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B. E. 6th Sem. (Mech. Engg.)

Examination – May, 2011

AUTOMATIC CONTROLS

Paper : ME-308-E

Time : Three hours]　　　　　　　*[Maximum Marks : 100*

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Derive the transfer function using block reduction technique.　　　　　　　　　　　　　10
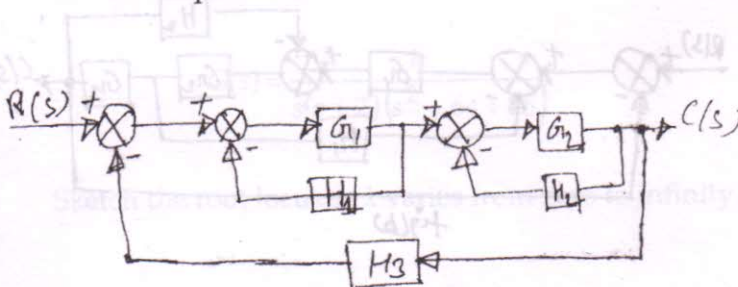
(b) For the figure shown above draw signal flow graph. **10**

2. For the system represented by the given equations find the transfer function (x_5 / x_1) by the help of signal flow graph : **20**

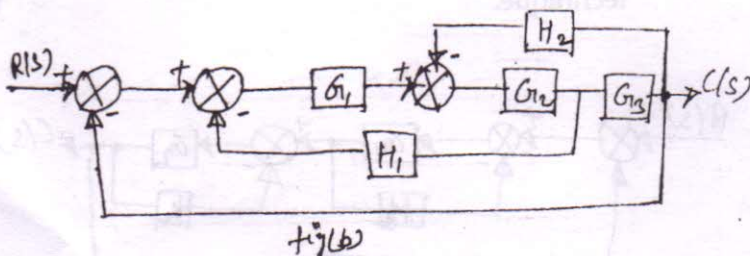$$x_2 = a_{12}\, x_1 + a_{32}\, x_3 + a_{42}\, x_4 + a_{52}\, x_5$$

$$x_3 = a_{23}\, x_2$$

$$x_4 = a_{34}\, x_3 + a_{44}\, x_4$$

$$x_5 = a_{35}\, x_3 + a_{45}\, x_4$$

Where x_1 is the input variable and x_5 is the output variable.

3. Determine the ratio $C(S)/R(S)$ for the system shown in fig (b) : **20**

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4. (a) Explain in detail proportional, proportional cum derivative and proportional cum integral control. **15**

(b) Discuss error constants. **5**

5. (a) Check the stability whose characteristic equation is given by $s^4 + 2s^3 + 6s^2 + 4s + 1 = 0$. **10**

(b) Investigate the stability having following characteristic equation : **10**

$$s^5 + 6s^4 + 3s^3 + 2s^2 + s + 1 = 0$$

6. For a unity feedback system the open loop transfer function is given by : **20**

$$G(s) = \frac{k}{s(s+2)\left(s^2 + 6s + 25\right)}$$

Sketch the root locus as k varies from zero to infinity.

7. Determine the closed loop stability of a control system whose open loop transfer function is :   20

$$G(s)\ H(s) = \frac{k}{s(1 + st)}$$

Using Nyquist criterion .

8. (a) Sketch the polar plot for $G(s) = \dfrac{1}{s(s+1)}$.   10

    (b) Explain Bode plot in detail.   10