

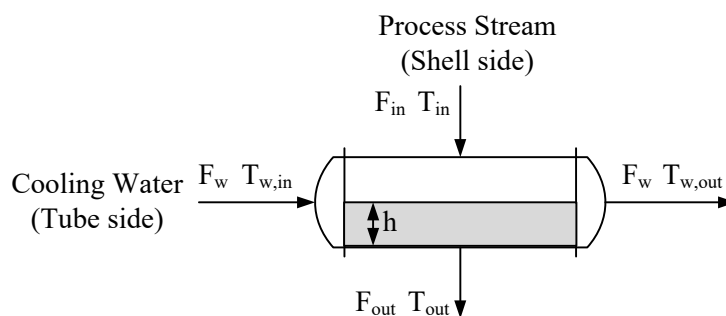
Q.1 Which of the following statements are true?

- (a) Feedback and feedforward control both require a measured variable.
- (b) The process variable to be controlled is measured in feedback control.
- (c) Feedforward control can be perfect in the theoretical sense that the controller can take action via manipulated variable even while the controlled variable remains equal to its desired value.
- (d) Feedforward control can provide perfect control; that the output can be kept at its desired value, even with an imperfect process model.
- (e) Feedback control will always take action regardless of the accuracy of any process model that was used to design it and the source of a disturbance.

Q.2 The distillation column is used to distill a binary mixture. It is desired to control distillate composition despite disturbances in feed flow rate  $F$ . All flow rates can be measured and manipulated with the exception of  $F$ , which can only be measured. A composition analyzer provides measurements of distillate composition.

- (a) Propose a feedback control method and sketch the control loop
- (b) Suggest a feedforward control method and sketch the control loop.

Q.3 A heat exchanger is shown in the diagram below. Design the feedback control for this unit operation.



Q.4 The process design has been shown in the following figure. The key variables to be controlled in this process are composition, temperature, and liquid level for CSTR. Disturbances occur in the feed temperature and composition.

- (a) Determine which sensors and final elements are required so that the important variables can be controlled.
- (b) Select controller pairings; that is, select which measured variable should be controlled by adjusting which manipulated variable.

