Ltd
3. Yuken India Limited.
3. Bosch Rexroth (India) Ltd;
4. Pall Corporation India limited

13. List five major manufactures of fluid power equipments and systems in world.

Rexroth, Vickers, Ingersoll-Rand, Eaton corporation, Brown and Sharp Manufacturing Company, DeLaval IMP pump Division, Sheffer corporation.

14. Visit any Industry nearby and list the hydraulic/pneumatic parts or systems used and its purpose.

Students should visit and make note of the following

1. Size of hydraulic power pack used
2. Oil used and its designation
3. Piping used – whether rigid, or flexible and their material and capacity
4. Valves used for control device
5. Type of controller used – like Siemens, Yamasaki etc
6. Valve mountings
7. Coolant recirculation system used
8. Lubricant unit and oil used and grade
9. Rating of pumps and motor
10. Safety devices used in machine