(vii) A double acting cylinder
(a) has rod at both ends
(b) area ratio of 2
(c) use fluid power in both directions
(d) has two pump connections.

(viii) A Meter-out circuit
(a) controls the oil flow rate into the cylinder
(b) controls the oil flow rate out of the cylinder
(c) keeps the oil flow rate into the cylinder constant
(d) none of the above.

(ix) An electrical relay is actuated by
(a) electromagnet
(b) external force
(c) hydraulic pressure
(d) temperature differential.

(x) 4 way direction control valve has
(a) 4 ports
(b) 4 position
(c) 4 actuators
(d) none of these.

Group – B

2. (a) Define the term 'Fluid Power'. Briefly discuss the components used in Fluid Power system.

(b) An automobile lift raises a 15600 N car, 2.13 m above the ground floor level. If the hydraulic cylinder contains a piston of diameter 20.32 cm and a rod of diameter 10.16 cm, determine the
(i) Work necessary to lift the car.
(ii) Required pressure.
(iii) Power needed if the lift raises the car in 10 sec.
(iv) Descending speed of the lift for 0.000629 m³/s flow rate at the rod end.
(v) Flow rate at the rod end, for the lift to descend in 10 sec.
(2 + 5) + 5 = 12

3. (a) With a sketch, explain the working principle of a vane pump.

(b) What is slippage loss in gear pumps?

(c) 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 hyd motor. Neglect the pressure drop at the strainer. The oil ta vented to atmosphere.
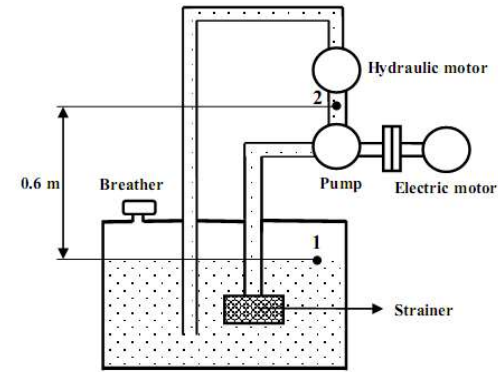

Figure 1

4 + 3 + !

Group – C

4. (a) What is the difference between a single-acting and a double-hydraulic cylinder?

(b) With sketch, differentiate between First and Second-class systems used with hydraulic cylinders to drive loads.

(c) A hydrostatic transmission operating at 105 bar pressure ha following characteristics:

Pump	Motor
$V_d = 100 \text{ cm}^3$	$V_d = ?$
$\eta_v = 85\%$	$\eta_v = 94\%$
$\eta_m = 90\%$	$\eta_m = 92\%$
$N = 1000\text{rpm}$	$N = 600 \text{ rpm}$

Find the (i) volumetric displacement (V_d) of motor and (ii) output torque.

1 + 4 + (4 + 3

5. (a) With a graphical symbol, explain the operation of a 4 way 3 po direction control valve.

(b) Briefly discuss the basic principle of operation of a pressure compensated flow control valve. What is the importance of an unloading valve?

6 + (5 + 1) = 12

Group – D

6. (a) A double acting cylinder is hooked up in the regenerative circuit. The relief valve is set at 100 bar. The piston area is 130 cm² and the rod area is 60 cm². If the pump flow is 100 litre/min, find the cylinder speed and load-carrying capacity during (i) extending stroke, (ii) retracting stroke. Also, draw the regenerative circuit diagram for solving the problem.

(b) Describe the operation of pump unloading circuit with a circuit diagram.

6 + 6 = 12

7. (a) With neat sketch, explain the Meter-in circuit for speed control of hydraulic cylinder.

(b) Draw the ANSI symbols of the following components:
(i) Adjustable flow control valve, (ii) Pressure Relief Valve, (iii) Shuttle valve.

6 + 6 = 12

Group – E

8. (a) Discuss the advantages and disadvantages of pneumatic system compared to hydraulic system.
What are the functions of Air-filters used in pneumatic system?

(b) List the components of Piston type reciprocating compressor used in pneumatic system.

(6 + 2) + 4 = 12

9. (a) Write short notes on the following switches used in electrically controlled fluid power circuits.
(i) limit switch, (ii) Push button switch

(b) With a diagram, explain the control of a double acting cylinder, using a single solenoid valve and a single limit switch.

(2 + 2) + 8 = 12

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) Source for generating pressurized oil is called
(a) hydraulic pump   (b) hydraulic actuator
(c) hydraulic motor   (d) power pack.

(ii) The pumps used in fluid power system are
(a) centrifugal pumps   (b) axial flow pumps
(c) positive displacement pumps   (d) all of the above.

(iii) A simple hydraulic jack is a multiplier of
(a) flow rate   (b) pressure   (c) power   (d) force.

(iv) A check valve allows flow in
(a) two directions   (b) three directions
(c) one direction   (d) different directions.

(v) Cushioning in hydraulic cylinder is done to
(a) prevent shock 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.

(vi) The pressure relief valve
(a) sets the maximum system pressure
(b) sets the minimum system pressure
(c) sets the maximum system flow
(d) sets the minimum system flow.