USN | | | | | | | | | | |

2002 SCHEME **EE43**

Fourth Semester B.E. Degree Examination, June-July 2009

Control System

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. Discuss the effects of feedback on i) Overall gain ii) Stability iii) Sensitivity iv) Noise. **(08 Marks)**

b. For the mechanical system shown in fig.1(b), i) draw the mechanical network ii) write the differential equation of the system iii) draw the Force – voltage analogous network. **(12 Marks)**

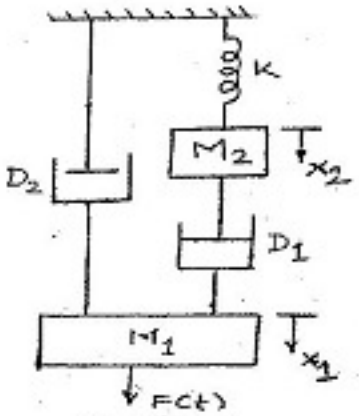

Fig. 1(b)

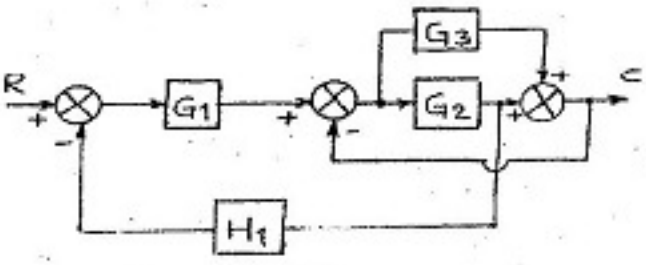

Fig. 2(a)

2 a. Obtain $\frac{C(s)}{R(s)}$ of the system shown in fig.2(a) by using block diagram reduction techniques. **(08 Marks)**

b. Draw the signal flow graph and obtain the transfer functions $\frac{E_o(s)}{E_i(s)}$ for the electrical network shown in fig.2(b). **(12 Marks)**

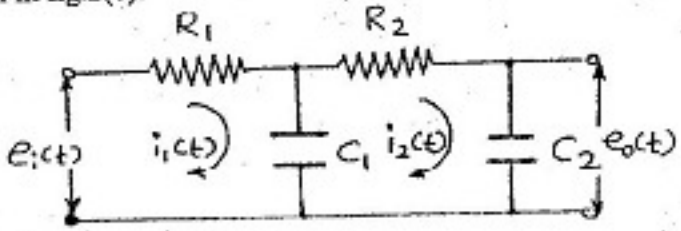

Fig. 2(b)

3 a. Derive an expression for the steady state error of a first order system subjected to an unit ramp input. **(06 Marks)**

b. The overall transfer function of a control system is given by $\frac{C(s)}{R(s)} = \frac{16}{S^2 + 1.6S + 16}$. Determine i) Rise time ii) Peak time iii) Peak over shoot and 47 settling time. **(08 Marks)**

c. A unity feed back system has an open loop transfer function $G(s) = \frac{10}{s(s^2 + 5s)}$. Determine i) The type and order of the system ii) Static error constants. **(06 Marks)**

4 a. Explain the concept of following with illustration i) Absolute stability ii) Relative stability iii) Marginal stability. **(06 Marks)**

b. Using RH criterion investigate the stability of a unity feed back control system whose open loop transfer function is given by $G(s) = \frac{e^{-ST}}{S(S+2)}$. **(06 Marks)**

c. Discuss the stability of the system whose characteristic equation is $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$. **(08 Marks)**

5 a. Explain the various rules used to construct Root locus. **(08 Marks)**

b. Sketch Root locus diagram for unity feed back system whose open loop transfer function is given by $G(s) = \frac{K}{S(S+2)(S^2+2S+5)}$ and mark all salient points. **(12 Marks)**

6 a. Derive an expression for the resonant peak (Mr) and resonant frequency (Wr) for a second order under – damped system. **(06 Marks)**

b. A unit step input is applied to unity feedback control system whose open loop transfer function is given by $G(s) = \frac{K}{S(ST+1)}$. Determine K, T and resonant peak (Mr) given that maximum overshoot $M_P = 26\%$ and resonant frequency (Wr) = 8 rad/sec. **(08 Marks)**

c. Define i) Gain crossover frequency ii) Phase crossover frequency iii) Gain Margin iv) Phase Margin. **(06 Marks)**

7 a. Determine the value of K in the transfer function given below such that i) the gain margin is 20db and ii) the phase margin is 30^0.

$G(s) = \frac{200K}{S(S+10)(S+20)}$ using Bode plot. **(12 Marks)**

b. Determine the transfer function for the Bode plot shown in fig. 7(b). **(08 Marks)**

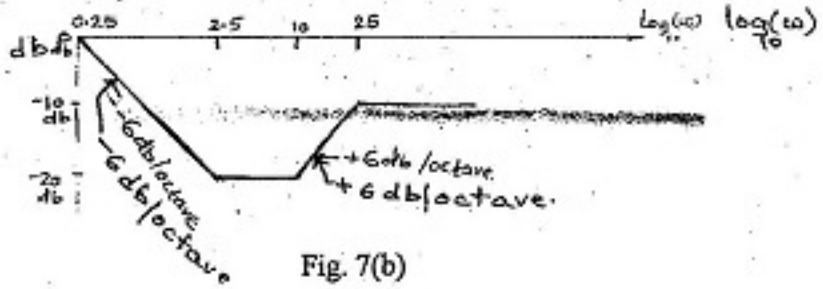

Fig. 7(b)

8 a. State and explain Nyquist stability criterion. **(06 Marks)**

b. Sketch the Nyquist plot of a unity feed back system with open loop transfer function

$G(s) = \frac{1}{S(1-2S)}$.

Is the closed loop system stable? Varify the same using RH criterion. **(14 Marks)**

*****