

Code No: 07A62304

R07

Set No. 2

III B.Tech II Semester Examinations, December 2010
INSTRUMENTATION AND PROCESS CONTROL
Bio-Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Mention & discuss different parts of a Biosensor using a Block Diagram? [16]
2. (a) What are the different performance criteria
(b) Describe in detail the $1/4$ decay ratio . [6+10]
3. Explain the process reaction curve method in detail. [16]
4. Describe the principle and mechanisms of single speed floating control with sketches of deviation vs time and block diagram. [16]
5. Derive the transfer function $H(s)/Q(s)$ for the liquid level system shown in the figure 1.
(a) When the tank level operates about the steady state value of $h_s = 1$ ft.
(b) When the tank level operates about the steady state value of $h_s = 3$ ft.

The pump removes water at a constant rate of $10 \text{ ft}^3 / \text{min}$. The rate is independent of head. The cross sectional area of the tank is 1.0 ft^2 and the resistance R is $0.5 \text{ ft} / \text{ft}^3$.

[8+8]

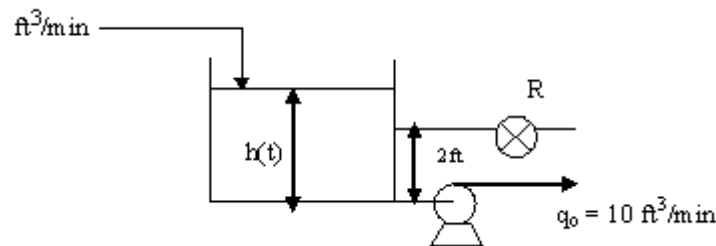


Figure 1:

6. (a) Define frictional force and thrust force in a control valve.
(b) A diaphragm area of 600 square centimeters of an actuator is operated between 0.2 to 1.0 kgf/cm². Calculate the allowable friction and thrust forces. [8+8]
7. (a) Is the thermometer bulb and thermal well arrangement a non-interacting system? Explain.

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- (b) With neat sketches explain the non-interacting, interacting dead end and interacting flow systems. [8+8]
8. (a) Explain the closed loop characterization of Cascade control systems.
- (b) Explain the primary and secondary loop gain adjustment in a cascade control systems. [8+8]

FIRSTRANKER

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R07**Set No. 4**

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- Discuss briefly about the various types of actuators.
 - Explain the working of a solenoid. [8+8]
- Differentiate between a continuous process and a batch process. Give a brief account of one batch process and one continuous process with the diagrams. [16]
- What is meant by process tuning and discuss the various methods of tuning controller parameters.
 - Discuss the process reaction curve method. [8+8]
- A proportional controller has an output m changing linearly from 0 to 15 psi when the deviation e changes from -100 to 0 to 100 degrees. Calculate the controller sensitivity.
 - In an integral controller the deviation changes sinusoidally with time. Show that the phase of manipulated variable is always 90° behind the deviation. [8+8]
- Derive the transfer function $H(s)/Q(s)$ for the liquid level system shown in the figure 2. The resistances are linear. H and Q are deviation variables. Give numerical values in the transfer function. [16]

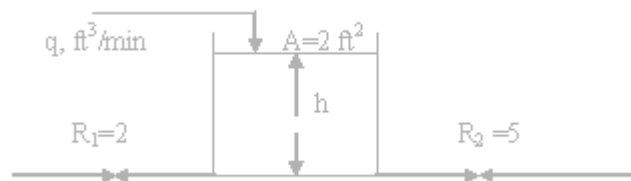


Figure 2:

- What is a ratio control system? Discuss such a control system for a flow process. [16]
- The transfer functions of a multicapacity process for the process, measuring element and final control element are $1/(5s+1)(2s+1)$, $1/10s+1$ and 1.0 respectively if a propeller is used:
 - Find the crossover frequency.

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- (b) AR at the crossover frequency. [8+8]
8. (a) Write a note on different generations of Biosensors?
- (b) Write a note on Ion selective membranes? [8+8]

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R07**Set No. 1**

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1. (a) Compare non interacting with interacting systems by giving respective transfer functions.
 (b) Discuss the effect on interaction step response of two tank liquid level system. [8+8]
2. Define the concept of Cascade control and give the applications of Cascade control. [16]
3. Write an essay on continuous cycling method of controller settings. [16]
4. A PD controller is used to control first order system with first order measuring element. Determine the expression for the offset for servomechanism control problem. [16]
5. (a) How do you define the order of system?
 (b) Give one example each for first order and second order systems and explain.
 (c) Write transfer function for second order system and explain the terms.
 (d) Explain damping factor. [2+6+4+4]
6. (a) Write a note on cavitation and flashing problems in control valves.
 (b) A valve discharges from a tank with a head of 20ft of water to a tank with a head of 10ft and maximum flow rate is 100gpm. Calculate the value of Cv. [8+8]
7. A control loop has four first order elements with time constants of 10, 2, 1 and 0.1min.
 (a) What is the critical frequency?
 (b) What is the maximum overall gain? [8+8]
8. Explain in detail about Environmental Biosensors? [16]

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1. What is meant by multiloop control system? Describe the feed forward control system with a diagram. [16]
2. (a) Describe the damped oscillation method of controller settlings.
(b) Write short notes on Cohen coon settlings. [8+8]
3. The block diagram of a unity feedback proportional controller is given in the following figure 3. Derive the transfer function for servomechanism control problem. [16]

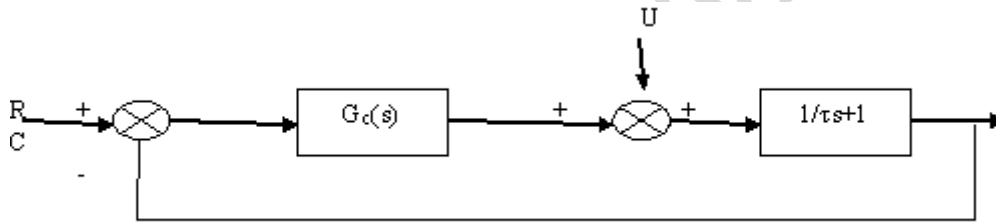


Figure 3:

4. A temperature alarm unit exhibit first order dynamics having time constant of 90sec is subjected to 90°C rise because of fire. An increase of 30°C is needed for the alarm to respond. Calculate the time needed for signalling the temperature range. [16]
5. Two non-interacting tanks are connected in series. The time constants are $\tau_1 = \tau_2 = 1$ and $R_2 = 1$. Sketch the response of the level in tank2 if a unit step change is made in the inlet flow rate to tank1. [16]
6. (a) What is a bioreceptor? What are the common bioreceptors?
(b) Discuss the applications of Biosensors in Aquatic & Soil samples? [8+8]
7. (a) What is meant by direct acting and indirect acting in pneumatic actuators.
(b) Explain the working of a pneumatic amplifier. [8+8]
8. A flow control system has a valve time constant of 10seconds, a process time constant of 0.5second and measurement time constant of 1.0second. What is the maximum permissible value of K. [16]
