SNS COLLEGE OF TECHNOLOGY, COIMBATORE – 35

Department of Mechanical Engineering

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II year B.E. – Mechanical Engineering IV semester

19MEE305 FLUID POWER AUTOMATION

UNIT - I

1. **What is fluid power?**

   The technology of generating, controlling and transmitting power using pressurized fluids is termed as fluid power.

2. **State the basic methods of transmitting power.**

   1. Electrical - Power transmission over large distance.
   2. Mechanical - Power transmission to short distance and
   3. Fluid power - Power transmission for intermediate distance.

3. **State the type of fluid systems.**

   Fluid power systems - used to perform work.
   Fluid transport systems -used for transporting fluids from one place to another.

4. **State the law of conservation of energy.**

   Energy can neither be created nor be destroyed but can be changed from one form to another.

5. **State the Pascal's law.**

   Pressure applied on a confined fluid at rest is transmitted undiminished in all directions and acts with equal force on equal areas, and at right angles to them.

6. **What is the difference between liquids and gases?**

S.No	Liquids	Gases
1	The spacing of molecules is lower than that of gases.	The spacing of molecules in gases is much larger than that of liquids & for this reason gases flow more readily than liquids.
2	incompressible in nature	compressible
3	It has definite mass and volume but no definite shape.	It has definite mass but no definite volume & definite shape.

7. **Name some of hydraulic fluids.**

   Water, petroleum oils, water glycols, water oil emulsion, phosphate esters and silicones are some of the hydraulic fluids used in fluid power.

8. **Name few properties which a hydraulic fluid should posses?**

   Viscosity, Demulsibility, Viscosity Index, Lubricity, Rust Prevention, Pour point, Flash Point and fire point and Oxidation stability.

9. **What is demulsibility?**

   The ability of hydraulic fluid to separate rapidly from moisture and successfully resist emulsification is known as demulsibility.

10. **What is called lubricity?**

The property of oil to lubricate itself the moving components is called lubricity.

11. Define viscosity.

Viscosity is defined as the measure of a liquid's resistance.
The viscosity depends on (i) thickness and (ii) temperature.

12. Define the term viscosity index.

The rate of change of viscosity with temperature is called viscosity index.

13. What are the applications of hydraulics in material handling field?

Hydraulic jacks, hydraulic rams, conveyor systems, hoists and cranes are some of the applications in material handling field.

14. Why must hydraulic fluid have good lubricating property?

All the moving parts of the hydraulic components must be properly lubricated to prevent damages and breakdown. The oil having good lubricating property serves this purpose.

15. What should be the range of flash and fire point of hydraulic fluid?

The range of flash and fire point of hydraulic fluid should be high enough to prevent fire accident.

16. What will be the causes if the oil is too viscous?

- The viscous oil may not be able to pass freely through the pipes.
- The working temperature will increase because there will be internal friction.
- The consumption of power will increase.

17. What will be the causes if the oil is less viscous?

The less viscous oil will cause both internal and external leakages and also it cannot lubricate the moving parts properly.

18. List any two fire resistant fluids.

Water, Water Glycols, Water Oil Emulsion and Phosphate Esters.

19. What is Neutralization number?

The neutralization number is a measure of acidity or alkalinity of a hydraulic fluid. This is referred to as the PH value of the fluid.

20. What are the two factors responsible for the high responsiveness of hydraulic devices?

Multiplication of small forces and step less variable speed control are the factors responsible for the high responsiveness of hydraulic devices

21. List five fields of application where fluid power can be used more effectively.

Agriculture : Farm equipment
Construction: Earth moving equipment
Ships : Controllable pitch propellers
Aviation : Hydraulic retractable landing wheels
Defense : Missile launch systems, navigation controls

22. What are the four primary functions of hydraulic fluid?

A hydraulic fluid must be able to i) Transmit power ii) Lubricate moving parts iii) Seal the clearances between moving parts and iv) Dissipate heat.

23. What is Bulk modulus?

The Bulk Modulus is a measure of the degree of compressibility of the fluid and is the reciprocal of compressibility.

$$\text{Bulk Modulus } (\beta) = -\nu \frac{\Delta P}{\Delta \nu}$$

24. What are the broad tasks of hydraulic oil in a hydraulic machine?

- To transfer hydraulic energy
- To lubricate all parts
- To avoid corrosion
- To remove impurities and abrasion
- To dissipate heat

25. What is the use of finding Reynolds number?

The Reynolds number used to know whether the flow is laminar or turbulent.

26. Define the term Laminar flow.

In laminar flow, a particle of fluid in a given layer stays in that layer. This type of fluid motion is called as streamline flow because all the particles of fluid are moving in parallel paths.

27. Define the term Turbulent flow.

The movement of particles when it becomes random and fluctuates up and down in a direction perpendicular as well as parallel to the mean flow direction, it is named as turbulence.

28. Why should to have a proper size of pipes, valves and fittings in hydraulic systems?

Energy losses due to friction associated with the flow of a fluid inside a pipeline and also occur in valves and fittings. It is important to keep all energy losses in a fluid power system to a minimum acceptable level. This requires proper selection of the size of pipes, valves and fittings that make up the Hydraulic systems.

29. What are the important conclusion resulting from Reynolds' Experiment?

* If R is less than 2000, the flow is laminar.
* If R is greater than 4000, the flow is turbulent.
* If R is between 2000 and 4000, the flow covers a critical zone between laminar and turbulent flow. (State of flow transition)

30. What is the formula for calculating the K factor of a valve or fitting?

Head losses in valves and fitting are proportional to the square of the velocity of the fluid.

$$H_L = K \left(\frac{\nu^2}{2g}\right)$$

where, K – Loss co-efficient of the valve or fitting

31. What is the use of Darcy's Equation?

Darcy's equation can be used to calculate the head loss due to friction in pipes for both laminar and turbulent flow.

32. What is the formula for calculating Head loss(H_L) in a system?

$$H_L = f\left(\frac{L}{D}\right)\left(\frac{v^2}{2g}\right)$$

where f - Friction factor
L - Length of pipe
D - Pipe inside diameter
v - Average fluid velocity
g - Acceleration of gravity

33. What is the formula for calculating the equivalent length of a valve or fitting?

$$\text{Equivalent length of a valve or fitting } (L_e) = \frac{KD}{f}$$

34. Differentiate oil hydraulics and pneumatics.

Oil hydraulics employs pressurized liquid and pneumatics employs compressed air.

Oil hydraulics systems operate at pressures up to 200 bars or even much higher. Pneumatic systems operate in a pressure range of 5 to 10 bar.

Oil hydraulics systems are used in high load applications and accurate speed control or positioning is required. Pneumatic systems are used in low or medium load application and high velocities are required.

35. Why should a hydraulic fluid have good lubricating ability?

If the hydraulic fluid does not have good lubricating ability it will not lubricate moving parts properly, causing wear. Wear results in increased clearance, which leads to all sorts of operational difficulties including fall of efficiency.

36. Define the term pour point and it importance.

The temperature at which oil will congeal is referred to as the pour point, i.e. the lowest temperature at which the oil is stable to flow easily. It is of importance in cold countries where the system is exposed to very low temperatures. The pour point must be well below the minimum temperature expected in normal conditions.

37. Mention the advantages of the fluid power.

i. Multiplication of small forces to achieve greater forces for performing work.
ii. It easily provides infinite and step less variable speed control which is difficult to obtain from other drives.
iii. Accuracy in controlling small or large forces with instant reversal is possible with hydraulic system.

38. What are the types of fluid power system?

Fluid power system can be categorised in different ways,

i. Based on control system
ii. Based on the type of control.

39. List the three basic types of fluid power control system.

i. Fluid logic control ii. Electrical control iii. Electronic control

40. Define open loop control system.

Open loop system does not use feedback and performance is based on the characteristics of individual components of the system. The open loop system is not as accurate as closed loop system but the error can be reduced by careful calibration.

41. Define closed loop control system

Closed loop system uses feedback. The output of the system is fed back by a measuring element to comparator. The comparator compares the actual output to the desired and gives an error signal to the control element.

42. Define pour point.

The temperature at which oil will congeal is referred to as the pour point. That is the lowest temperature at which the oil is able to flow easily.

PART - B QUESTIONS

UNIT-I

1. Compare the use of fluid power to a mechanical system by listing advantages and disadvantages.
2. Comment on the difference between using pneumatic fluid power and hydraulic fluid power.
3. Explain the basic components of Hydraulic & Pneumatic system with neat sketch.
4. Explain the applications of Hydraulic & Pneumatic system.
5. Explain the primary functions of a Hydraulic fluid.
6. State Pascal's law and explain with neat diagram along with applications.
7. What are the desirable properties of hydraulic fluids? Discuss any eight of them in detail.
8. Compare and contrast hydraulic, pneumatic and electromechanical power systems.
9. Explain the working principle of positive displacement pumps.