TEC-501 **1010** Printed Pages : 5

Paper Code & Roll No. to be filled in your Answer Book

Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐

B. Tech. III Year (V Sem.)

Odd Semester Examination-2015

Automatic Control System

Time : 3 Hours] [Maximum Marks :100

Answer Any Four (4x5=20)

1. (1) Define the following terms:

   i) System

   ii) Control system

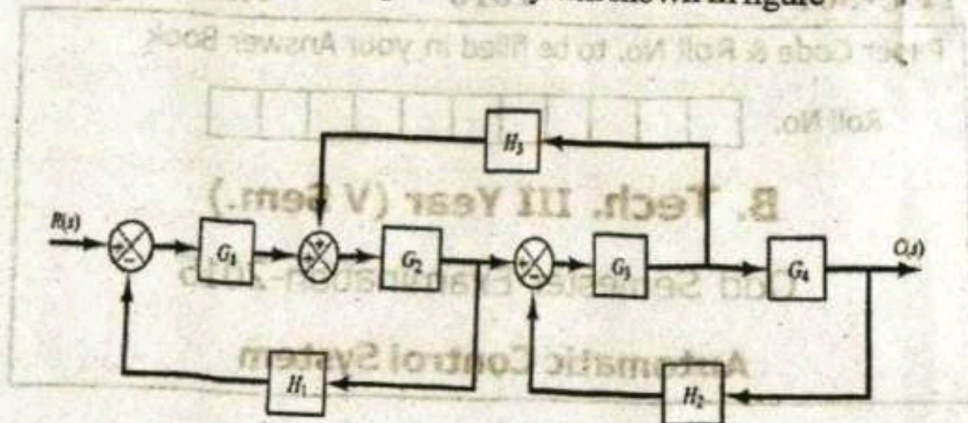   iii) Input

   iv) Output

   v) Disturbance

1. (2) What is feedback? Explain the effects of feedback.
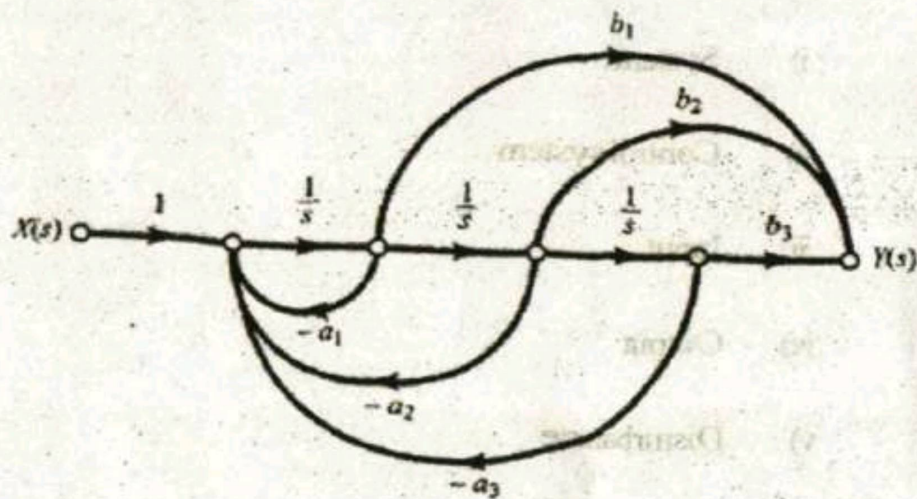
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1.   (3)   Obtain the output of the system shown in figure

1.   (4)   Obtain transfer function of the system shown in figure

1.   (5)   Compare block diagram and signal flow graph methods.

(2)   TEC-501 / 1500

Answer Any Four $(4 \times 5 = 20)$

2. (1) Derive the step-input response of a second order system.

2. (2) What is meant by dominant poles and insignificant poles of transfer function? What is the effect of neglecting the insignificant poles are?

2. (3) What is the effect of addition of a zero to the closed-loop transfer function?

2. (4) What is meant by PID control? What are the advantages of PID controller?

   Obtain the expression for unit step response of the system.

2. (5) Given the transfer function

$$G(s) = \frac{100}{s^2 + 15s + 100}$$

   Find peak time, percent overshoot and rise time.

Answer Any Two $(2 \times 10 = 20)$

3. (1) For the system with $F(s) = s^4 + 22s^3 + 10s^2 + s + K$

   Obtain the marginal value of, the frequency of oscillation of the value of K.

(3)

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3. (2) Using Routh criterion, determine the range of values of for stability for the following system

$$\frac{C(s)}{R(s)} = \frac{K}{s(s^2 + s + 1)(s + 4) + K}$$

3. (3) The open-loop transfer function of a unity feedback system is $\frac{K(1+s)}{s(1+0.1s)(1+0.4s)}$ Using the straight-line approximations, draw the bode diagram and hence find

a) The value of K for a gain margin of 22 dB.

b) The value of K for phase margin of $45°$.

Answer Any Two (2x10=20)

4. (1) What are the effects of phase-lead compensation? State the limitations of a single-stage phase-lead control.

4. (2) What is a lag compensator? Obtained the transfer function of lag compensator and draw the pole-zero plot.

4. (3) Derive expression for the transfer function of a lag-lead compensator.

Answer Any Two (2x10=20)

5. (1) A system is described by the transfer function

$$G(s) = \frac{20(10s+1)}{s^3 + 3s^2 + 2s + 1}$$

Obtain a state model of the system.

5. (2) The state space representation of a system is described by

$$\dot{x}_1 = -x_1 + u$$
$$\dot{x}_2 = x_1 - 2x_2 + u$$

State whether the system is controllable or not.

5. (3) Comment on the complete state observability of the system described by

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} X$$
$$Y = [1 \quad -1 \quad 1]X$$

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