Code No: RR321101 **Set No. 1**

III B.Tech II Semester Regular Examinations, Apr/May 2006
BIOLOGICAL CONTROL SYSTEMS
(Bio-Medical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Find the overall gain C(S)/R(S) for the signal flow graph shown in figure1the below figure?

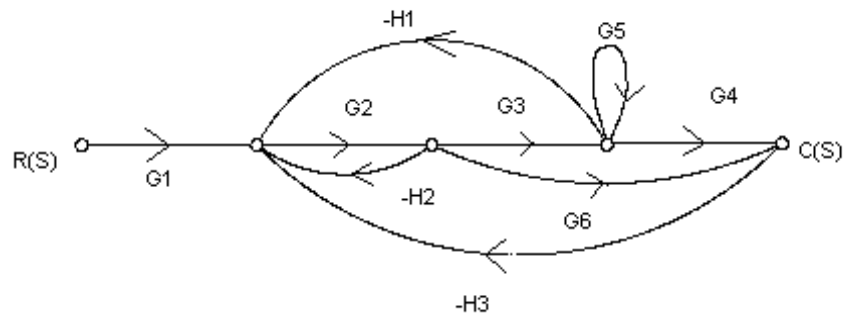

Figure 1:

[16]

2. (a) Find the initial and final values of the following functions:
   i. $F(s) = s(s+2)/(s+2)(s+4)(s+6)$
   ii. $F(s) = 12(s+1)/s(s+2)^2(s+3)$
   (b) Discuss briefly the various positive and negative feedback systems present in the human body? [8+8]

3. The open loop transfer function of a unity feedback system is given by $k(s+2)/s^2(s+3)(s+1)$. Find the restriction on k so that the closed loop system is absolutely stable. [16]

4. Construct the Bode plot for a unity feedback system whose open-loop transfer function is given by G(s)=10/s(s+1)(1+0.02s). And determine [16]
   (a) Gain and Phase crossover frequencies
   (b) Gain and Phase margin, and
   (c) Stability of the closed loop system.

5. Explain convergence and accommodation of the pupil control system. Explain how illumination is controlled. [16]

6. (a) What are the forces acting on a free-swinging human limb?

(b) Write the equations and write the expression for the same. What is Weber-Fechner law? [8+8]

7. Explain the respiratory control system with a neat information flow diagram? [16]

8. (a) Explain the terms Adaptation and Rate Sensitivity.

   (b) Obtain the transfer function of the Mechano-receptor due to Chapman& Smith. [8+8]

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Code No: RR321101 **Set No. 2**

III B.Tech II Semester Regular Examinations, Apr/May 2006
BIOLOGICAL CONTROL SYSTEMS
(Bio-Medical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Differentiate between the following types of technological control systems with examples:
   (a) Open loop and Closed loop systems.
   (b) A Regulator and a Servomechanism. [8+8]
2. (a) The forward transfer function of a unity feedback type-I, second order system has a pole at -2.The nature of gain K is so adjusted that damping ratio is 0.4.The above equation is subjected to input r $(t) = 1 + 4t$. Find the steady state error.
   (b) Define static error coefficients, k_v k_a and k_p. Explain how the steady state error can be computed using the error coefficients. [16]
3. The characteristic polynomial of a system is $S^7 + 5S^6 + 9S^5 + 9S^4 + 4S^3 + 20S^2 + 36S + 36 = 0$. Determine the location of roots on the S-plane and hence the stability of the system? [16]
4. Sketch the Bode plot for the following transfer function and obtain gain and phase margin.
   $(S) = \frac{10(1+0.5S)}{S(1+0.1S)(1+0.2S)}$ [16]
5. Discuss about pupil control system and develop block diagram for the same? [16]
6. Draw the information flow diagram of human thermoregulation system and explain how the temperature is maintained? [16]
7. Explain the respiratory control system with a neat information flow diagram? [16]
8. (a) Write in detail about the human operator models.
   (b) Explain about the human operator tracking characteristics. [8+8]

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Code No: RR321101 **Set No. 3**

III B.Tech II Semester Regular Examinations, Apr/May 2006
BIOLOGICAL CONTROL SYSTEMS
(Bio-Medical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Differentiate between the following types of technological control systems with examples:
   (a) Open loop and Closed loop systems.
   (b) A Regulator and a Servomechanism. [8+8]
2. (a) The forward transfer function of a unity feedback type-I, second order system has a pole at -2.The nature of gain K is so adjusted that damping ratio is 0.4.The above equation is subjected to input r $(t) = 1 + 4t$. Find the steady state error.
   (b) Define static error coefficients, k_v k_a and k_p. Explain how the steady state error can be computed using the error coefficients. [16]
3. (a) Show that the output of a system to a bounded input is stable if the impulse response is finite.
   (b) Write about the various methods for finding the stability of a system. [8+8]
4. Sketch the Bode plot for the following transfer function and obtain gain and phase margin.
   $(S) = \frac{10(1+0.5S)}{S(1+0.1S)(1+0.2S)}$ [16]
5. Discuss about pupil control system and develop block diagram for the same? [16]
6. (a) Explain the anatomy of human thermoregulation. What are the various feedback transducers?
   (b) Explain the thermo receptor characteristics? [8+8]
7. What is the purpose of the visual fixation system? Explain in detail. [16]
8. (a) Explain the terms Adaptation and Rate Sensitivity.
   (b) Obtain the transfer function of the Mechano-receptor due to Chapman& Smith. [8+8]

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Code No: RR321101 **Set No. 4**

III B.Tech II Semester Regular Examinations, Apr/May 2006
BIOLOGICAL CONTROL SYSTEMS
(Bio-Medical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Differentiate between the following types of technological control systems with examples:
   (a) Open loop and Closed loop systems.
   (b) A Regulator and a Servomechanism. [8+8]
2. (a) Define various time domain and frequency domain specifications?
   (b) Distinguish between Proportional and Proportional plus Derivative control. [8+8]
3. Construct Routh array and determine the stability of the system whose characteristic equation is $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$. Also determine the number of roots lying on right half of S-plane, left half of S-plane and on imaginary axis. [16]
4. Sketch the Bode plot for the following transfer function and obtain gain and phase margin.
   $(S) = \frac{10(1+0.5S)}{S(1+0.1S)(1+0.2S)}$ [16]
5. (a) Discuss the dynamic and steady state response characteristics of the Pupil control system?
   (b) Derive the transfer function of a semi-circular canal. [8+8]
6. Draw the information flow diagram of human thermoregulation system and explain how the temperature is maintained? [16]
7. Explain the respiratory control system with a neat information flow diagram? [16]
8. (a) Explain the terms Adaptation and Rate Sensitivity.
   (b) Obtain the transfer function of the Mechano-receptor due to Chapman& Smith. [8+8]

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