Name: **Enrolment No:**	

UPES

End Semester Examination, May 2023

Course: Hydraulics and Pneumatics **Semester: VI**
Program: B. Tech Mechatronics **Time : 03 hrs.**
Course Code: MECH3029 **Max. Marks: 100**

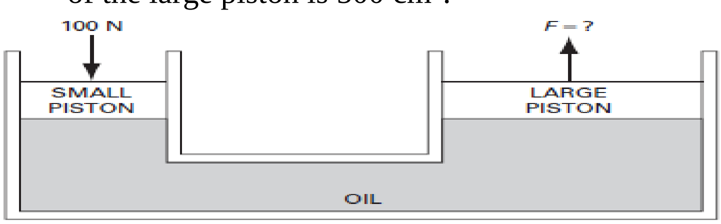
Instructions: Attempt all questions

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Sketch the graphical symbol of the following hydraulic component (a) compound pressure relief valve (b) spring-centered lever operated 4/3 direction control valve	**4**	**CO1**
Q2	Define and classify the pumps.	**4**	**CO1**
Q3	Define hydraulic circuit design. List the primary function of hydraulic circuit design.	**4**	**CO1**
Q4	Differentiate between hydraulic and pneumatics.	**4**	**CO1**
Q5	List four uses of accumulators.	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q6	A hydraulic motor has a displacement of 130 cm^3 and operates with a pressure of 105 bars and speed of 2000 rpm. If the actual flow rate consumed by the motor is 0.005 m^3/s and the actual torque delivered by the motor is 200 N.m , calculate the (a) η_v (b) η_m (c) η_o	**10**	**CO3**
Q7	Sketch and explain the working of pressure relief valve.	**10**	**CO2**
Q8	A 20-in^3 sample of oil is compressed in a cylinder until its pressure is increased from 50 to 1000 psi. If the bulk modulus equals 300,000 psi, find the change in volume of the oil.	**10**	**CO3**

Q9	Draw and explain the working of bladder gas accumulator. OR Draw and explain the double pump hydraulic circuit for hydraulic punch machine.	**10**	**CO2**
	SECTION-C **(2Qx20M=40 Marks)**		
Q10	A hydraulic cylinder is to compress a car body down to bale size in 8 s.The operation requires a 3-m stroke and a 40,000-N force. If a 10-MPa pump has been selected, and assuming the cylinder is 100% efficient, find **a.** The required piston area (m^2) **b.** The necessary pump flow rate (m^3/s) **c.** The hydraulic power (kW) delivered to the cylinder **d.** The output power (kW) delivered by the cylinder to the load **e.** Solve parts a, b, c, and d assuming a 400-N friction force and a leakage of 1.0 LPM. What is the efficiency of the cylinder with the given friction force and leakage?	**20**	**CO4**
Q11	**a.** In the hydraulic jack shown in Figure, a force of 100 N is exerted on the small piston. Determine the upward force on the large piston. The area of the small piston is 50 cm^2, and the area of the large piston is 500 cm^2.  **b.** A tank truck contains 125,000 liters of a hydraulic fluid having a specific gravity of 0.9. Determine the fluid's specific weight, density, and weight. **OR** A compressor delivers air at 6.894 bar and 470 m^3/h. **a.** Determine the actual hp required to drive the compressor if the overall efficiency of the compressor is 75%. **b.** Repeat part **a** assuming the compressor is required to provide air at 7.92 bar to offset a 1.03bar pressure loss in the pipeline due to friction. **c.** Calculate the cost of electricity per year for parts a and b. Assume the efficiency of the electric motor driving the	**10+10** **20**	**CO3** **CO4**

	compressor is 92% and that the compressor operates 3000 hr per year. The cost of electricity is Rs 2/kWh.		