**Safety Hazards**

**Fluid Machinery Laboratory Room B-10**

**HAZARD:** Rotating Equipment / Machine Tools

**Personal Protective Equipment:** Safety Goggles; Standing Shields, Sturdy Shoes.

**Personal Care**
1. Do not wear loose clothing, Neck Ties/Scarves; Jewelry (remove).
2. Tie back long hair.

**HAZARD:** High Pressure Air-Fluid / Gas Cylinders / Vacuum

**Personal Care**
1. Inspect before using any pressure / vacuum equipment.
2. Gas cylinders must be secured at all times.

**HAZARD:** Electrical - Burns / Shock

**Personal Care:** Take Care while doing electrical connections, particularly with grounding; do not use frayed electrical cords.

**HAZARD:** Water / Slip Hazard

**Personal Care:** Clean any spills immediately.
Flow Level Process Control (PID Controller)

Procedure:

A. Component Familiarization and Manual Control

1. Turn on Computer → Double left-click to open Process Control →
   Click System → Index. Open Assignment 2 Flow/level Rig Familiarization.

2. Subtask 1: Centrifugal Pump
   a. Go to the menu Patching and then select Centrifugal Pump. Make connections as instructed in Patching Diagram 1.
   b. Go to the menu Practical, select Centrifugal Pump. Close manual valve MV3 and Open manual valve MV2; Switch on the PI, then turn on the switched ac supply o/p.
   c. Using the onscreen stopwatch, record the length of time taken from switching on the pump to overflow of the tank. Calculate the volume of water in the upper tank at overflow, and hence calculate the pump flow rate.
   d. Turn off ac supply o/p.

   a. Go to the menu Patching and select Man. Valves & Flow Gauge. The patching diagram in this practical is the same as for Practical 1.
   b. Go to the menu Practical and select Man. Valves & Flow Gauge. Switch on the pump with the ac supply o/p.
   c. Fully open the manual valve MV2, adjust MV3 to keep a constant water level in the tank; Control flow rate by valve MV2, adjust the manual valve MV3 to maintain the water level in the tank constant at an intermediate value.
   d. Turn off ac supply o/p.

4. Subtask 3: Servo Valve
   a. Enter the menu Patching and select Servo Valve. The patching diagram in this practical is the same as for Practical 1.
   b. Go to the menu Practical and select Servo Valve. Open manual valves, MV1, MV2 and MV3.
   c. Set the current source output to 4mA; Turn on ac supply o/p; Gradually increase the current source output to 20 mA, observe the flow rate and water level, respectively.
d. Turn off ac supply o/p.

5. Subtask 4: Solenoid Valves
   a. Go to the menu **Patching** then select **Solenoid Valves**. Make connections as instructed in Patching Diagram 2.
   b. Go to the menu **Practical** and select **Solenoid Valves**. Open manual valve **MV1**, close manual valves **MV2** and **MV3**; Switch on ac supply o/p and **24Vdc** output for SV1.
   c. Adjust manual valve **MV1** to obtain constant water level in tank under 5 different flow rate. Record the level and flow rate.
   d. Turn off ac supply o/p and **24Vdc** output.

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**Figure 1** Patching Diagram 1 for the Centrifugal Pump.
B. Flow Level Transmitter and Level Control Demo

1. Open Assignment 8 on Flow Level Transmitter.
2. Subtask 1: Flow Level Transmitter
   a. Go to the menu Patching → Float Level Transmitter. Make connections as instructed in Patching Diagram 5 (Figure 3).
   b. Fully open the manual valve MV2, half-open manual valve MV3. Turn on ac supply o/p.
   c. Using the current source control, vary the servo position so that the water level in the tank could be adjusted. Record the DDM display (current from the flow level transmitter) for 5 different balanced level heights.
   d. Turn off ac supply o/p.
3. Subtask 2: Level Control
   a. Go to the menu Patching → A Level Control Demo. Make connections as instructed in Patching Diagram 6 (Figure 4).
   b. Close manual valves MV2 and MV3, half open MV1. Turn on ac supply o/p and 24Vdc output. Change the 38-300 to automatic control.
   c. Vary the value of the set point and observe its effect. Click on solenoid valve SV2 and observe its effect.
d. Turn off ac supply o/p. Turn off Computer.

Figure 3 Patching Diagram 5 for Float Level Transmitter

Figure 4 Patching Diagram 6 for Level Control Demo