Ain Shams University
Faculty of Engineering
Mechatronics Department

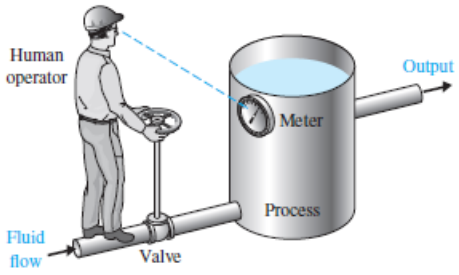
Spring 2025 Course Code: MCT211

Automatic Control

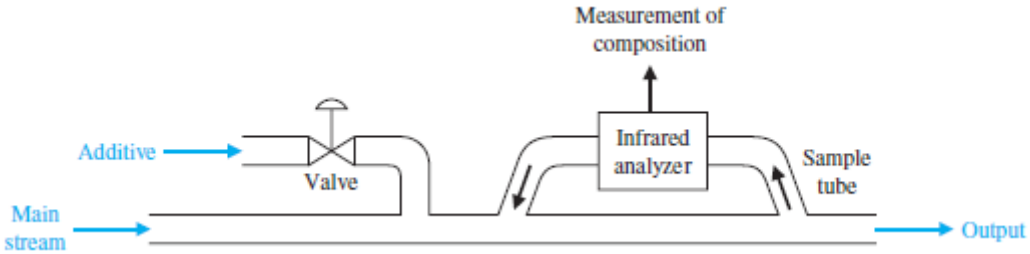
Sheet 1: Introduction to Control Systems

Question 1: Many luxury automobiles have thermostatically controlled air-conditioning systems for the comfort of the passengers. Sketch a block diagram of an air-conditioning system where the driver sets the desired interior temperature. Identify the function of each element of the thermostatically controlled cooling system.

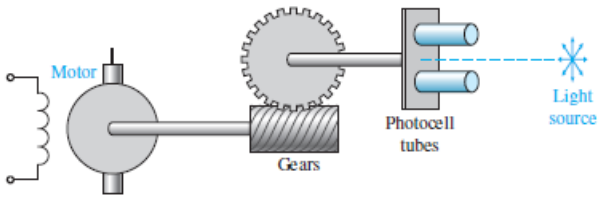
Question 2: Control systems can use a human operator as part of a closed-loop control system. Sketch the block diagram of the valve control system shown in Figure 1.



Question 3: In a chemical process control system, it is valuable to control the chemical composition of the product. To do so, a measurement of the composition can be obtained by using an infrared stream analyzer, as shown in Figure 2. The valve on the additive stream may be controlled. Complete the control feedback loop and sketch a block diagram describing the operation of the control loop.



Question 4: A light-seeking control system, used to track the sun, is shown in Figure 3. The output shaft, driven by the motor through a worm reduction gear, has a bracket attached on which are mounted two photocells. Complete the closed-loop system so that the system follows the light source.



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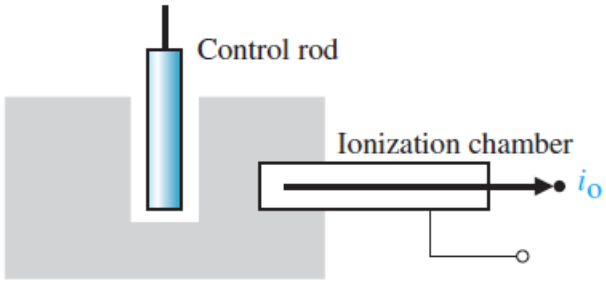
Question 5: The accurate control of a nuclear reactor is important for power system generators. Assuming the number of neutrons present is proportional to the power level, an ionization chamber is used to measure the power level. The current *io* is proportional to the power level. The position of the graphite control rods moderates the power level. Complete the control system of the nuclear reactor shown in Figure 4 and sketch the block diagram describing the operation of the feedback control loop.



Question 6: A high-performance race car with an adjustable wing (airfoil) is shown in Figure 5. Develop a block diagram describing the ability of the airfoil to keep a constant road adhesion between the car's tires and the race track surface. Why is it important to maintain good road adhesion?