COLLEGE OF ENGINEERING & TECHNOLOGY

Department : MECHANICAL ENGINEERING

Lecturer : Dr. Ashraf, Dr. Rola and Dr. Shoier Course : Hydraulic Systems

Course No. : ME 464 Marks : 40

Date : 28/05/2016 Time : 2 hours

FINAL EXAMINATION PAPER

Question (1)

a) Name two advantages and two disadvantages that air have in comparison to oil when used in a fluid power system. [2 marks]

b) Differentiate between gage and absolute pressures. [2 marks]

c) Relative to power, there is an analogy between mechanical, electrical, and hydraulic systems. Describe this analogy (mention rule for each). [2 marks]

d) Figure (1) shows a mechanical/ hydraulic system used for clamping a cylindrical workpiece during a machining operation. If the machine operator applies a 100 N force to the lever as shown, what clamping force is applied to the workpiece? [4 marks]

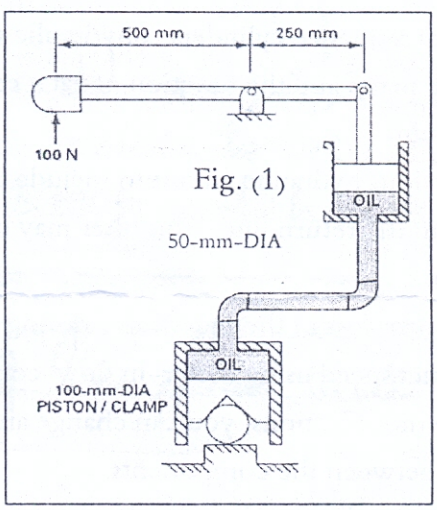

Fig. (1)

Question (2)

a) What is a positive displacement pump? In what ways does it differ from a centrifugal pump? Clarify the difference by drawing. [2 marks]

b) What is the deference between pump displacement and pump flow rate? Mention the rules for both. [2 marks]

c) Draw hydraulic symbols for the following pumps: Internal gear pump, bidirectional balanced vane pump, unidirectional variable displacement piston pump. [3 marks]

d) A pump has a displacement volume of 98.4 cm^3. It delivers 0.00152 m^3/ s of oil at 1000 rpm and 70 bars. If the prime mover input torque is 124.3 N · m.

i). What is the overall efficiency of the pump?

ii). What is the theoretical torque required to operate the pump? [3 marks]

Question (3)

a) Draw the hydraulic symbols for the following:

- Pressure compensated flow control valve.
- Pilot operated check valve (signal to close).
- Solenoid-actuated, four-way, three-position, spring-~~offset~~ Centered. directional control valve.
- Pressure counterbalance valve [4 marks]

b) Compare between the following valves, and draw their symbols. [2 marks]

- Relief Valve.
- Reducing Valve.

c) A hydraulic motor has a displacement of 164 cm^3 and operates with a pressure of 70 bars and a speed of 2000 rpm. The actual flow rate consumed by the motor is 0.006 m^3/s and the actual torque delivered by the motor is 170 N.m. Find the volumetric, mechanical, and overall efficiencies and the actual power delivered by the motor. [4 marks]

Question (4)

a) A pressure relief valve has a pressure setting of 140 bars. Compute the kW power loss across this valve if it returns all the flow back to the tank from a 0.0016- m^3/s pump. [2 marks]

b) In order to control sequence cylinders, a hydraulic system, shown in the fig. (2), is used.

i). Write down the name and the function of each component and explain the operation of the hydraulic circuit.

ii). Modify the previous hydraulic circuit to include the following improvements:

- Reinstall a filter in the return line. This filter may be blocked with oil contamination at any instant during operation.
- Eliminate the power-lost in the relief valve during the locked position.
- Control the retract speed using meter-in flow-control-valve.

To accomplish these modifications, you can change an existing valve, add new valves and/or modify the connecting way between the components.

Draw the modified hydraulic circuit and write the name and function of each component. [8 marks]

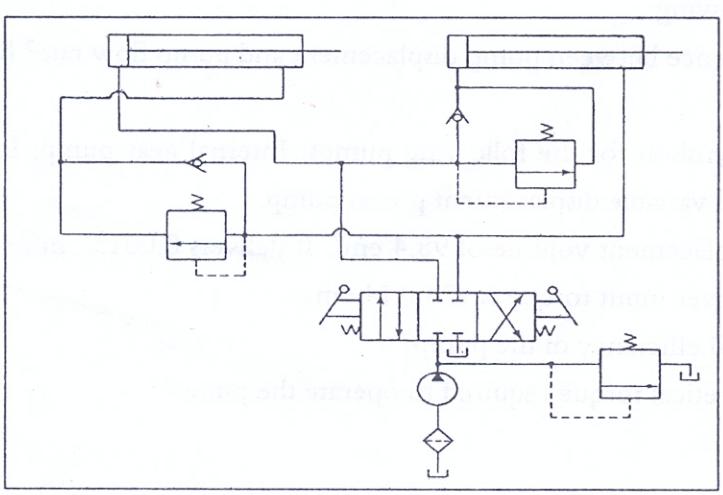

Fig. (2)

Good Luck