Code.No: 45106 | R07 | SET-2

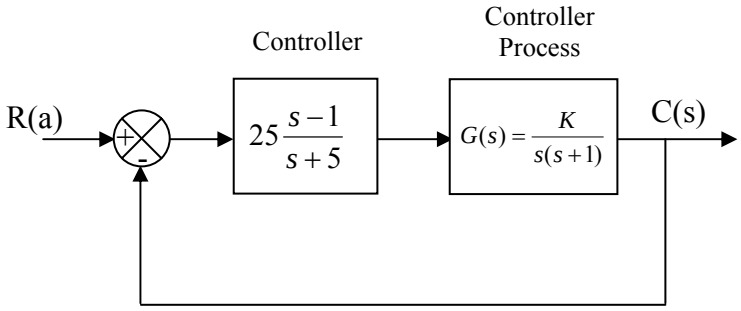
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III.B.TECH - I SEMESTER REGULAR EXAMINATIONS NOVEMBER, 2009
CONTROL SYSTEMS
(Common to EIE, AE)

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

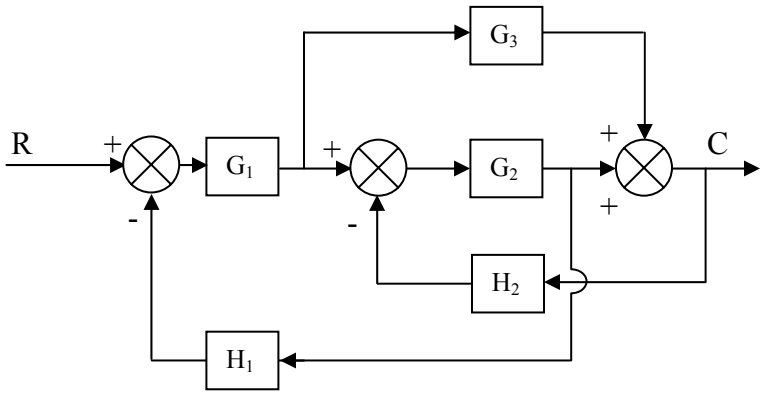
Answer any FIVE questions
All questions carry equal marks
- - -

1.a) Explain regenerative feedback?

b) Determine the sensitivity of the closed loop transfer function $T(s)=\frac{C(s)}{R(s)}$ to variations in parameter K at w = 5 rad/sec. Assume the normal value of K is 1 Shown in figure. [8+8]

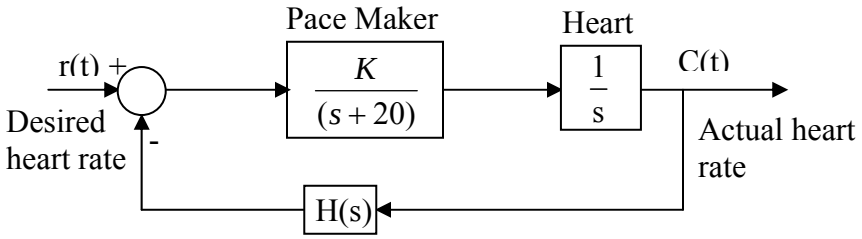


2.a) Determine the overall transfer function relating C and R for the system whose block diagram is given in figure.



b) Explain the properties of block diagrams. [8+8]

3.a) A block diagram of an electric pace maker for controlling rate of heart beat is shown below:



Determine the sensitivity of the closed loop system transfer function to small changes in K at the normal heart rate of 72 beats per minute if H(s) = 1 and the nominal value of K = 400.

b) Consider the standard second order system transfer function. From it, derive damping factor for critically, under damped and over damped cases. [8+8]

4.a) The characteristic equation of a certain control system is $s^3 + (2K+3)s^2 + (6K+7)s + (7K+8.5) = 0$ Determine the range of 'K', (K > 0), such that the roots of the equation are more negative than -1

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b) Find the stability of the system whose characteristic equation is given below using R-H criterion $s^8 + s^7 + 4s^6 + 3s^5 + 14s^4 + 11s^3 + 20s^2 + 9s + 9 = 0$ [8+8]

5.a) Explain why it is important to conduct frequency domain analysis of linear control systems.

b) Sketch the Bode Magnitude plot for the transfer function

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}.$$

Hence find 'K' such that gain cross over frequency is 5 r/s. [6+10]

6.a) Distinguish between polar plots & Nyquist plots.

b) Discuss the effect of adding poles & zeros to G(s)H(s) on the shape of Nyquist plots [6+10]

7. The open loop transfer function of certain unity feedback control system is given by G(S) $= \frac{K}{S(S+4)(S+80)}$. It is desired to have the phase margin to be at least 33^0 and velocity error constant $K_V = 30\ Sec^{-1}$. Design a phase lag series compensator? [16]

8.a) A feed back system has a closed loop transfer function. $\frac{Y(s)}{V(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$

Construct canonical state models for this system?

b) Explain the significance of state space Analysis. [10+6]