Reg. No. : | | | | | | | | | | | |

Question Paper Code : 11337

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2011

Sixth Semester

Electronics and Instrumentation Engineering

EI 2352 — PROCESS CONTROL

(Common to Instrumentation and Control Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions

PART A — (10 × 2 = 20 marks)

1. What is the need for Process Control?

2. Differentiate interacting and non interacting systems.

3. What is meant Proportional Band in Proportional Controller?

4. Compare the effect of PI and PD controllers with respect to (a) order of the closed Loop system and (b) offset.

5. Define Quarter decay ratio and Integral square error.

6. Write down the procedure for obtaining process reaction curve.

7. List the drawbacks of Feedforward controller.

8. What is ratio control, and why is it useful in process control?

9. A valve with a C_v rating of 4 is used to throttle the flow of a liquid for which specific gravity G = 1.26. Determine the maximum flow through the valve for a pressure drop of 100 psi.

10. What do you mean by control value sizing?

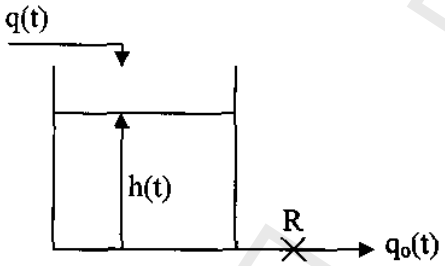
PART B — (5 × 16 = 80 marks)

11. (a) (i) Develop the first order transfer function for a liquid level process shown below. (8)

where, q, q_0 are inlet and outlet volumetric flow rates respectively

R - Resistance of the valve and pipe

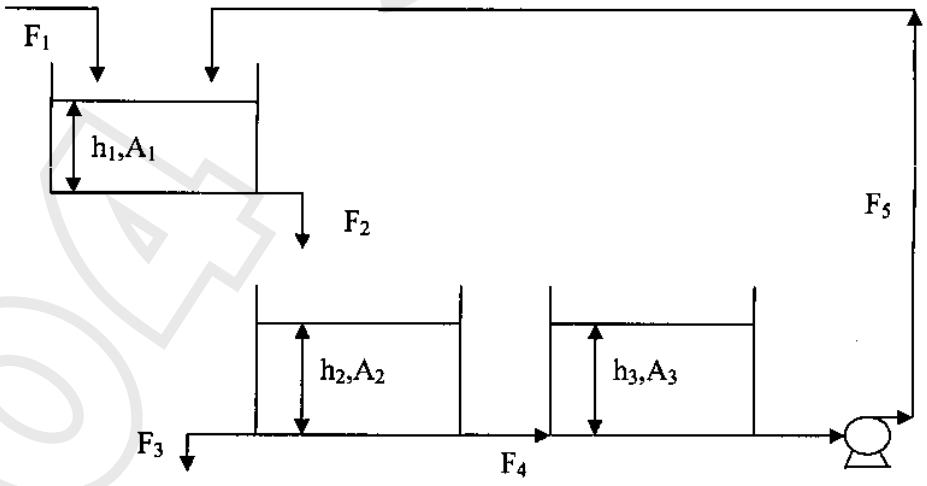
h - head



(ii) Develop a mathematical model for a mercury thermometer. Make necessary assumptions. (8)

Or

(b) Develop a mathematical model for the system shown in figure below. What are the states for this system? All the flow rates are volumetric and the cross sectional areas of the tanks are A_1 A_2 and A_3 (ft^2), respectively. The flow rate F_5 is constant and does not depend on h_3, while all other flow rates are proportional to corresponding hydrostatic liquid pressures that cause the flow.



12. (a) Describe the characteristics of ON-OFF and Single speed floating controllers. Also explain how they can be implemented using electronic elements.

Or

(b) (i) Explain the characteristics of PI and PD controllers. (8)

(ii) Draw the circuit for electronic PID controller and describe its working. (8)

13. (a) Design a PID Controller using Root locus method for the plant $G(s)=\frac{1}{(s+1)(s+5)}$ to satisfy the following specifications.

Peak time = 0.5 s;

Peak overshoot ≤ 10 % and Steady state error $\leq$ 10 %.

Or

(b) Explain the procedure for tuning the controller settings by the following methods.

(i) Zeigler Nichols method (8)

(ii) Damped oscillation method. (8)

14. (a) (i) Explain the concept of feedforward control with the example of distillation column. (8)

(ii) Describe what is split range control. Explain with an example. (8)

Or

(b) (i) Discuss the rational of cascade control system and demonstrate why it provides better response than simple feedback control with an example. (8)

(ii) Explain the concept of multivariable control with the boiler example. (8)

15. (a) (i) Explain the functioning of I/P converter with a neat sketch. (6)

(ii) Write down the flow equation of an equal percentage valve and sketch its inherent valve characteristic. (4)

(iii) Explain how you will practically determine the installed valve characteristic of a control valve in an installation and also the reasons for determining the installed characteristic. (6)

Or

(b) (i) Explain the occurrences of cavitation and flashing in control valves. (8)

(ii) Discuss the factors to be considered before the selection of control valve for a given application. (8)

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