College of Engineering & Technology

Department: Mechanical Engineering	Marks: 20
Lecturer: Dr. Rola Afify	Time: 8:30 - 10:00
Course Code: ME464	Date: 4/5/2016

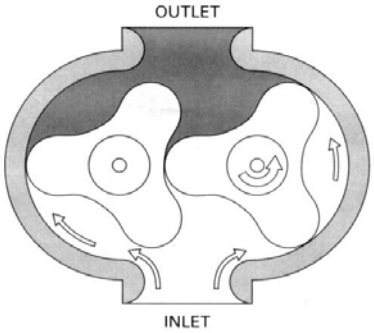
20

Name: **Model Answer** R.N.:

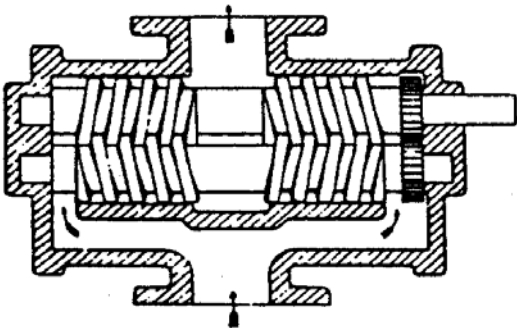
Answer the following questions:

Question one (8 marks)

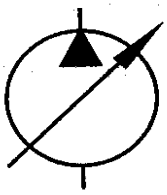
Write down the words that represent the name of each of the following:



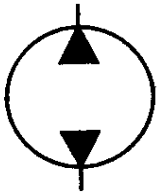
Lobe Pump



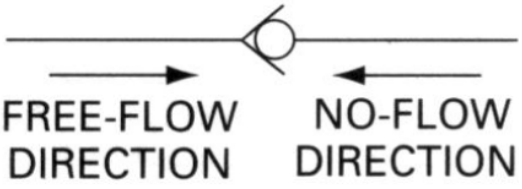
Screw Pump



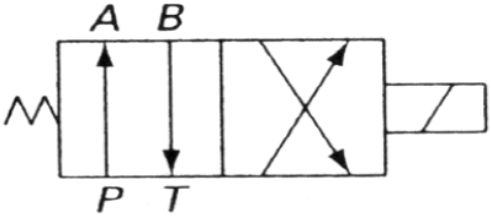
Uni-directional variable displacement



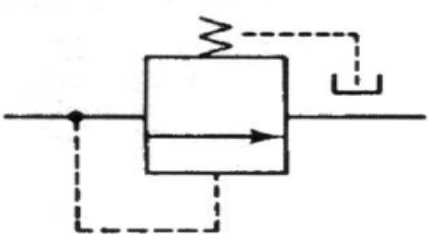
Bi-directional fixed displacement



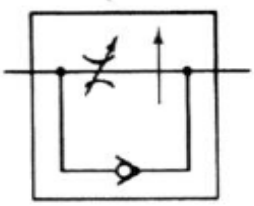
Check Valve



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



Sequence Valves



Pressure-Compensated Valves

Question two (6 marks)

a) What is the function of:-

Check Valve

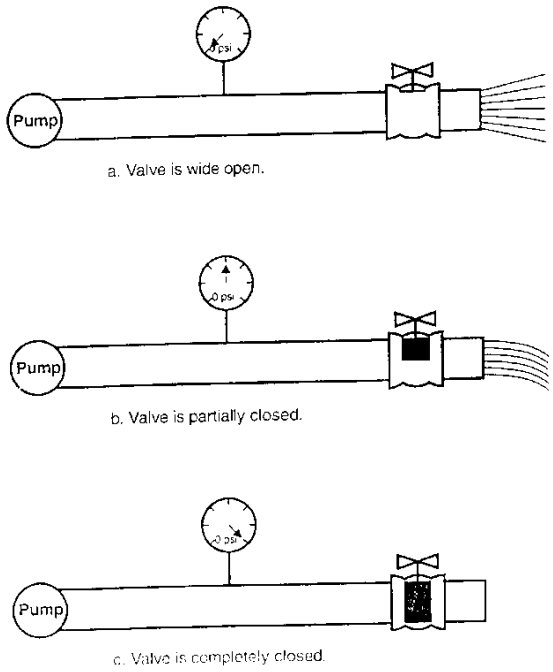
It permits free flow in one direction and prevent any flow in the opposite direction.

Relief valve

It permits flow through the outlet to the tank as long as this high pressure level is maintained.

Needle Valve

It regulates the speed of hydraulic cylinders and motors by controlling the flow-rate to these actuators.



b) Prove that Pumps Do Not Pump Pressure, instead they produce Fluid Flow.

If a Positive Pump has its Discharge Line opens to the Atmosphere, there will be Flow, but there will be No discharge Pressure above Atmospheric because there is essentially no Resistance to Flow. If the Discharge Line is blocked, then we have Theoretically Infinite Resistance to Flow. Hence, there is No Place for the Fluid to go. The Pressure will therefore Rise until some Component Breaks unless Pressure Relief is provided. This is the Reason a Pressure Relief Valve is needed when a Positive Displacement Pump is used. When the Pressure reaches a Set Value, the Relief Valve will open to allow Flow Back to the oil Tank. A Pressure Relief Valve determines the Maximum Pressure Level that the System will Experience regardless of the magnitude of the load Resistance.

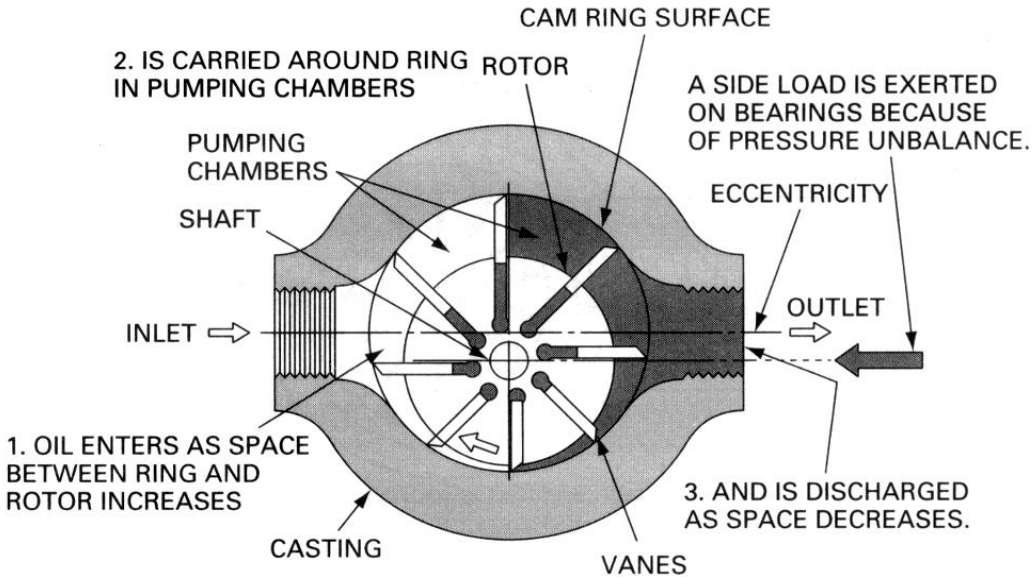
Question three (6 marks)

Compare between Vane Pump and Radial 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.

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



Radial Piston Pump

This Design consists of: A Pintle to Direct Fluid In and Out of the Cylinders, A Cylinder Barrel with Pistons, and A Rotor containing a Reaction Ring. The Pistons Remain in Constant Contact with the Reaction Ring due to Centrifugal Force and Back Pressure on the Pistons. For Pumping Action, the Reaction Ring is Moved Eccentrically with respect to the Pintle or Shaft Axis. As the Cylinder Barrel Rotates, the Pistons on One Side travel outward. This Draws in Fluid as Each Cylinder passes the Suction Ports of the Pintle.