



College of Engineering & Technology

Department: Mechanical Engineering Marks: 20
Lecturer: Dr. Rola Afify Time: 8:30 - 10:00
Course Code: ME464 Date: 8/5/2016

Name: **Model Answer**

R.N.:

Answer the following questions:

Question one (6 marks)

a) For Axial Piston pump (Bent-Axis design) when the cylinder block centerline is parallel to the drive shaft centerline, the produced flow is:

- i) **Zero** ii) Average iii) Maximum

b) Which type of Gears [**Spur**, Helical, Herringbone] is very noisy?
Which type develops excessive end thrust? **Helical**

e) Which of the following valves are used for Direction control?

- i- Needle valve
- ii- Pressure-reducing valve
- iii- Check valve**
- iv- Sequence valve
- v- Shuttle valve**
- vi- Unloading valve
- vii- Relief valve
- viii- Four-way, two position valve**

Question two (8 marks)

Find the number of pistons of an axial piston pump delivers $0.033 \text{ m}^3/\text{min}$ at 1000 rpm. The offset angle is set at 10° and the volumetric efficiency is 94%. 15-mm-diameter pistons arranged on a 125-mm-diameter piston circle.

$$Q_A = \eta_v \times Q_T = 0.033 \text{ m}^3/\text{min}$$

$$Q_T = Q_A / \eta_v = 0.0351 \text{ m}^3/\text{min}$$

$$Q_T = D \times A_p \times N \times Y \times \tan \theta = 0.0351 \text{ m}^3/\text{min}$$

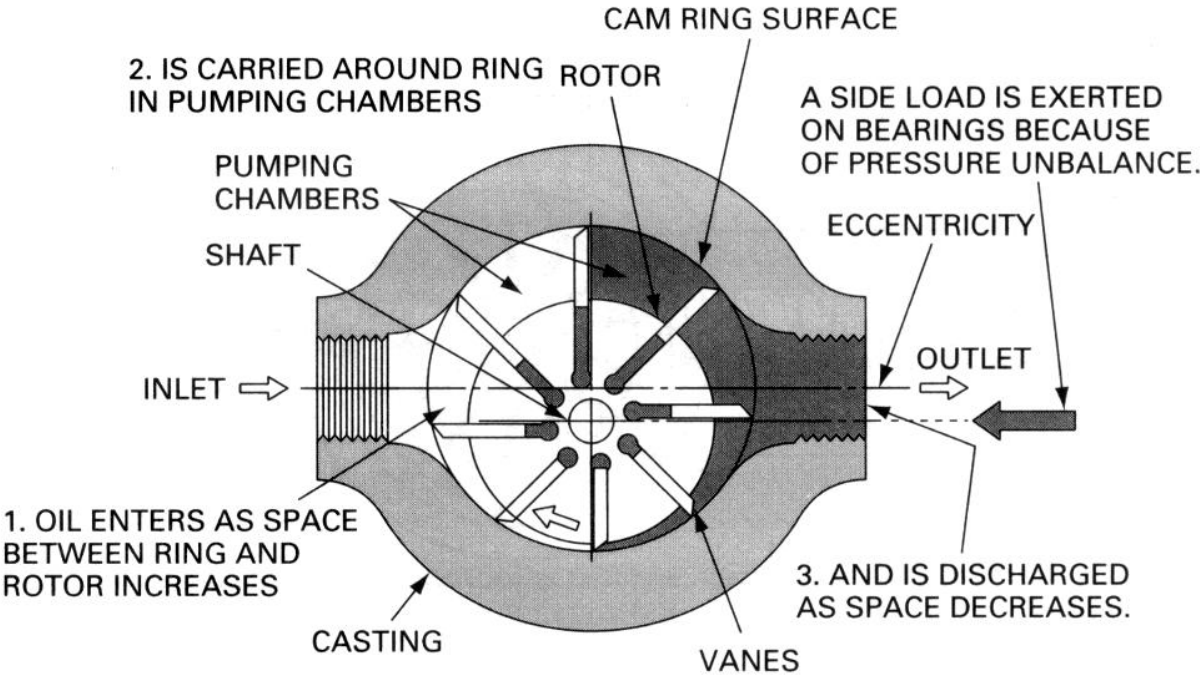
$$Y = 9 \text{ pistons}$$

B) Compare between Vane Pump and Piston Pump.

Vane Pumps

The Rotor, which contains Radial Slots, is splined to the Drive Shaft and Rotates inside a Cam Ring. Each Slot contains a Vane designed to mate with the surface of the Cam Ring as the Rotor Turns. Centrifugal Force keeps the Vanes Out against the Surface of the Cam Ring. During One-Half Revolution of Rotor Rotation, the Volume increases between the Rotor and Cam Ring. The resulting Volume Expansion causes a Reduction of Pressure. This is the Suction Process, which causes Fluid to Flow through the Inlet Port and Fill the Void. As the Rotor Rotates through the

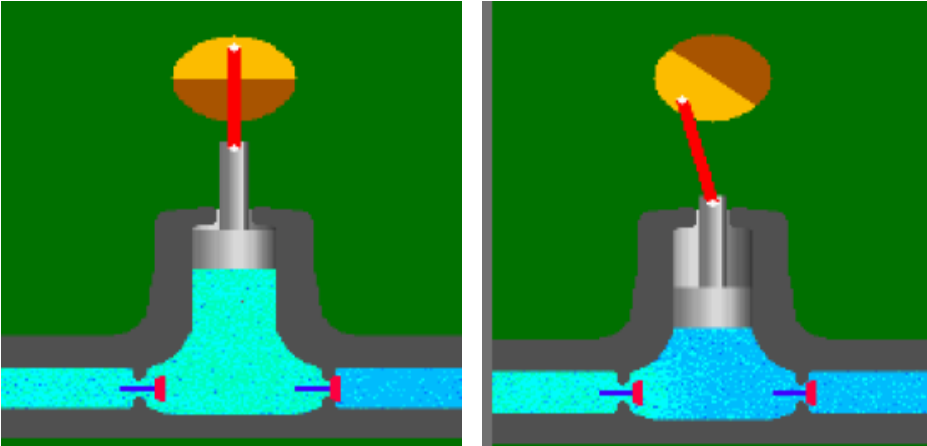
Second Half Revolution, the Surface of the Cam Ring pushes the Vanes Back into their Slots, and the Trapped Volume is reduced. This Positively ejects the Trapped Fluid through the Discharge Port.



$$V_D = \frac{\pi}{2} (D_C + D_R)eL$$

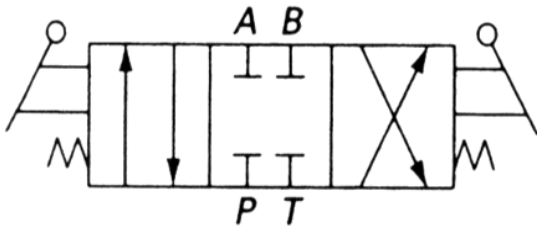
Piston Pumps

A Piston Pump works on the Principle that a Reciprocating Piston can draw in Fluid when it retracts in a Cylinder Bore and Discharge it when it extends. The basic question is How to Mechanize a Series of Reciprocating Pistons. There are Two Basic Types of Piston Pumps. One is the Axial Design, having Pistons that are parallel to the Axis of the Cylinder Block. Axial Piston Pumps can be either of the Bent Axis Configuration or of the Swash Plate Design. The Second Type of piston pump is the Radial Design, which has Pistons arranged radially in a Cylinder Block.

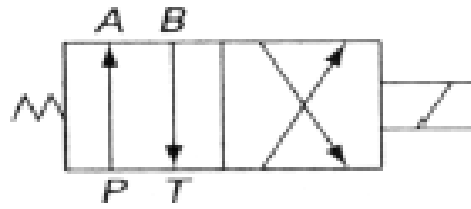


Question three (6 marks)

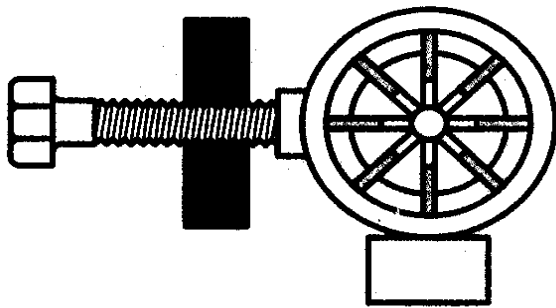
Write down the words that represent the name of each of the following:



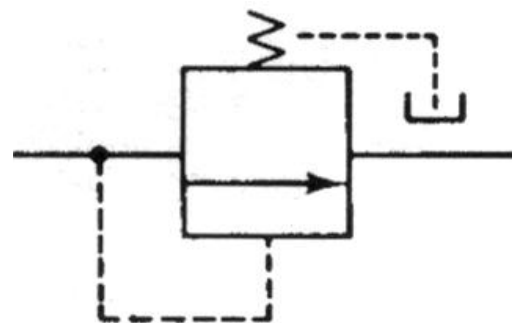
Manually Actuated Spring-Centered, Three-Position, Four-Way Valve



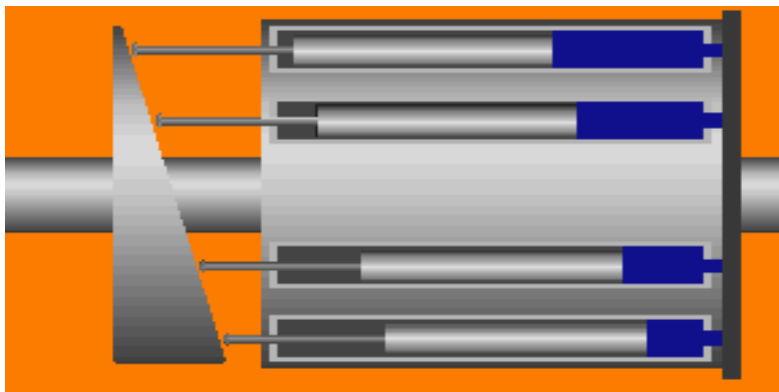
A single solenoid-actuated four-way, two-position, spring-offset, directional control valve



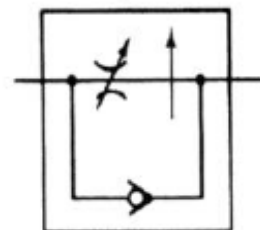
The Flow of a Variable Displacement Pump can be varied by Using the Adjustment Screw off stroke



Sequence Valve



Swash Plate Design Axial Piston Pump



Pressure-Compensated Valve