2. Flush the entire hydraulic system, preferably with the same type of fluid to be used, before normal system operation is begun.

3. Filter the hydraulic oil before using, to minimise introducing contaminants into the system.

4. Provide continuous protection from airborne contamination by sealing the hydraulic system, or installing air filter/breather.

5. Clean or replace filter elements on a routine basis.

6. Maintain fluid viscosity and pH level within fluid suppliers' recommendations.

7. Minimise sources of water entry into the hydraulic system.

8. Avoid introducing thread sealants into the fluid stream.

HEAT EXCHANGERS:

The steady-state temperature of fluid of a hydraulic system depends on the heat-generation rate and the heat-dissipation rate of the system. If the fluid operating temperature in a hydraulic system becomes excessive, it means that the heat-generation rate is too large relative to the heat-dissipation rate. Assuming that the system is reasonably efficient, the solution is to increase the heat-dissipation rate. This is accomplished by the use of coolers, which are commonly called "heat exchangers."

In some applications, the fluid must be heated to produce a satisfactory value of viscosity. This is typical when, for example, mobile hydraulic equipment is to operate below 0°C. In these cases, the heat exchangers are called "heaters." However, for most hydraulic systems, the natural heat-generation rate is sufficient to produce high enough temperatures after an initial warm-up period.

Basically, there are two types of heat exchangers: Air cooled heat exchangers and Water cooled heat exchangers. Air coolers are used where water is not readily available and the air is at least 3° to 5°C cooler than the oil. But water coolers are more compact, reliable, and efficient and use simple temperature controls.

QUESTIONS FROM PREVIOUS YEAR QUESTION PAPERS:

DEC 2015/JAN 2016

1) With a neat sketch, explain the hydraulic circuit and laws plugged to develop the circuit.
2) What are the various functions performed by the hydraulic fluid and list its desirable properties and types of hydraulic fluid.
3) Explain Beta ratio and Beta efficiency.
4) Explain the common location of mounting filters in the hydraulic system.

JUNE/JULY 2016

1) Sketch and explain structure of a hydraulic control system.
2) What are the desirable properties of hydraulic oil? Explain them.
3) Sketch and explain full flow filter.

DEC 2016/JAN 2017

1) State Pascal's law. Explain its applications, with a neat sketch.
2) How are hydraulic seals classified? Explain positive and non-positive seals.
3) With the aid of sketches, explain the following: i) Return line filtering ii) Suction line filtering iii) Pressure line filtering

JUNE/JULY 2017

1) State Pascal's law. With a neat sketch explain basic hydraulic power system.
2) What are the desirable properties of hydraulic fluids? Explain briefly.
3) How hydraulic seals are classified? Explain any one method.
4) What is a filter? What are the methods of filtering? Explain briefly.

DEC 2017/JAN 2018

1) With a neat block diagram, explain the structure of hydraulic power system.
2) What are the advantages of hydraulic system?
3) Write any five desirable properties of a hydraulic fluid.
4) Explain three basic types of filtering methods used in hydraulic system.
5) Explain static seals and dynamic seals with examples.

JUNE/JULY 2018

1) State Pascal's law.

2) What is seal and what are its functions? Explain sealing devices used in hydraulic systems.

3) What is a filter and how they are classified?

ONE TIME EXIT SCHEME – APRIL 2018

1) Define hydraulic system. What are its advantages and disadvantages?

2) Draw a structure of hydraulic system and explain the parts.

3) For a simple hydraulic jack the following data is given. $F_1 = 100N$, $A_1 = 50cm^2$, $S_1 = 10cm$ Find load F_2 and displacement S_2 if area of piston that to be lifted is $500cm^2$. Also find energy input and energy output.

4) What are the desirable properties of hydraulic oils?

5) Sketch and explain different filtering systems in a circuit.

MODULE 2: PUMPS AND ACTUATORS

Pumps: Classification of pumps, pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders. Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flow rate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

PUMPS

A pump, which is the heart of hydraulic system, converts mechanical energy into hydraulic energy. The mechanical energy is delivered to the pump using a prime mover such as an electric motor. Due to the mechanical action, the pump creates a partial vaccum at its inlet. This permits atmospheric pressure to force the fluid through the inlet line and into the pump. The pump then pushes the fluid into the hydraulic system.

CLASSIFICATION OF PUMPS:

Pumps are broadly classified into two types

1) Dynamic (non-positive displacement) pumps
2) Positive displacement pumps

1) Dynamic (non-positive displacement) pumps: This type is generally used for low-pressure, high-volume flow applications. Because they are not capable of withstanding high pressures, they are of little use in the fluid power field. Normally their maximum pressure capacity is limited to 250-300psi. This type of pump is primarily used for transporting fluids from one location to another. The two most common types of dynamic pumps are the centrifugal and axial flow propeller pumps.

2) Positive displacement pumps: This type is universally used for fluid power systems. As the name implies, a positive displacement pump ejects a fixed amount of fluid into the hydraulic system per revolution of pump shaft rotation. Such a pump is capable of overcoming the pressure resulting from the mechanical loads on the system as well as the resistance to flow due to friction.

Positive displacement pumps are further classified into:

i) Fixed displacement pumps: It is the one in which the amount of fluid ejected per revolution (displacement) cannot be varied.

ii) Variable displacement pumps: In this type of pumps, the displacement can be varied by changing the physical relationships of various pump elements. This change in pump displacement produces a change in pump flow output even though pump speed remains constant.

The advantages of positive displacement pumps over non-positive displacement pumps are as follows:

1. They can operate at very high pressures of up to 800 bar (used for lifting oils from very deep oil wells).

2. They can achieve a high volumetric efficiency of up to 98%.

3. They are highly efficient and almost constant throughout the designed pressure range.

4. They are a compact unit, having a high power-to-weight ratio.

5. They can obtain a smooth and precisely controlled motion.

6. By proper application and control, they produce only the amount of flow required to move the load at the desired velocity.

7. They have a great flexibility of performance. They can be made to operate over a wide range of pressures and speeds.