15

College of Engineering & Technology

Department: Mechanical Engineering Marks: 15
Lecturer: Dr. Rola Afify Time: 9:30- 10:10
Course Code: ME464 Date: 23/3/2016

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

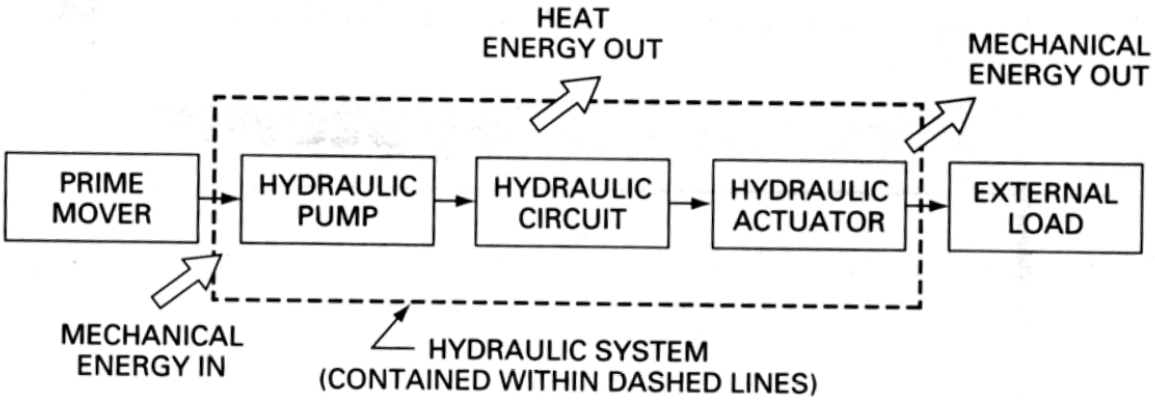
Answer the following questions:

Question one (7 marks)

A) What are the functions of Hydraulic Fluid?

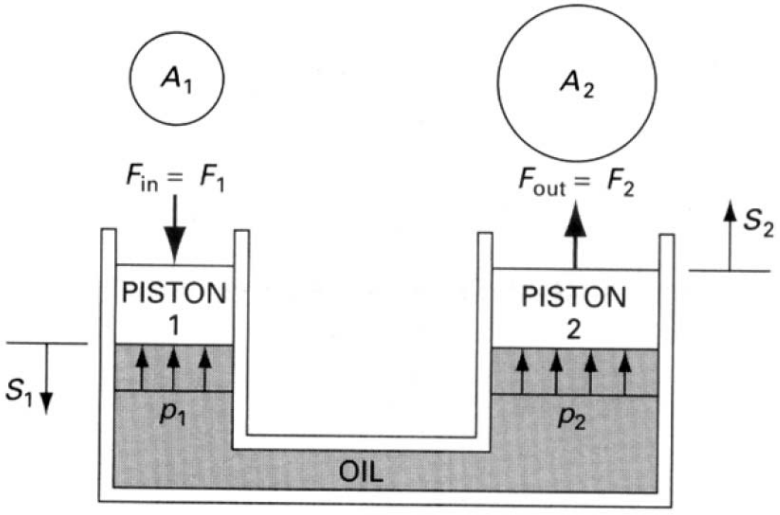
1 – Transmit power.
2 – Lubricate moving parts
3 – Seal clearances between mating pats.
4 – Dissipate heat.
5 – Prevent corrosion.

B) Draw the Block Diagram of Hydraulic System Showing Major Components showing how Energy is transferred throughout a Hydraulic System.



Question two (8 marks)

A) Prove the Conservation of Energy Law.



Operation of Simple Hydraulic Jack

By Pascal's Law, $p_1 = p_2$.

$$(F_1/A_1) = (F_2/A_2)$$
$$(F_2/F_1) = (A_2/A_1) \qquad (1)$$

A Force Multiplication occurs from the Input to the Output of the Jack if the Output Piston Area is greater than the Input Piston Area.

The cylindrical volume of oil displaced by the input piston equals the cylindrical volume displaced by the output piston:

$$V_1 = V_2$$
$$A_1S_1 = A_2S_2$$

S_1 = Downward movement of piston 1,
S_2 = Upward movement of piston 2.

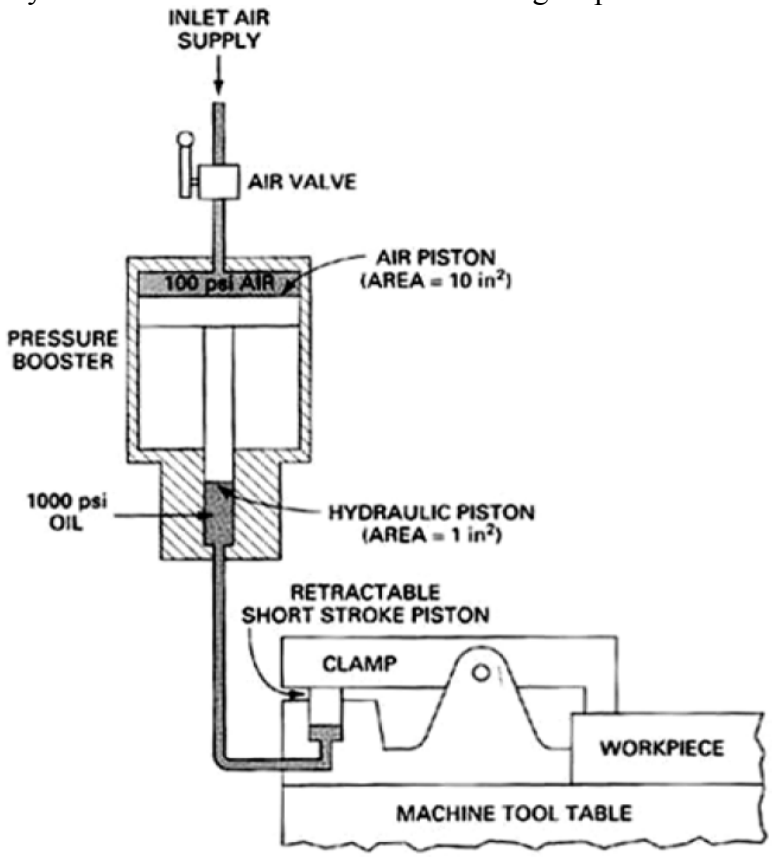
$$(S_1/S_2) = (A_2/A_1) \qquad (2)$$

Combining Eq. (1) and (2) yields the corresponding relationship

$$(F_1/F_2) = (S_1/S_2)$$
$$F_1S_1 = F_2S_2 \qquad (3)$$

The Energy Input to the Hydraulic Jack equals the Energy Output from the Jack.

B) Sketch Air-to-Hydraulic Pressure Booster with declaring its pressure ratio.



$$\text{pressure ratio} = \frac{\text{output oil pressure}}{\text{input air pressure}} = \frac{\text{area of air piston}}{\text{area of hydraulic piston}}$$

$$\text{pressure ratio} = \frac{1000\ \text{psi}}{100\ \text{psi}} = \frac{10\ \text{in}^2}{1\ \text{in}^2} = 10$$