MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING
(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
Accredited by NAAC with A+ Grade & ISO 9001:2015 Certified Institution

Model Question Paper

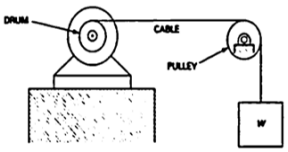
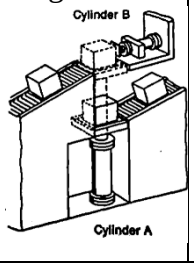
Fourth Semester BE Degree Examination

Fluid Mechanics-Hydraulics and Pneumatics

Time: 3 Hours **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.

		Module -1	M	L	C
Q1	a.	Describe specific weight, mass density, specific volume, specific gravity and dynamic viscosity	10	L1	CO1
	b.	Explain with a neat sketch Continuity Equation	10	L1	CO1
		OR			
Q2	a.	State Paskal's law and describe the Force-Area, Force Distance and Area-Distance relationships.	10	L1	CO1
	b.	Describe with a neat sketch, the absolute, gauge, atmospheric and vacuum pressures	10	L1	CO1
		Module- 2			
Q3	a.	A Gear Pump has a 80 mm outside diameter, a 55 inside diameter, and a 25 mm width. If the actual pump flows at 1600 rpm and the rated pressure is 95×10^{-3} m^3/min. Calculate volumetric efficiency. Give 4 advantages and disadvantages of Gear Pump.	10	L3	CO2
	b.	A hydraulic pump has a displacement volume of 0.00012 m^3/rev. Its actual flow rate is 0.0015 m^3/s at 900 rpm and 75 bar. If the actual torque input by the prime mover to the pump is 150 Nm, determine the overall efficiency of the pump. Also, find the theoretical torque input to the pump for its operation. Represent graphical symbols of unidirectional fixed displacement and bidirectional variable displacement pumps.	10	L3	CO2
		OR			
Q4	a.	A Vane Pump has a rotor diameter of 50 mm, a cam ring diameter of 80 mm, and the vane's width of 40 mm. Compute the volumetric displacement and theoretical discharge for an eccentricity of 10 mm and speed of 600 rpm. State types of Vane Pump	10	L3	CO2
	b.	An Axial Flow Piston Pump delivers 0.04 m^3/min at 3000 rpm. The pump has 9 pistons of 12.5 mm diameter arranged on a 125 mm cylinder block. Determine the theoretical discharge and offset angle if the volumetric efficiency is 95 %.	10	L3	CO2
		Module - 3			
Q5	a.	Analyze a hydraulic system's operating conditions to determine the Overall efficiency and Actual power delivered by the motor. The hydraulic system uses a motor with a displacement of 165×10^{-6} m^3 and operates with a pressure of 70×10^5 N/m^2 at a speed of 2000 rpm. If the actual flow rate consumed by the motor is 0.006 m^3/s and the actual torque delivered by the motor is 170 N-m: i. Using given displacement, determine the Overall efficiency ii. Calculate the Actual power delivered by the motor	10	L4	CO3

	b.	In a hydraulic system, a double-acting cylinder is used to extend and retract a piston, which is used to open and close a furnace door. The cylinder has a bore diameter of 50 mm and a rod diameter of 20 mm. If the extension force is 60 KN, the retraction force is 6 KN and the oil flow rate to the actuator is 0.002 m^3/s, critically analyze the pressure, velocity and power during extension and retraction	10	L4	CO3
OR					
Q6	a.	A hydrostatic transmission operating at 105 bar pressure has the following characteristics: Pump: V_d= 100 x 10^{-6} m^3; η_v= 85 %; η_m= 90 %; N= 1000 rpm Motor: V_d=; η_v= 94 %; η_m= 92 %; N= 600 rpm Interpret the characteristics and identify the displacement and output torque of the motor	10	L4	CO3
	b.	 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 load, as shown in the figure below. Determine the flow rate and brake power if the motor efficiency is 100 %. Differentiate between a power source and an actuator for a hydraulic system.	10	L4	CO3
Module - 4					
Q7	a.	In many hydraulic systems, the pump is kept running continuously even under, no load conditions. This is to avoid shock loads, heating of oil and power loss. Provide a suitable type of Pressure Control Valve as a solution to keep the pump on and reduce the power loss. Illustrate the working of the valve	10	L3	CO4
	b.	In a pneumatic circuit, it is required to accelerate the venting of the actuator and retract quickly. Suggest a suitable valve and interpret its workings using its constructional diagram.	10	L3	CO4
OR					
Q8	a.	A press with a 2-ton load would require an opposing force to avoid its fall on the shift of DCV. Provide a type of Pressure Control Valve solution to keep the actuator safe from fall. Interpret the workings of the suggested valve using its constructional diagram.	10	L3	CO4
	b.	A bus driver uses push buttons to control the opening and closing of the bus door. Build a circuit with the memory function of a DCV to indirectly control a DAC to achieve the door operation.	10	L3	CO4
Module – 5					
Q9	a.	A DAC is hooked up in a Regenerative circuit using 3/2 DCV with a relief valve setting of 70 bar, piston area of 0.016 m^2, rod area of 0.0045 m^2 and the pump flow is 0.0013 m^3/sec. Analyse the given and calculate the cylinder speed and load-carrying capacity for extending and retracting strokes.	10	L4	CO5
	b.	Products are required to be transferred from lower level conveyor to higher level conveyor using two Pneumatic cylinders as follows: i. Lifting Cylinder A: lifts the product on receiving it at lower level ii. Shifting Cylinder B: shifts the product from the platform to the higher level conveyor iii. Lifting Cylinder retracts iv. Shifting Cylinder retracts 	10	L4	CO5
OR					

Q10	a.	A windshield has to be fit on a car body by a Simultaneously acting 2 DAC. Build a hydraulic circuit for achieving the task and explain its working in brief.	10	L4	CO5
	b.	Build a circuit for sequential operation of A+, A-, B+, B- using Cascading Method of signal elimination	10	L4	CO5

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