Con. 5652-09. (REVISED COURSE) SP-7343

S.E. (ETRX) Sem III (R) 22/12/09

(3 Hours) [Total Marks : 100

Control System 2.30 to 5.30

N.B. (1) Question No.1 is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data wherever **necessary**.
(4) **Figures** to the **right** indicate **full** marks.

1. Answer the following (any **five**) :— **20**

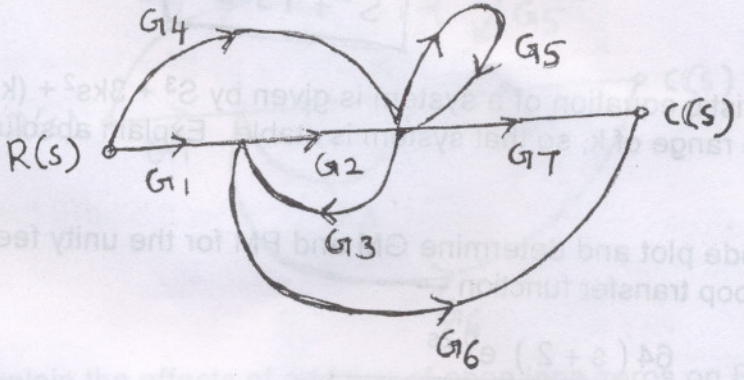
(a) How to find GM and PM from polar plot ?

(b) Explain the block diagram of closed loop control system with suitable example.

(c) Obtain the state transition matrix for the system matrix given by $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$.

(d) Derive expression for peak resonant of a standard second order control system.

(e) Find $\frac{C(s)}{R(s)}$ by using Mason's gain formula :—



(f) Explain the effects of addition of open loop zeros on Root Locus.

2. (a) Sketch the root locus of a unity feedback system having **12**

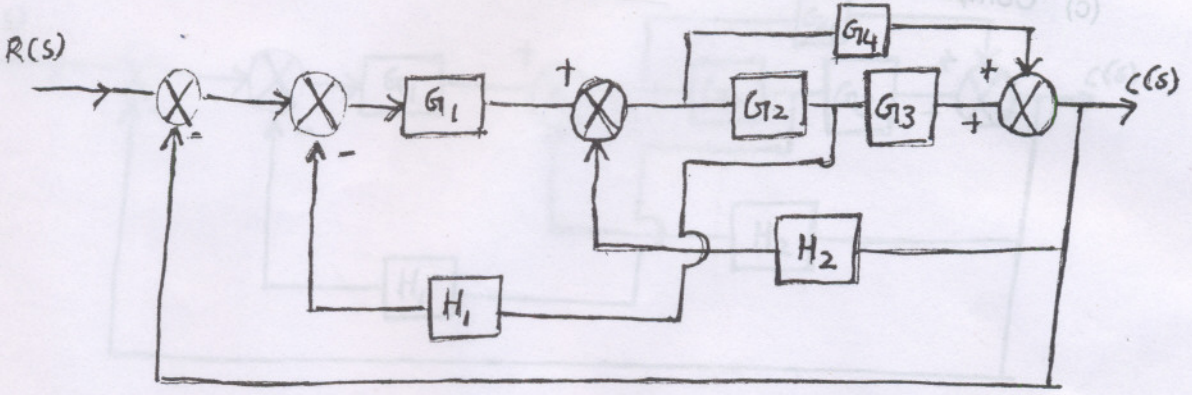
$G(s) = \frac{K}{(s+3)(s+5)(s^2+2s+5)}$; $K > 0$ and comment on stability of system.

Also find the gain margin of the system, if design valve of k = 16.

(b) Determine the output response of second order control system given by **8**

$\frac{C(s)}{R(s)} = \frac{25}{S^2+6s+25}$. Find its rise time, peak time, setting time and peak overshoot if subjected to unit step input.

3. (a) Find the transfer function $\frac{C(s)}{R(s)}$ using Block diagram reduction Technique :— 10



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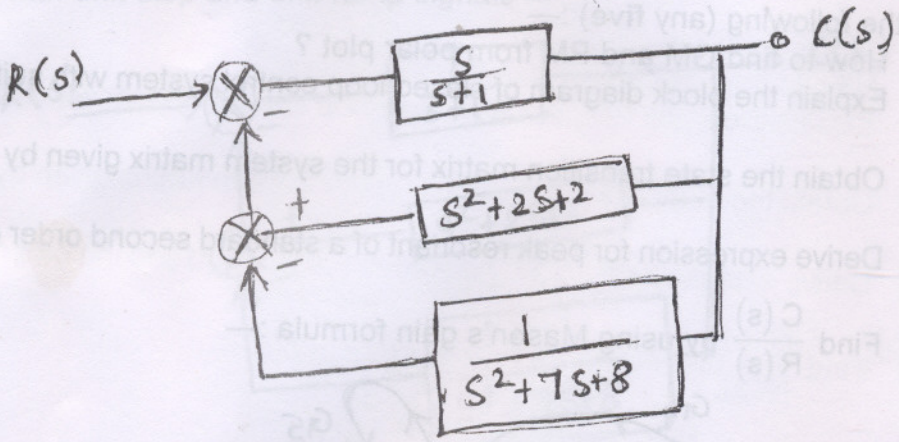
(b) Transfer function of the system is given below $H(s) = \dfrac{s^2 + s + 5}{s^3 + 6s^2 + 8s + 4}$ 10

Obtain state variable model of the system.

4. (a) Find the steady state error and error constants for the following system when it is excited with unit step and unit ramp signals — 10



(b) The characteristic equation of a system is given by $S^3 + 3ks^2 + (k + 2)\, s + 4 = 0$ Determine the range of k, so that system is stable. Explain absolute and relative stability. 10

5. (a) Sketch the bode plot and determine GM and PM for the unity feedback system having open loop transfer function — 15

$$G(s) = \frac{64\,(s+2)\,e^{0\cdot 2s}}{s\,(s+0\cdot 5)\left(s^2 + 3\cdot 2s + 64\right)}$$

(b) Explain the effect of feedback on stability. 5

6 (a) Sketch the polar plot and discuss the stability of the system represented by — 10

$$G(s)\,H(s) = \frac{K}{S\,(s+1)\,(s+5)}$$

(b) Discuss the stability using Nyquist Criteria for $G(s)\,H(s) = \dfrac{4\,(s-1)}{s+2}$ 10

7. Write short notes on the following (any **three**) :— 20

(a) Co-relation between time domain and frequency domain specifications
(b) Synchros
(c) Continuous controller modes
(c) Compansion of lead, lag and lag lead network compensation.