TERTIARY AND VOCATIONAL EDUCATION COMMISSION

Fluid Power Technology
NVQ Level 5 Semester l Examination

Hydraulics – E40C00M07

Instructions to Candidates:

Answer any five (05) questions.

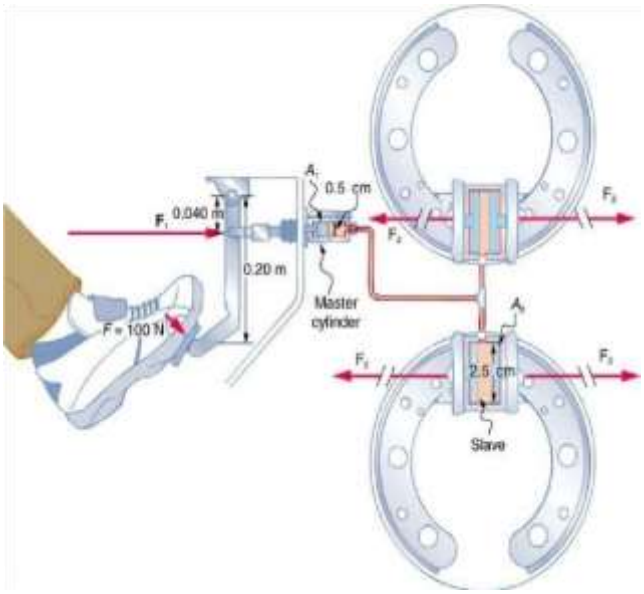
Time: 03 hours **Total Marks: 100**

Q1

(i) State the Pascal's law. (02 marks)

(ii) A force of 100 N is applied to the brake pedal as shown in Fig 1, which acts on the cylinder-called the master-through a lever. A force of F_1 is exerted on the master cylinder. Pressure created in the master cylinder is transmitted to four so- called slave cylinders. The master cylinder has a diameter of 0.5cm, and each slave cylinder has a diameter of 2.5cm. Calculate the forces F_1 and F_2.

(05 marks)



(Fig 1)

(iii)Briefly discuss the Archimedes' principle using suitable diagram.

(03 marks)

(iv)With reference to filters, explain each of the following terms

a. Surface Filters
b. Depth Filters
c. Normal Rating
d. Absolute Rating
e. Beta (β) Rating

(10 Mark)

Q2

A. Two identical double acting hydraulic cylinders are powered by a hydraulic power pack, where the said cylinders are synchronized by connecting them in parallel connection. The load acting on each cylinder is 4000 N. Cylinders has the piston diameter of 50 mm and rod diameter of 20 mm. The cylinders extend 200 mm in 0.05 seconds.

Find the following by drawing a neat sketch consisting of the cylinders & the hydraulic power pack.

Find the following:

i) The pressure requirements of the pump.
ii) Flow capacity of the pump.
iii) Pump output.
iv) Capacity of motor driving pump if overall efficiency of pump is 80%.

Assume the power pack consist of the reservoir, control valves, safety valves, pump, electric motor and other necessary equipment to function the cylinders as required.

B. State at least 3 main features of following pumps
   a. Gear Pumps
   b. Vane Pumps
   c. Piston Pumps
C. Name five different applications of Hydraulics used by different industries.

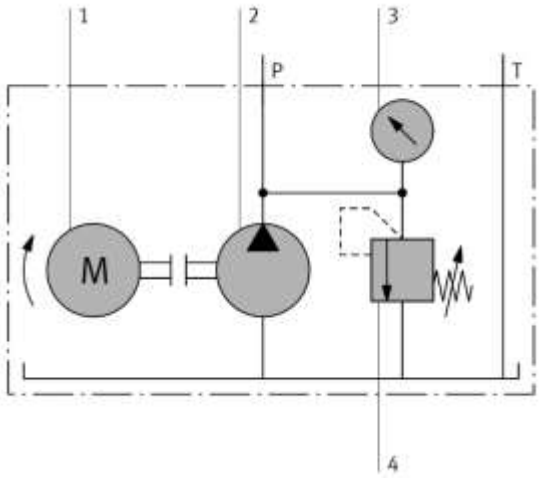


Figure 1

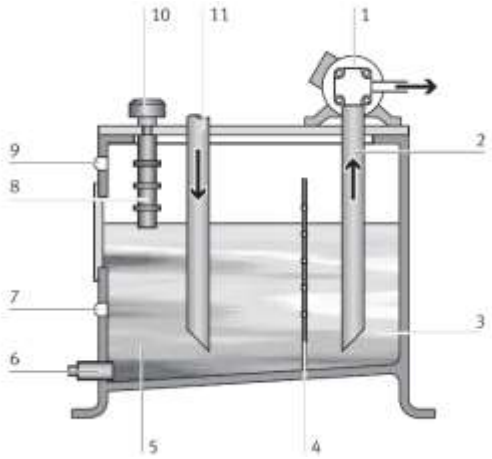


Figure 2

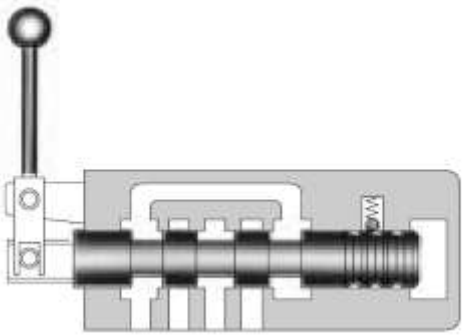
[20 Marks]

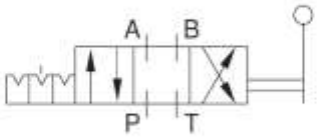
Q3

a) Name the circuit symbols (No.1-4) shown in figure 1 and briefly describe the function of its components
b) Match up the individual components of the hydraulic power unit with the corresponding numbers in the Figure 2
c) Draw, using standard symbols, a circuit diagram to represent a hydraulic circuit operating a single-ended double-acting cylinder consisting of the following components

- Reservoir
- Suction line Filter
- Electric motor
- Fixed Displacement pump
- Pressure relief valve
- Pressure gauge
- 4/2, Manual operated, spring return, directional control valve
- Single ended double acting cylinder

d) Compare the characteristics of a Gear Pump & a Piston Pump
e) Name the valve shown bellow





Graphic Symbol

[20 Marks]

Q4

a. Explain, Fully (In point Form), the function of each of the following pressure control Valves in a hydraulic circuit & state an Application of Each
   (i) Counterbalance Valve
   (ii) Sequence Valve
   (iii) Unloading Valve

b. State the differences between the following methods of flow control & give with reasons, two applications where each would use.
   (i) Meter-In
   (ii) Meter-Out

[20 Marks]

Q5

(i) Name each 5 disadvantages of pneumatic and hydraulic systems.

(ii) Name each 5 advantages of pneumatic and hydraulic systems.

(iii) List 5 applications where hydraulic power can be used more effectively than other power sources.

(iv) List the main 8 components of hydraulic circuit system and their function

(v) State why the flow velocity of hydraulic fluid in a system must be kept within specified limits

[20 Marks]