
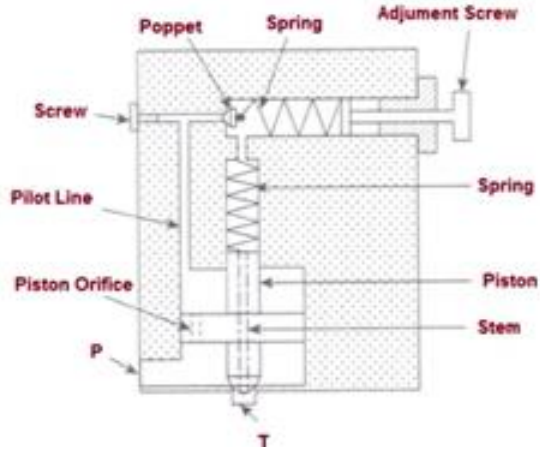
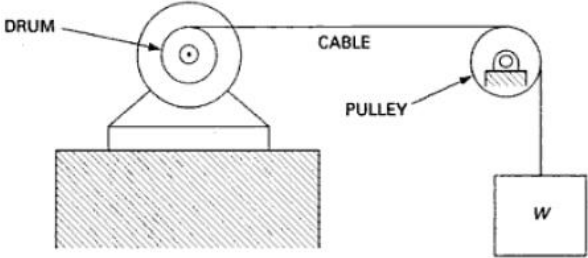


Name:			
Enrolment No:			
UPES End Semester Examination, May 2024			
Course: Hydraulics and Pneumatics Program: B.Tech Mechatronics Course Code: MECH3029		Semester: VI Time : 03 hrs. Max. Marks: 100	
Instructions: Assume suitable value of parameters/variables if not given in any question.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Draw the graphical symbol of the following hydraulic components. (i) counterbalanced valve (ii) sequence control valve (iii) 4/3 solenoid operated tandem position direction control valve (iv) pilot-operated check valve	4	CO1
Q 2	Classify different types of control valves.	4	CO1
Q 3	Explain the purpose and functioning of cylinder cushions.	4	CO1
Q 4	A hydraulic motor has an 82 cm ³ volumetric displacement. if it has a pressure rating of 70 bars and it receives oil from a 0.0006 m ³ /s theoretical flow rate pump, find the motor (a) speed (b) theoretical torque (c) theoretical power	4	CO2
Q 5	Describe the primary functions of hydraulic circuit design and pneumatic circuit design.	4	CO4
SECTION B (4Qx10M= 40 Marks)			
Q 6	A pressure relief valve contains a poppet with a 4.20 cm ² area on which system pressure acts. During assembly, a spring with a spring constant of 3200 N/cm is installed in the valve to hold the poppet against its seat. The adjustment mechanism is then set so that the spring is initially compressed 0.50 cm from its free length condition. In order to pass full pump flow through the valve at the PRV pressure setting, the poppet must move 0.30 cm from its fully closed position. Determine (a) cracking pressure (b) full pump flow pressure (PRV pressure setting)	10	CO2

<p>Q 7</p>	<p>(a) Comment on the construction and functioning of Poppet and Spool-type valves in terms of ease of manufacturing and efficiency.</p> <p>(b) Explain the working principle of the valve shown below.</p> 	<p>10</p>	<p>CO2</p>
<p>Q 8</p>	<p>The pressure rating of the components in a hydraulic system is 10^5 kPa. The system contains a hydraulic motor to turn a 0.3 m radius drum at 30 RPM to lift a weight of 4000 N, as shown in Figure. Determine the flow rate and brake power if the motor efficiency is 90%.</p> 	<p>10</p>	<p>CO3</p>
<p>Q 9</p>	<p>An electric motor drives a pump at a constant speed and delivers power to the pump at a constant rate. The pump delivers oil to a hydraulic cylinder. By what factor would the cylinder force and time to travel through full stroke change during extension if (a) The cylinder stroke is doubled, and the piston and rod diameter remain the same, (b) The piston and rod diameter are both doubled, and the stroke remains the same (c) The stroke, piston and rod diameters are all doubled.</p> <p style="text-align: center;">OR</p> <p>A hydraulic motor has a displacement of 164 cm^3 and operates with a pressure of 70 bars and a speed of 2000 rpm. If the actual flow rate consumed by the motor is $0.006 \text{ m}^3/\text{s}$ and the actual torque delivered by the motor is 170 N-m, find (i) volumetric efficiency (ii) mechanical efficiency (iii) overall efficiency (iv) the actual kW delivered by the motor.</p>	<p>10</p>	<p>CO3</p>

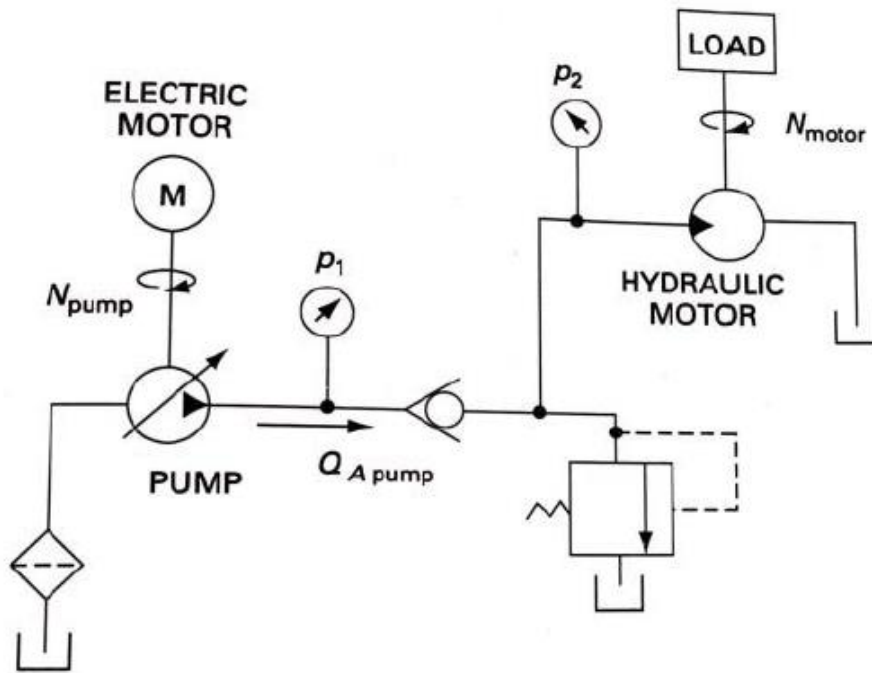
SECTION-C
(2Qx20M=40 Marks)

Q 10

The system shown in the Figure contains a pump delivering high-pressure oil to a hydraulic motor, which drives an external load via a rotating shaft. The following data are given:

Pump	Hydraulic Motor
$\eta_v = 92\%$	$\eta_v = 90\%$
$\eta_m = 94\%$	$\eta_m = 92\%$
$V_D = 150 \text{ cm}^3$	$V_D = 100 \text{ cm}^3$
$N = 1000 \text{ rpm}$	Inlet pressure p_2 required to drive
Inlet Pressure = -1.5 bar	load = 150 bar
	Motor discharge pressure = 2 bar

If the hydraulic motor is 20 cm above the pump. Determine the (a) pump flow rate (b) pump discharge pressure (c) Overall efficiency of the system.



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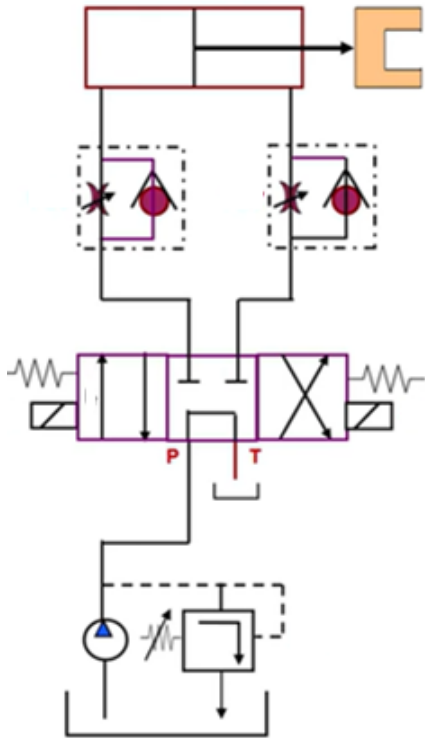
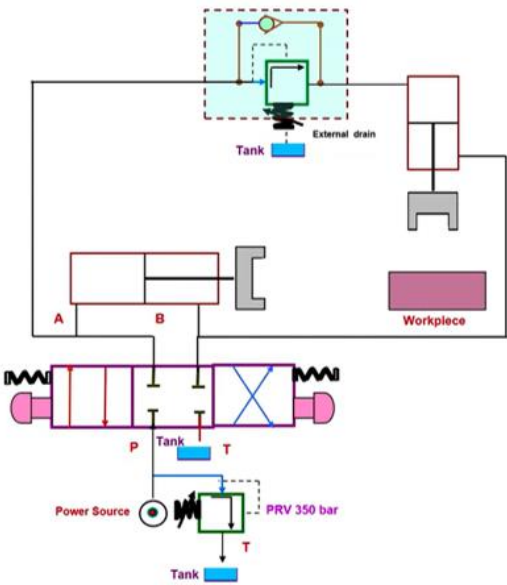
CO4

Q 11

- (a) Explain the working principle of the axial piston motor with a force diagram.
- (b) Identify all the components of the hydraulic circuits shown below. Also, describe the operations in different positions of the direction control valve (DCV).

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CO4



OR

For the circuit, as shown in the figure below, cylinder 1 will not hold against a load while cylinder 2 is retracting. Modify this circuit by adding a pilot check valve and appropriate piping so that cylinder 1 will hold while Cylinder 2 is retracting.

