

Code No: 07A61101

R07**Set No. 2**

III B.Tech II Semester Examinations, APRIL 2011
BIOLOGICAL CONTROL SYSTEMS
Bio-Medical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) Explain human operator tracking characteristics.
 (b) What is transfer function of a control system. [12+4]
2. A unity feedback control system is characterized by the following open loop transfer function $G(S) = \frac{0.4S+1}{S(S+0.6)}$. Determine its transient response for a unit ramp input. Evaluate the maximum overshoot and the corresponding peak time. [16]
3. Determine the closed loop transfer function using block diagram reduction technique whose block diagram is shown below in figure 1. [16]

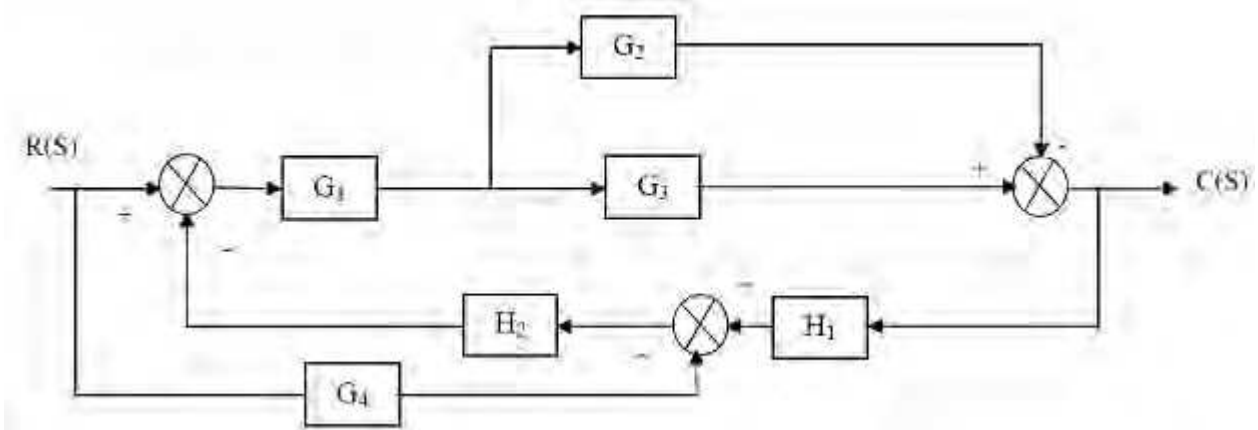


Figure 1:

4. Explain oculo-motor system with needed curves for saccadic and smooth-pursuit modes. [16]
5. (a) Discuss how heat is produced in the body and the factors influencing the thermoregulation in humans.
 (b) Describe model for heat transfer between core and skin. [8+8]
6. Sketch the Bode plot for a open loop transfer function, $G(s) = \frac{1+s}{s^2+2s+4}$ and from the plot determine the phase margin and gain margin. [16]
7. Discuss a model for O_2 uptake by pulmonary capillaries. [16]
8. Discuss the importance of blood glucose control system. [16]

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R07**Set No. 4**

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1. (a) Explain about transfer function models of receptors.
 (b) Discuss the model for perceived intensity. [8+8]
2. An innovative ship steering control system is represented by signal flow graph shown in figure 2. Find the transfer function $C(s)/R(s)$. [16]

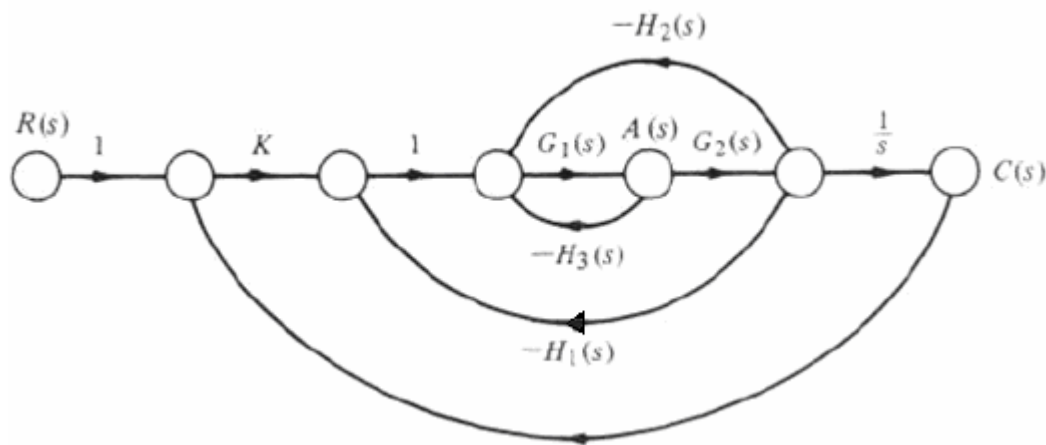


Figure 2:

3. (a) A unity feedback control system has an open loop transfer function $G(S) = 10/S(S+2)$. Find the rise time, percentage over shoot, peak time and settling time.
 (b) Obtain the response of unity feedback system whose open loop transfer function is $G(S) = 4 / S (S+5)$ and When the input is unit step. [8+8]
4. (a) Explain the gas transport mechanism in the lungs.
 (b) Discuss the theoretical model for O_2 uptake by RBC's. [8+8]
5. (a) What are the necessary conditions to have all the roots of the characteristic Equation in the left half of s-plane?
 (b) What are the difficulties in RH stability crititerion? Explain, how you can over come them? [8+8]
6. (a) Describe the muscle torques of cylinder model of leg of human being.
 (b) Give the neat sketch of manipulated semicircular canals block diagram. [8+8]

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7. Discuss the homeostasis of blood glucose. [16]
8. Explain the conjugal synthesis of oculo-motor control with neat diagram. [16]

FIRSTRANKER

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Set No. 1

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Answer any FIVE Questions
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1. A control system is represented by figure 3

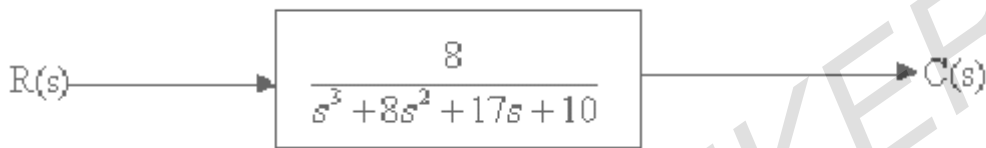


Figure 3:

- (a) Determine the partial fraction expansion and $c(t)$ for a impulse input, $r(t) = t$, $t \geq 0$ and find $c(t)$ for $t = 1$ sec.
- (b) Determine the impulse response of the system $c(t)$ for $t \geq 0$ and find $c(t)$ for $t = 1$ sec. [8+8]
2. Plot the Bode diagram for the following transfer function and obtain the gain margin and phase cross over frequencies $G(s) = \frac{10}{s+1}$. [16]
3. Determine the transfer function of the system in Figure 4. Then let $H_1 = 1/G_1$, and $H_2 = 1/G_2$. [16]

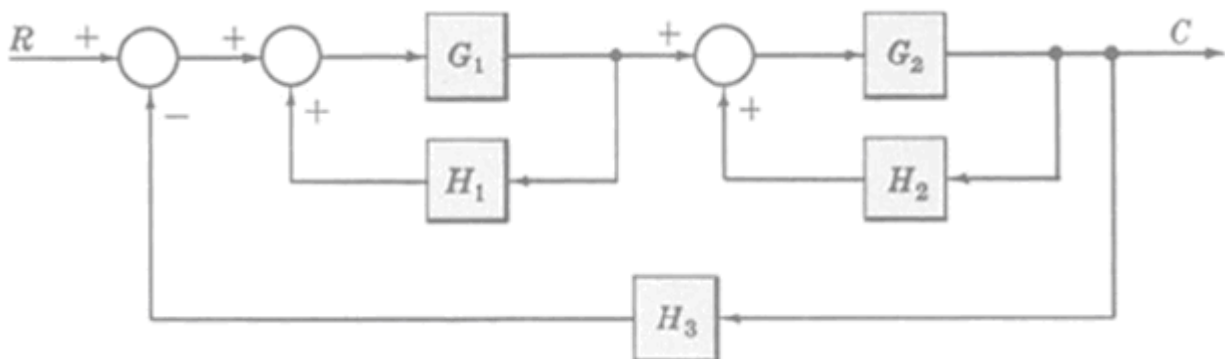


Figure 4:

4. Discuss a theoretical model for O_2 uptake by RBC's. [16]
5. Discuss the model for the heat transfer in the entire body. [16]

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6. Explain visual fixation system with information flow diagram. [16]
7. Discuss transfer function models of biological receptors. [16]
8. Explain the effects of ineffective sugar level control mechanism. [16]

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R07**Set No. 3**

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Answer any FIVE Questions
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1. Discuss about the various receptor characteristics and their transfer functions. Name some receptors and their functions. [16]
2. Obtain the unit step response of a unity-feedback system whose open-loop transfer function is $G(S) = \frac{5(S+20)}{S(S+4.59)(S^2+3.41s+16.35)}$. [16]
3. Explain the endocrine control system with associated diagrams. [16]
4. Explain the respiratory control system with preliminary information-flow diagram. [16]
5. Describe briefly about vestibular control system of human body with a neat block diagram. [16]
6. An interactive control system with two inputs is shown in fig 5. Solve for $C_1(s)/R_2(s)$ and $C_1(s)/R_1(s)$ [16]

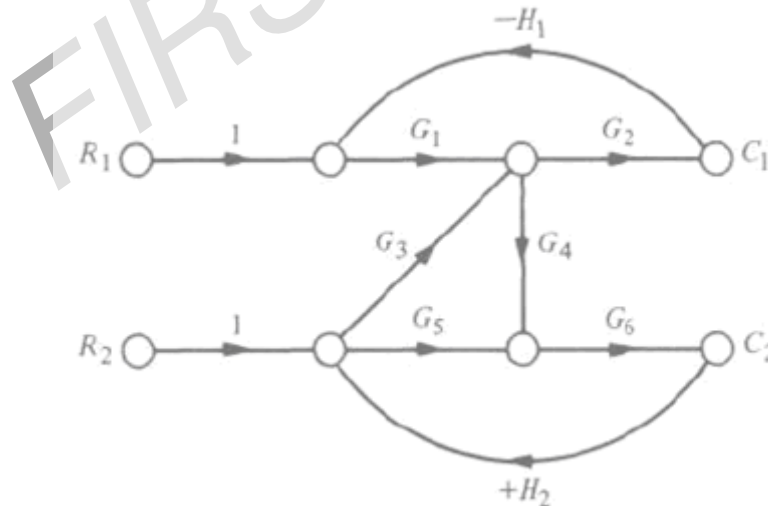


Figure 5:

7. Determine the stability of unity feed back system whose open loop transfer function is $G(s) = \frac{s+1}{(s+2)(s+4)(s^2+6s+25)}$. [16]
8. (a) What is a control system? List out some examples of biological control systems.

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(b) Explain with the steady-state flow diagram, the pupil control system. [8+8]

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