Code No: 07A62304 **R07** **Set No. 2**

III B.Tech II Semester Examinations,APRIL 2011
INSTRUMENTATION AND BIO PROCESS CONTROL
Bio-Technology

Time: 3 hours
Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) What is an actuator.

   (b) Explain the mechanism of any device which converts electrical signal into mechanical motion. [8+8]

2. Write an essay on continuous cycling method of controller settlings. [16]

3. Discuss the principle of a cascade control system and how is better than a simple feedback control. [16]

4. Describe the principle and mechanisms of single speed floating control with sketches of deviation vs time and block diagram. [16]

5. (a) Is the thermometer bulb and thermal well arrangement a non-interacting system? Explain.

   (b) With neat sketches explain the non-interacting, interacting dead end and interacting flow systems. [8+8]

6. Derive the transfer function H(s)/Q(s) for the liquid level system shown in the figure 1. The resistances are linear. H and Q are deviation variables. Give numerical values in the transfer function. [16]
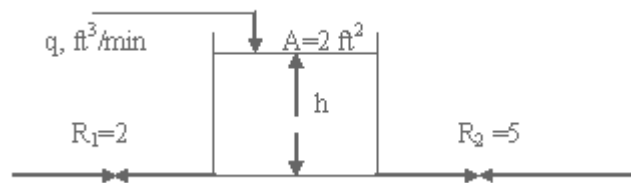

Figure 1:

7. Explain the theoretical principle of Piezoelectric Biosensor with proper Mathematical expression? [16]

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]

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1

Code No: 07A62304 | **R07** | **Set No. 4**

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Bio-Technology

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
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⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What are the main advantages and disadvantages of Cascade control system.

   (b) Explain override control with an example. [8+8]

2. Explain the following input and response functions with relevant equations:

   (a) Step.

   (b) Impulse.

   (c) Ramp

   (d) Sinusoidal. [16]

3. (a) Explain the essential features of a control valve with a sketch.

   (b) Explain the different responses of the three main types of control valves with respect to stem position. [8+8]

4. 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]

5. (a) Explain the principle of operation of a force type pneumatic proportional controller.

   (b) A proportional pneumatic controller has equal area bellows. If 3-15psi signals are used on input and output, find the ratio of pivot distances that provides 25% proportional band. [8+8]

6. The open loop transfer function for a process is expressed as $G(s) = kc/(3s+1)^4$ Calculate:

   (a) Ultimate gain.

   (b) Radian frequency for stable control system . [8+8]

7. For the control system shown in the figure 2 determine the PI controller settings using c-c method. [16]

8. Explain in detail about Environmental Biosensors? [16]

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2

Code No: 07A62304 | **R07** | **Set No. 1**

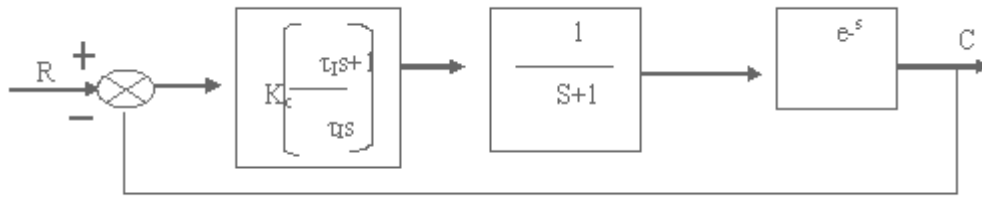Figure 2:

III B.Tech II Semester Examinations,APRIL 2011
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Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
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1. (a) Explain servo operation and regulator operation with examples.

   (b) Explain the regulator operation of a heated tank with the block diagram.[8+8]

2. (a) Discuss the applications of Calorimetric Biosensors in detail?

   (b) Explain the working mechanism of calorimetric biosensor in detail?   [8+8]

3. (a) Discuss the general guidelines for the tuning of control systems

   (b) Discuss briefly transportation lag compensation.   [8+8]

4. (a) Where an on-off controller is recommended? What is the effect of dead time on response?

   (b) Idealized first order integrating process has a lag of 3 minutes and static gain 1.5. The on-off controller has a dead zone of 2Volts and its operating voltage is 12 volts. Obtain the on-off periods for a step disturbance of equivalent to 1 volt when the system has I dead time of 2 minutes II no dead time.   [4+12]

5. A temperature alarm unit exhibit first order dynamics having time constant of 90sec is subjected to 90^0C rise because of fire. An increase of 30^0C is needed for the alarm to respond. Calculate the time needed for signalling the temperature range.   [16]

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. (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]

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FIRSTRANKER

4

Code No: 07A62304 | R07 | Set No. 3

III B.Tech II Semester Examinations,APRIL 2011
INSTRUMENTATION AND BIO PROCESS CONTROL
Bio-Technology

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Explain ISE, IAE, and ITAE as criteria for good control.   [16]

2. 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]

3. (a) Explain the open loop response of a pressure system with one resistance.

   (b) Explain the open loop response of a pressure system with two resistance.[8+8]

4. (a) Write a note on different generations of Biosensors?

   (b) Write a note on Ion selective membranes?   [8+8]

5. (a) Define frictional force and thrust force in a control valve.

   (b) A diaphragm area of 600 square centimeters of a actuator is operated between 0.2to1.0kgf/cm2. Calculate the allowable friction and thrust forces.   [8+8]

6. In a PID controller the error is increased linearly at the rate of 5^0per minute. Proportional sensitivity is 4, reset rate is 1 and the derivative time is 0.5. Obtain the response and sketch P (t) Vs t.   [16]

7. The process reaction curve of a temperature control gave the following results K=10, t=2.5min and td=0.2min calculate optimum settings for a PID controller.   [16]

8. (a) Discuss the relative advantages and disadvantages of a feedback and forward control system.

   (b) Describe the principle of feed forward and feedback control system.   [8+8]

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