U.S.N

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; June - 2016

Control System

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.*
ii) Assume missing data suitably.

UNIT - I

1 a. Distinguish between open-loop and closed –loop control system with examples for each. 10

b. Find the transfer function of the electrical network in Fig. Q1(b) 10

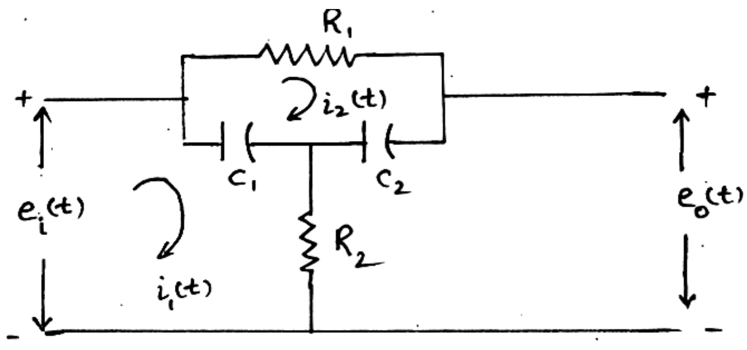

Fig. Q.1(b)

2 a. Write the differential equations for the mechanical system shown in Fig. Q.2 (a) and obtain F.V. analogy and F.I Analogy. 10

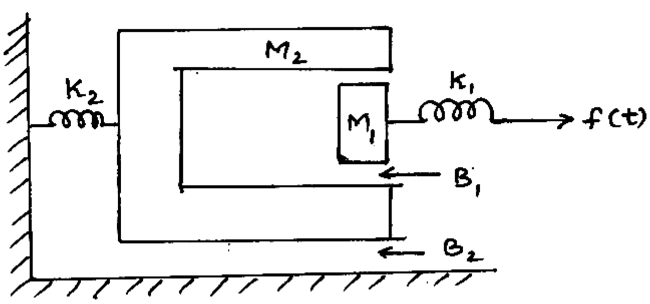

Fig. Q. 2(a)

b. For the mechanical system shown in Fig. 2(b). (i) Draw equivalent mechanical system (ii) Write F.V. Analogy iii) Write F.I. Analogy 10

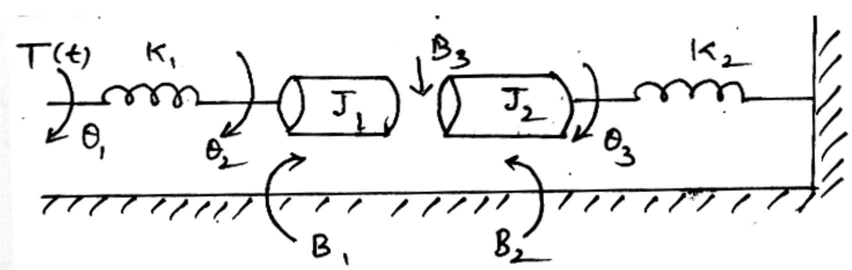

Fig Q. 2(b)

UNIT - II

3 a. Draw a block-diagram for the bridge circuit shown in Fig. Q. 3(a) where V_i and i_o are the input and output variables respectively. Also determine $\frac{I_0(S)}{V_1(S)}$ by the block diagram reduction technique. 10

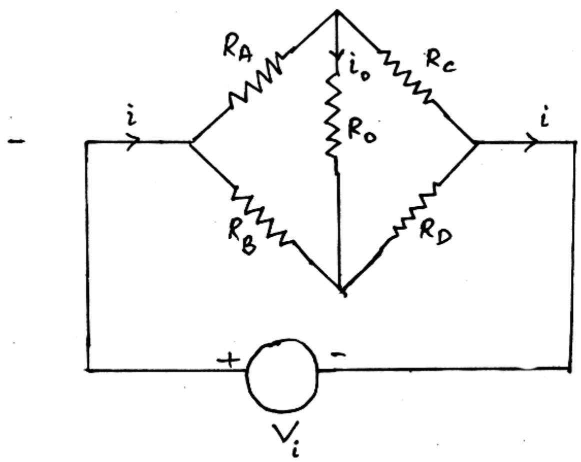

Fig Q. 3(a)

b. Find the C/R for the following system using Mason's gain rule. 10

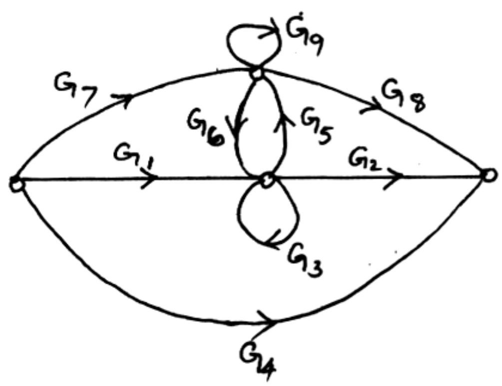

Fig Q-3(b)

4 a. Derive an expression for unit step response of a second order system (underdamped case). 10

b. A second order system is represented by the transfer function.

$$\frac{Q(S)}{I(S)} = \frac{1}{JS^2 + fs + k}$$

A step input of 10Nm is applied to the system and the test results are 10

(a) Maximum overshoot = 6%

(b) time at Peak overshoot = 1sec

(c) The steady state value of the output is 0.5radian. Determine the values of J, f and K.

UNIT - III

5 a. A control system is depicted in Fig. 5(a). If K = 2, find out how many times the gain may be increased before on stability access. 6

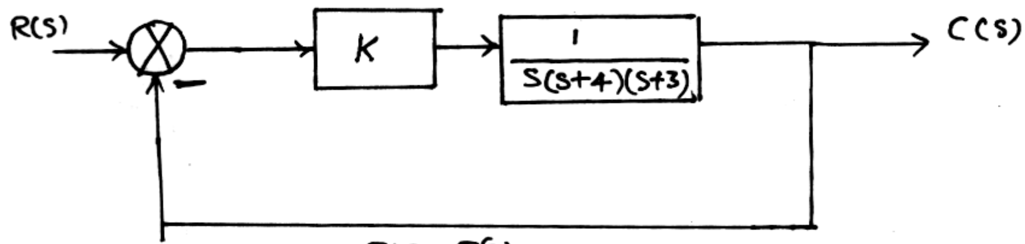

Fig 5(a)

b. A feedback control system has characteristic equation

$$s^3+3(k+1)s^2+(7k+5)s+(4k+7)=0$$ 6

Determine the range of 'k' such that system has roots more negative than s = - 1.

c. Determine the values of k and b, so that the system whose open-loop transfer function is $G(s)=\frac{k(s+1)}{s^3+bs^2+3s+1}$ oscillates at a frequency of oscillations of 2 radls. Assume unity feedback. 8

6. Sketch the root locus diagram for a unit feedback control system with $G(s)=\frac{k}{s(s^2+8s+17)}$ Using the rules of construction by determining the breakaway/break in points and the angle of departure. Find the value of 'k' for which the system just oscillates from root locus; determine the value of 'k' for a damping ratio of 0.5. 20

UNIT - IV

7 a. Explain the co-relation between time-domain and frequency-domain approach. 5

b. Explain Nyquist stability criterion. 5

c. The open-loop Transfer function of a negative feedback control system is

$G(S)H(S)=\frac{1}{S(S+1)(S+0.5)}$. Sketch the polar plot and hence find the following: 10

(i) Phase cross over frequency ii) Gain cross-over frequency

iii) Gain Margin iv) Phase-Margin

8 a. Discuss the stability of the unity feedback control system with

$G(s)=\frac{1}{s^2(1+s)}$ by using Nyquist criteria. If $H(s)=1+2s$ test the stability of the system. 15

b. Mention the steps to solve problems by Nyquist criterion. 5

UNIT - V

9 a. For a certain system when

$$X(O)=\begin{bmatrix}1\\-3\end{bmatrix}\ then\ X(t)=\begin{bmatrix}e^{-3t}\\-3e^{-3t}\end{bmatrix}$$

$$While\ X(O)=\begin{bmatrix}1\\1\end{bmatrix}\ then\ X(t)=\begin{bmatrix}e^{t}\\e^{t}\end{bmatrix}$$ 12

Determine the system matrix A. Also find state transform matrix

b. Obtain the state equation and output equation of the electric network shown in Fig. Q. 9(b). 8

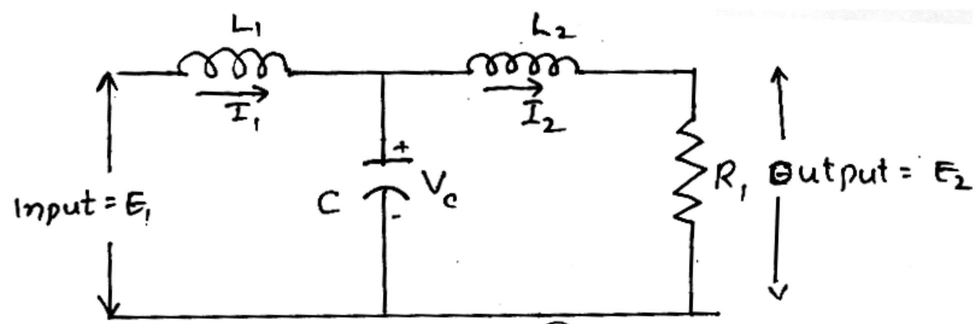

Fig. Q.9(b)

10 a. The open loop transfer function of a unity feedback control system is given by

$$G(s)=\frac{k(1+s)}{s(1+0.1s)^2(1+0.2s)}$$ 14

(i) Draw the Bode plot and hence find phase Margin and gain margin for k = 1

(ii) Determine the value of ‘k’ for a gain margin of 20dB and the value of ‘k’ for a phase margin of 30°

b. Explain briefly about ALL pass systems. 6

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