

# MCL431: CAM AND AUTOMATION

## Minor 1 Exam (29-Aug-2016)

**MAX MARKS: 60**

**MAX TIME: 60 min**

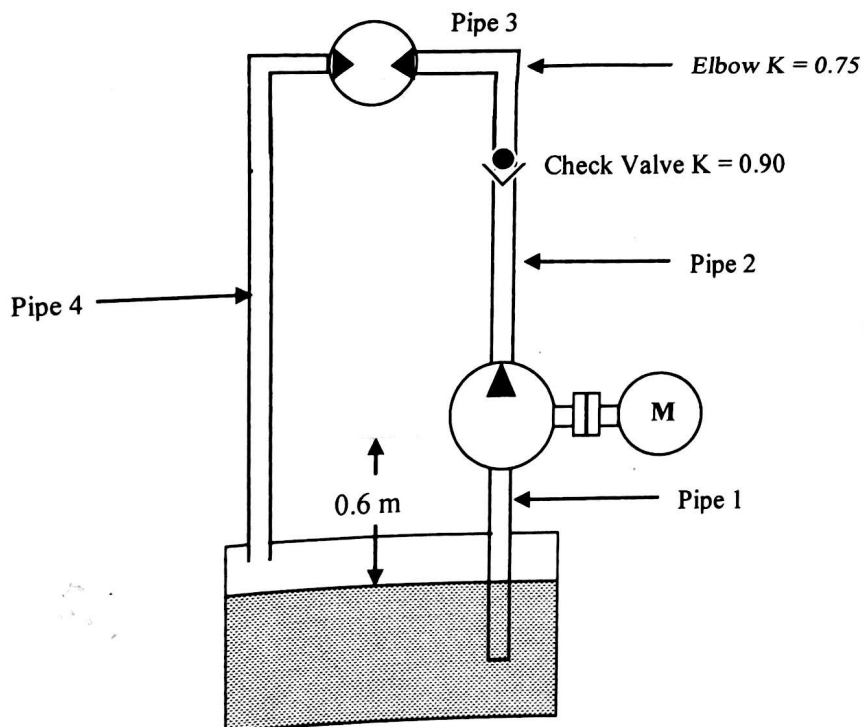
**Instructions:**

- Only Hand written notes are allowed in the exam.
- No printed or Xeroxed material allowed except Lecture Slides and Symbols

**Q1.** A hydraulic system shown in Fig. 1 is designed to lift a load of 5.4 Ton at an average speed of 1300 mm/min using Hydraulic chain hoist driven by a Hydraulic motor having volumetric displacement of 90 cc. Volumetric & Mechanical efficiency of Motor is 92% and 87% respectively. Hoist pulley dia is 250 cm. A Vane pump having volumetric displacement of 170 cc is used to drive the system. Pump has Volumetric & Mechanical efficiency of 83% and 89% respectively. Hydraulic oil: Specific gravity 0.85, Kinematic viscosity 120 cS. Considering losses in hydraulic circuit, calculate the following:

- i) Pressure at Pump outlet **(15 Marks)**
- ii) Electric Motor RPM and HP **(10 Marks)**

Volumetric displacement is the volume of fluid displaced in one rotation of pump or Motor.  
 Pipe 1: L = 1m, D = 30 mm; Pipe 2: L = 3.85m, D = 25 mm; Pipe 3: L = 1.40m, D = 25 mm; Pipe 4: L = 4.50 m, D = 30 mm;



**Hint: Volumetric and Mechanical Efficiencies of Hydraulic Motor and Pump**

	Volumetric Efficiency	Mechanical Efficiency
<b>Motor</b>	$\eta_v = \frac{\text{theoretical flow} - \text{rate motor should consume}}{\text{actual flow} - \text{rate consumed by motor}}$	$\eta_m = \frac{\text{actual torque delivered by motor}}{\text{torque motor should theoretically deliver}}$
<b>Pump</b>	$\eta_v = \frac{\text{actual flow rate produced by pump}}{\text{theoretical flow rate pump should produce}}$	$\eta_m = \frac{\text{pump output power assuming no leakage}}{\text{input power delivered to pump}}$

**Q2.** A workpiece is to be clamped by activating the start push button S1 when workpiece is present in the gravity fed magazine (to be sensed by proximity sensor). When the workpiece is clamped by Cylinder 1A1, cylinder 2A1 extends and embosses the workpiece. Cylinder 2A1 should remain extended till the embossing pressure reaches 4 bar and then retract back. Use Pneumatic-electric Converter as pressure switch to sense pressure (see *Hint at the end of paper*). All cylinders should then be at retracted end position before commencement of embossing cycle.

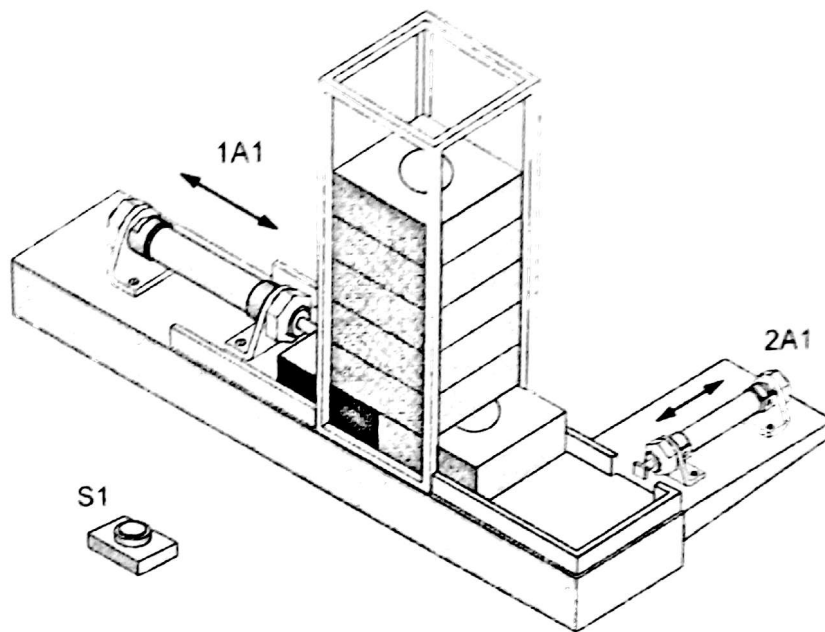


Figure for Q2

**Attempt the following:**

- Draw pneumatic circuit with bill of material listed clearly. **(10 Marks)**
- Draw the Displacement step diagram for cylinders 1A1 and 2A1. **(5 Marks)**
- Draw the Electrical circuit for the embossing machine. **(20 Marks)**

**Hint: Pneumatic Electrical Converter**

Symbol	Function:
	<p>Pneumatic electrical converter in pressure switch mode give high output on Signal pin (BK) when Pressure on port P1 is greater than the set pressure. Pressure is set by means of adjustable screw on the switch. Pressure port P2 is used as input for operating as Vacuum switch. Both port P1 and P2 are used to operate switch on differential pressure mode.</p> <p>Red (RD): +24V, Blue (BU): GND, Black (BK): Signal</p>