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) Pneumatics and Hydraulics require following component to direct and regulate the flow
(a) energy sources (b) control valves
(c) air receiver (d) actuators.

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

(iii) Pump slippage in external gear pump is related to
(a) internal leakage (b) external leakage
(c) both (a) and (b) (d) no leakage.

(iv) A hydraulic actuator is used to convert
(a) pressure energy to mechanical energy
(b) mechanical energy to pressure energy
(c) pressure energy to kinetic energy
(d) kinetic energy to pressure energy.

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

(vi) Three way Direction Control valve is used to control
(a) double acting cylinder (b) single acting cylinder
(c) both (a) and (b) (d) unloading valve.

(vii) Speed of a hydraulic motor depends on
(a) flow rate of oil (b) pressure of oil
(c) viscosity of oil (d) density of oil.

(viii) A pressure reducing valve is normally
(a) open type (b) closed type
(c) both (a) and (b) (d) same as Pressure Relief Valve.

(ix) Push button switches are used in
(a) Mechanically controlled fluid power circuits
(b) Manually controlled fluid power circuits
(c) Electrically controlled fluid power circuits
(d) both (a) and (c).

(x) A Flow Control Valve generally includes a check valve for
(a) better accuracy (b) pressure compensation
(c) free flow in opposite direction (d) safety against high pressure.

Group – B

2. (a) An automobile lift raises a 20 kN car, 2 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 s.
(iv) Descending speed of the lift for 0.0008 m^3/s flow rate at the rod end.
(v) Flow rate at the rod end, for the lift to descend in 10 s.

(b) With sketch, explain the working principle of external gear pump for hydraulic systems.

5 + 7 = 12

3. (a) Define hydraulic power. Obtain its expression in terms of flow rate and pressure of the system. With a neat sketch, explain the operation of a hand operated hydraulic jack.

(b) Oil with specific gravity 0.8 enters a tee, as shown in Fig.1, with velocity V = 6 m/s. The diameter at section 1 is 10 cm, the diameter at section 2 is 7 cm and the diameter at section 3 is 6 cm. If equal flow rates are to occur at sections 2 and 3, find the velocities V_2 and V_3.

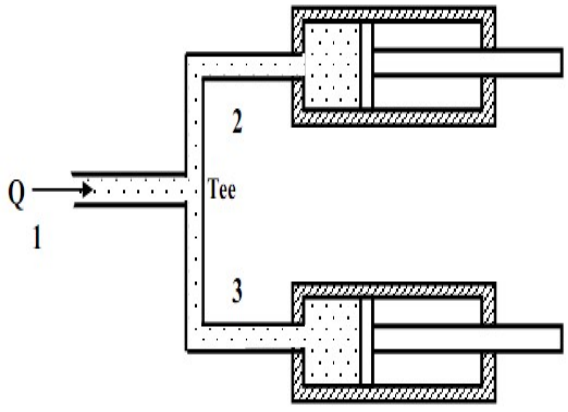

Fig.1

(1 + 2 + 5) + 4 = 12

Group – C

4. (a) Differentiate between a hydraulic pump and a hydraulic motor. Define Volumetric efficiency and mechanical efficiency of a hydraulic motor.

   (b) For the crane system, determine the hydraulic cylinder force required to lift a 2000 N load.

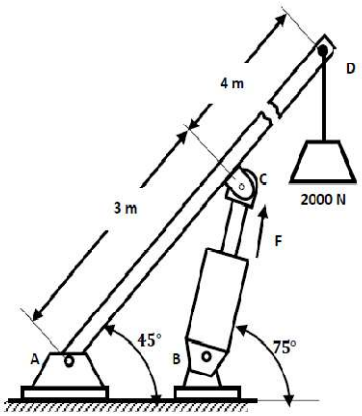

Fig.2

(2 + 4) + 6 = 12

5. (a) Classify Direction Control Valves.
   Illustrate with symbol: (i) 3 way Direction Control valve, (ii) 4 way Direction Control valve.

   (b) Explain the operation of a Pressure Relief valve.

(2 + 3 + 3) + 4 = 12

Group – D

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

   (b) Draw circuit diagram for: (i) Double acting cylinder control, (ii) Speed control of a hydraulic motor.

3 + (4 + 5) = 12

7. (a) With neat sketch, explain the Double pump hydraulic system.

   (b) What is meant by (i) Spring-centered DCV (ii) Spring-offset DCV.

6 + (3 + 3) = 12

Group – E

8. (a) Discuss the advantages and disadvantages of pneumatic system compared to hydraulic system. What are the functions of pressure regulator and lubricator used in pneumatic system?

   (b) Draw a pneumatic circuit for operation of single acting cylinder.

(6 + 2) + 4 = 12

9. (a) Write short notes on: (i) Relays (ii) Solenoid.

(b) Briefly describe a hydraulic circuit for the reciprocation of a cylinder using pressure or limit switches.

(3 + 3) + 6 = 12

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