R – 482

Seat No.

T.E. (Electrical) (Semester – V) (New Course) Examination, 2009
FEEDBACK CONTROL SYSTEMS

Day and Date : Thursday, 3-12-2009 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions : 1) *Solve* ***any three*** *questions from Section* ***I*** *and* ***any three*** *questions from Section* ***II.***
2) *Assume suitble data* ***wherever*** *necessary.*
3) *Figures to the* ***right*** *indicate* ***full*** *marks.*

SECTION – I

1. a) Obtain the transfer function $E_0(s)/E_i(s)$ for the circuit shown in Fig.1. **8**

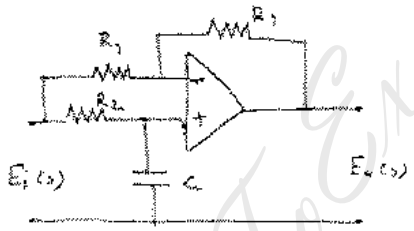

Fig - 1

b) With suitable example state and explain Mason's gain formula for S.F.G. **8**

2. Obtain the transfer function of a system shown in fig. 2 **18**

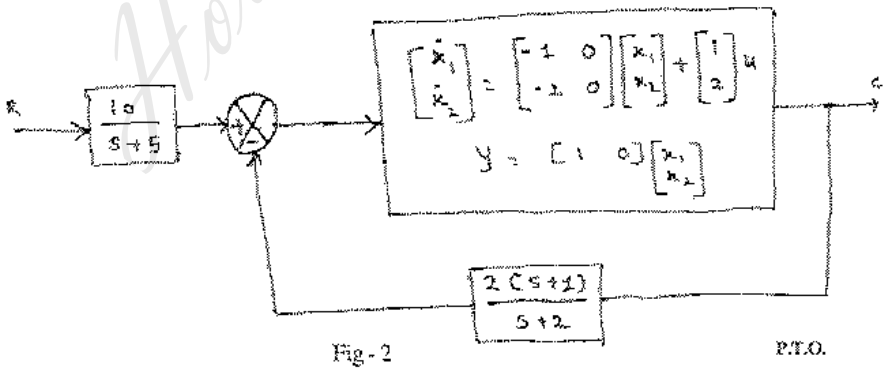

Fig - 2

P.T.O.

3. a) Determine the values of w_n and y so that the maximum overshoot in unit step response is 25% and the peak time is 2 sec.

$$\frac{C(s)}{R(s)} = \frac{w_n^2}{s^2 + 2yw_n\, s + w_n^2}.$$ 10

b) For a closed loop control system.

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 + G(s)}$$

Find

a) Steady state error.

b) Static position error constant, k_p.

c) Static velocity error constant, k_v. 6

4. a) Obtain the transfer function of field controlled D.C. servo mechanism. 8

b) Draw a neat schematic of hydraulic PI controller and obtain its transfer function. 8

SECTION – II

5. a) Obtain the unit ramp response of a system defined by,

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$ 8

b) For the following characteristic equation $s^4 + ks^3 + s^2 + s + 1 = 0$ determine the range of k for stability. 8

6. For a unity feedback closed loop system with open loop transfer function as

$$G(s) = \frac{k}{s(s+1)(s+2)}$$

the 'k' is non negative

Sketch the root locus plot. 16

7. a) The transfer function of a system is $G(s) = \frac{k}{T_{s+1}}$. Obtain the steady state output $y_{ss}(t)$ if input $x(t) = X \sin wt$. 8

b) Obtain the phase and gain margins of a system shown in fig.3 for k = 10, and k=100. 10

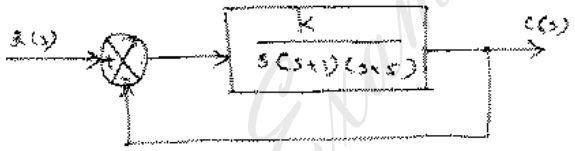

Fig - 3

8. State and explain common physical non-linearities present in control systems. 16