(4 + (3 + 5) = 12)

7. (a)   What is meant by 'cylinder synchronizing'? What are the conditions for cylinder synchronization in parallel configuration?

   (b)   Explain (with diagram) the sequencing operation of two cylinders in a hydraulic circuit.

   ((2+ 3) +7)=12

Group – E

8. (a)   (i)   Discuss the advantages and disadvantages of pneumatic system compared to hydraulic system.

       (ii)   What are the factors need to consider while selecting pipe and other air line installations in pneumatic system?

   (b)   Draw a pneumatic circuit diagram for operation of a single acting cylinder and discuss about its performance.

   ((4 + 3) + 5) =12

9. (a)   Explain the working principle of relays with suitable diagrams.

   (b)   What is the function of pressure switch. Draw the symbols of different limit switches.

   6 +(2 + 4)=12

FLUID POWER CONTROL
(MECH 3131)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   'Power Pack' is a component of
           (a) Electrical system   (b) Hydraulic system
           (c) Pneumatic system   (d) Mechanical system.

    (ii)   For a simple hydraulic jack, output is gained as multiplication of
           (a) flow rate   (b) pressure   (c) power   (d) force.

    (iii) Cushioning in hydraulic cylinder is done to
           (a) prevent shock due to stopping loads at the end of the piston stroke
           (b) prevent heat due to seal friction
           (c) increase the velocity of the cylinder
           (d) prevent overloading of the cylinder.

    (iv)   The ideal flow rate from a gear pump is a function of
           (a) pressure head   (b) discharge valve opening
           (c) rotational speed of the gears   (d) both (a) and (b).

    (v)   A shoe plate is a component attached to _____ pump.
           (a) gear   (b) vane
           (c) inline axial piston pump   (d) radial piston pump.

    (vi)   A pressure relief valve is normally
           (a) open type   (b) closed type
           (c) both (a) and (b)   (d) blocked.

    (vii) Regenerative circuit is used to _____ the cylinder speed during _____ stroke.
           (a) decrease, extension   (b) increase, extension
           (c) increase, retraction   (d) decrease, retraction.

(viii)   A meter-out circuit controls the speed of a cylinder during
(a) retraction stroke   (b) extending stroke
(c) both (a) and (b)   (d) unloading.

(ix)   The lubricator used in FRL unit follows the principle of
(a) rotameter   (b) venturimeter
(c) flow-nozzle   (d) orificemeter.

(x)   In an axial piston motor, the piston
(a) reciprocates parallel to the axis of the cylinder block.
(b) reciprocates perpendicular to the axis of the cylinder block.
(c) reciprocates at any angle to the axis of the cylinder block.
(d) rotates about the axis of the cylinder block.

Group – B

2. (a)   For a simple hydraulic jack, derive the force-displacement relationship with area ratio of input and output piston.
With a neat sketch, explain the operation of a hand operated hydraulic jack.

(b)   For the hydraulic system shown in Figure 1, the following data are given:
The pump is adding 4 kW to the fluid (i.e., the hydraulic power of the pump).
The pump flow is 0.002m³/s. The pipe has an inside diameter of 25 mm.
The specific gravity of oil is 0.9.
Point 2 is at an elevation of 0.6 m above the oil level, that is, point 1.
The head loss due to friction in the line between points 1 and 2 is 10 m.
Determine the fluid pressure at point 2, the inlet to the hydraulic motor. Neglect the pressure drop at the strainer. The oil tank is vented to atmosphere.
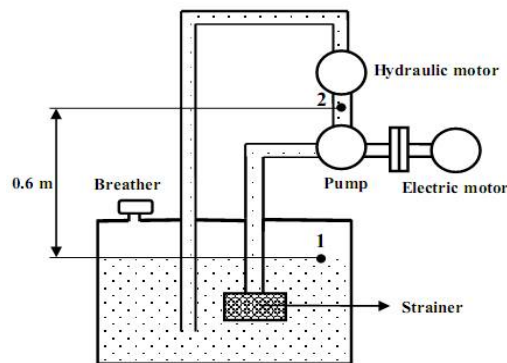

Figure 1

(2 + 4) + 6 =12

3. (a)   Explain with neat sketch, the application and working principle of a piston pump used in fluid power systems.

(b)   Draw the performance curves of a positive displacement rotary pump and mention the factors affecting the actual flow rate.

7 + 5 =12

Group – C

4. (a)   A hydraulic motor has a 100 cm³ volumetric displacement. If it has a pressure rating of 140 bar and receives oil from a 0.001m³/s theoretical flow rate pump, find the
(i) motor speed in rpm
(ii) theoretical torque
(iii) theoretical output power in kW.
Why does a hydraulic motor deliver less torque than it should theoretically?

(b)   (i) With sketches, differentiate between second and third-class lever systems used with hydraulic cylinders to drive loads.
(ii) A hydraulic cylinder is to compress a body down to bale size in 10 sec. The operation requires a 3 m stroke and a 40000 N force. If a 10 MPa pump has been selected, assuming the cylinder to be 100% efficient, find the required piston area, the necessary pump flow rate and the hydraulic power delivered to the cylinder.

(3 + 2) + (4 + 3) =12

5. (a)   Explain the working principle of pressure reducing valve with symbol.

(b)   Why a pressure relief valve is employed in a fluid circuit? Draw the ANSI symbol of a pressure relief valve.

(7+ (3+2))=12

Group – D

6. (a)   How unloading valve saves power consumption during a fluid power circuit operation?

(b)   Why a check valve is incorporated in parallel with a flow control valve? Sketch a meter-in circuit with ANSI symbols and briefly explain the speed control of hydraulic cylinder using the circuit.