Total No. of Questions : 5] [Total No. of Printed Pages : 4

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503(O)

B. E. (Fifth Semester) EXAMINATION, Dec., 2009

(Old Scheme)

(Common for EC, EI & BM Engg.)

CONTROL ENGINEERING

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *one* question from each Unit. Assume suitable data if not given.

Unit – I

1. (a) Draw the block diagram of open loop and close loop control scheme and compare them. 6

(b) Determine the transfer function for the given differential equation using Laplace transform : 14

$$\frac{d^2 c(t)}{dt^2} + 4\frac{dc(t)}{dt} + c(t) = r(t)$$

Assume all the initial conditions to zero. If $r(t) = 1$ evaluate the time solution for $c(t)$.

Or

(a) Reduce the given block diagram into : 10

(i) A form having one block in the forward path and one in feedback path

(ii) Single block representation

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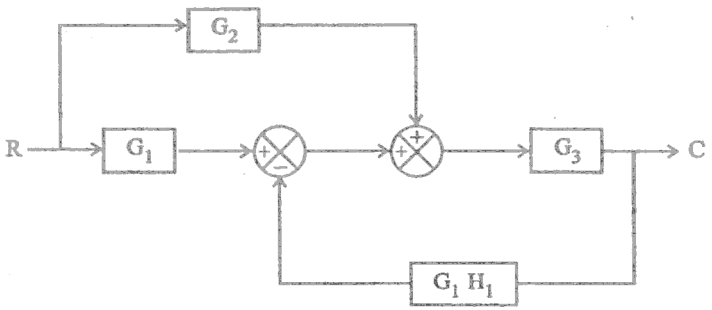

Fig. 1

(b) Find the transfer function of an operational amplifier used in inverting mode. 10

Unit – II

2. (a) Draw the time response of first order control system subjected to unit ramp input function. Calculate the steady state error. 10

(b) A unity feedback control system has forward path transfer function given by 10

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

Determine :

(i) The expression for unit step response

(ii) The rise time

(iii) The maximum overshoot

Or

(a) Draw the transient response of a second order control system and define the following parameters with its reference :
rise time, maximum overshoot and settling time. 10

(b) Determine the sensitivity of the overall (closed loop) transfer function for the system having $G(s) = \frac{25}{s(s+2)}$, $H(s) = 0{\cdot}25$ at $\omega = 1$ rad/sec. with respect to (i) forward path transfer function (ii) feedback path transfer function. 10

Unit – III

3. (a) Define absolute and relative stability. How the time response and location of roots of a characteristic equation help in prediction of stability ? 10

(b) Determine the stability of a unity feedback control system given by : 10

$$G(s) = \frac{K}{s(sT_1 + 1)(sT_2 + 1)}.$$

Or

A unity feedback control system has an open loop transfer function $G(s) = \frac{K}{s(s+4)}$. Draw the root locus and determine the value of K if the damping ration is $0{\cdot}707$. 20

Unit – IV

4. (a) List the various control actions. Derive the expression for steady state error for a second order system with integral control and with unit ramp input. 10

(b) Derive the state space representation of the given electrical network. 10

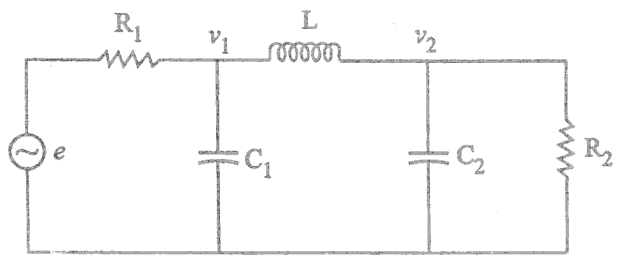

Fig. 2

Or

Draw the state block diagram for the transfer function given below and obtain state equations : 20

(i) $\frac{C(s)}{R(s)} = \frac{1}{(s+1)(s+3)}$

(ii) $\frac{C(s)}{R(s)} = \frac{2s+1}{s^2+2}$

Unit – V

5. (a) The open loop transfer function of a unity feedback closed loop system is $G(s) = \frac{(2s^2 + 5s + 1)}{(s^2 + 2s + 3)}$? Write a MATLAB script to plot root locus using 'rlocus' command for K = – 0·4 to 4. 10

(b) Write a script file that prompt the user to enter the time to plot the speed '*v*' of a falling object as a function of time ($v = gt$, where $g = 9{\cdot}81\ m/s^2$). Plot the '*v*' as a function of time. 10

Or

(a) Give the MATLAB operators used for the following operations : 5

Logical AND, Logical NOT, Logical Exclusive OR, Square and Not equal to.

(b) Write a MATLAB script file to plot the function : 15

$$y = \begin{cases} 15\sqrt{4x} + 10 & x >= 9 \\ 10x + 10 & 0 \le x \le 9 \\ 10 & x < 0 \end{cases}$$

for $-5 \le x \le 30$.

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