Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH/CSE(O)/EEE(O)/SEM-5/EE-503/2012-13

2012

CONTROL SYSTEM

Time Allotted : 3 Hours   *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words
as far as practicable.

Graph sheet(s) will be supplied by the Institute on demand.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

    i)   In force-voltage analogy, mass is analogous to

          a)   change   b)   current

          c)   inductance   d)   resistance.

    ii)   Gain margin is a measure of

          a)   relative stability   b)   controllability

          c)   observability   d)   absolute stability.

5101(O)   [Turn over

iii) Addition of a zero to the closed loop transfer function

    a) increases rise time   b) decreases rise time

    c) increases overshot   d) has no effect.

iv) The transfer function of a simple R-C integrator circuit shown in the figure is
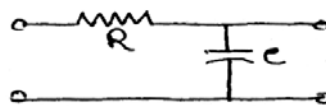
    a) $\dfrac{1}{s-a}$ b) $\dfrac{1}{s+a}$

    c) $\dfrac{a}{s-a}$ d) $\dfrac{a}{s+a}\left[a=\dfrac{1}{RC}\right]$.

v) The initial slope of Bode plot for a transfer function having simple pole at origin is

    a) 20 db/dec   b) – 40 db/dec

    c) 40 db/dec   d) – 20 db/dec.

vi) The steady state error for a type 2 system subjected to a unit ramp input is

a) 2   b) 1

c) 0   d) ∞.

vii) For a second order system $2\dfrac{d^2y}{dt} + 4\dfrac{dy}{dt} + 8y = 8x$. The damping ratio is

a) 0·1   b) 0·25

c) 0·333   d) 0·5.

viii) The unit step response of a particular control system is $C(t) = 1 - 10\,e^{-1}$. Then transfer function is

a) $\dfrac{10}{s+1}$ b) $\dfrac{s-9}{s+1}$

c) $\dfrac{1-9s}{s+1}$ d) $\dfrac{1-9s}{s(s+1)}$.

ix) A system has 3 zeros & 4 poles. The number of root locus branches is equal to

    a) 3   b) 4

    c) 1   d) 7.
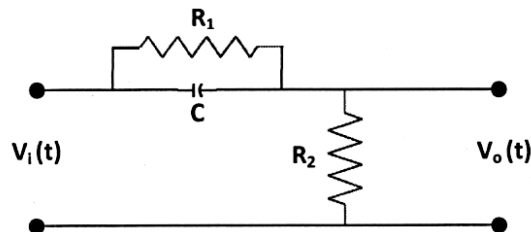
x) The gain of a system is 10. In terms of dB, the gain is

    a) 1   b) 10

    c) 20   d) 100.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Find the Transfer function of the following circuit :

3. Using Routh's Stability Criterion determine the range of *K* for stability from the characteristic equation :

$$S^4 + K.S^3 + S^2 + S + 1 = 0$$

4. Write short notes on the following :

i) DC Tacho-Generators

ii) AC Servomotor.

5. Explain the stability of system as per the position of the poles.

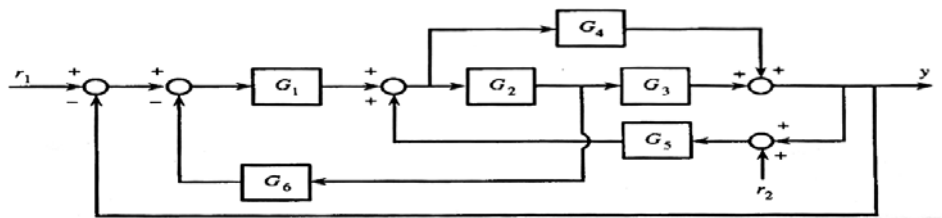6. Construct the state model for the system characterized by differential equation $\dfrac{d^3y}{dt^3} + 6\dfrac{d^2y}{dt^2} + 11\dfrac{dy}{dt} + 6y = u$.
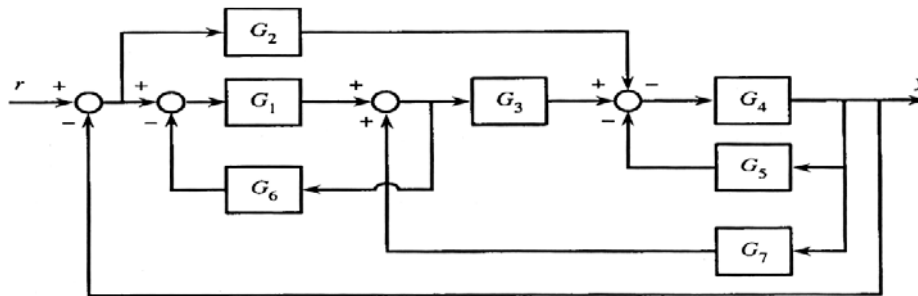
GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7. a) Use Mason's Gain Formula, compute the transfer functions from r_1 to y and r_2 to y of the block diagram shown below :

b) By Block Diagram Reduction Technique find the

transfer function of the block diagram shown below :

8. a) State and explain Nyquist Criterion.

b) A unity feedback control system has open loop transfer

function $G(s)H(s) = \dfrac{4s+1}{s^2(s+1)(2s+1)}$. Draw the Nyquist

Plot & determine the Close loop stability.

9. The open loop transfer function of a unity feedback system is

given by $G(s) = \dfrac{k(20+s)}{(s+1)(s+2)(s+10)}$. Construct Bode plot for

k = 10 & check its stability and find (a) Gain Margin,

(b) Phase Margin, (c) Gain Crossover frequency,

(d) Phase Crossover frequency.

10. Write short notes on any *three* of the following : 3 × 5

    a) Synchro error Detector

    b) Stepper Motor

    c) PID controller

    d) Special cases of Routh-Hurwitz Criterion

    e) Open loop & close loop control systems.

=============