Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/ECE(NEW)/SEM-5/EC-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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) A system is stable

a) if bounded inputs produce bounded outputs

b) if bounded inputs produce unbounded outputs

c) if bounded inputs produce unbounded outputs

d) if all bounded inputs produce bounded outputs.

ii) The characteristics of a second order system is $S^2 + 6s + 25 = 0$, the system is

a) Underdamped b) Overdamped

c) Undamped d) Critically Damped.

iii) In terms of Bode Plot, the system is stable if

a) PM = GM

b) PM & GM both are positive

c) PM & GM both are negative

d) PM negative but GM positive.

iv) The response of control system, having damping factor as unity will be

a) Oscillatory b) Underdamped

c) Critically damped d) none of these.

v) A second order control system with $\xi = 0$ is always

a) marginally stable b) stable

c) unstable d) none of these.

vi) The Routh Hurwitz criterion gives

a) Relative stability b) Absolute stability

c) Gain margin d) Phase margin.

vii) For a stable system

a) the gain crossover occurs before phase crossover

b) the gain crossover occurs after phase crossover

c) the gain crossover and phase crossover frequencies are very close to each other

d) the gain cross and phase crossover frequencies are same.

viii) The initial slope of the Bode Plot gives an indication of

a) type of the system

b) nature of the system time response

c) system stability

d) gain margin.

ix) If the root locus branches cross the imaginary axis, the system becomes

a) Overdamped b) Underdamped

c) Oscillatory d) Sustained oscillation.

x) The transfer function of a system is defined as

a) the ratio of Laplace transform of output to Laplace transform of input considering initial conditions as zero

b) the ratio of output to input

c) both (a) and (b)

d) none of these.

xi) A system is represented by the differential equation $M\frac{d^2x}{dt^2} + F\frac{dx}{dt} + Kx = u(t)$. The transfer function relating $X(s)$ and $U(s)$ is

a) $\frac{M}{(Ms^2 + Fs + K)}$ b) $\frac{M}{(Fs^2 + Ms + K)}$

c) $\frac{1}{(Ms^2 + Fs + K)}$ d) $\frac{1}{(Fs^2 + Ms + K)}$.

xii) Area under a unit impulse function is

a) infinity b) unity

c) zero d) none of these.

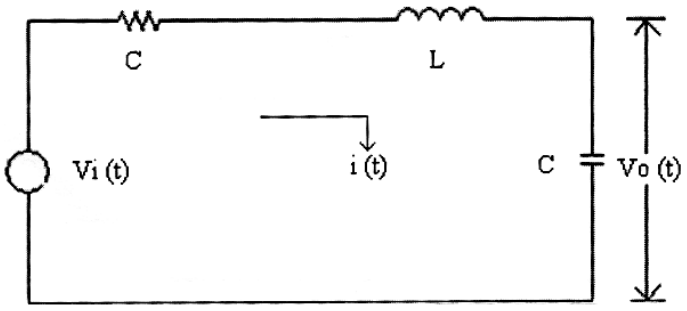
GROUP – B

(Short Answer Type Questions)

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

2. What are 'Analogous system' ? Explain 'Force-Voltage analogy' and 'Force-Current analogy' in brief. 1 + 4

3. Obtain the Transfer function of the given electrical system. The symbols have their usual meaning.



4. What do you mean by the term 'Transmittance' ? Differentiate between 'Self Loop' and 'Closed Loop'. Write down 'Mason's gain' formula and explain the meaning of each and every team. 1 + 2 + 2

5. What do you mean by 'Transient response' and 'Steady State response' of a system ? Obtain an expression for 'Unit impulse response' of first order system. 2 + 3

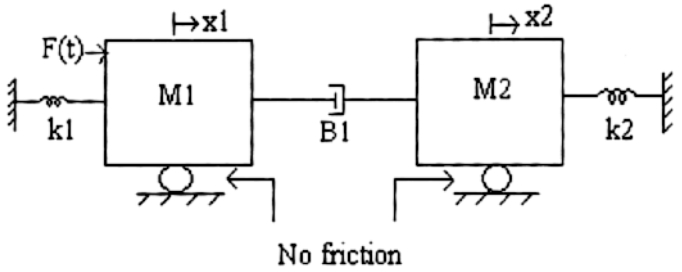
6. What is 'Damping ratio' ? Obtain an expression for 'Unit step response' of a second order system when the damping ratio is unity. 1 + 4

GROUP – C

(Long Answer Type Questions)

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

7. a) Obtain the differential equation of the mechanical system.

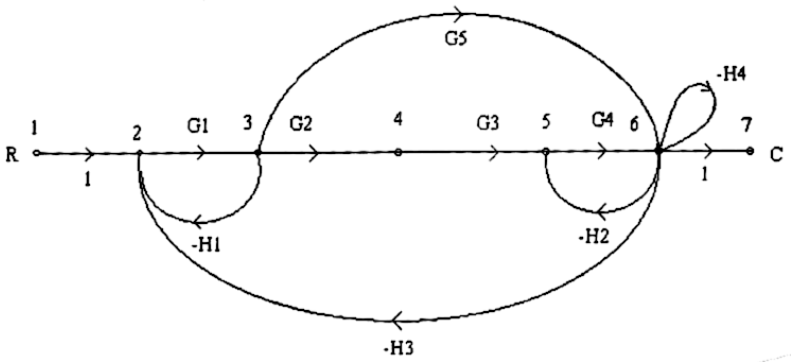


b) Draw the Electrical analogous circuit based on 'force-current' analogy. 7½ + 7½

8. a) Explain the different 'Signal Flow Graph' terminologies.

   b) Compare between 'Block Diagram' and 'Signal Flow Graph' methods.

   c) For the given signal flow graph find the C/R ratio.



5 + 2 + 8

9. a) Write down the advantages and disadvantages of state space techniques.

   b) Obtain state transition matrix $\varphi(t)$ from non-homogeneous state equation of a linear time invariant control system and list the properties of it.

   c) Obtain the eigenvalues and eigenvectors for a system described by $\dot{X} = \begin{bmatrix} 0 & 6 & -5 \\ 1 & 0 & 2 \\ 3 & 2 & 4 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} U$ and $Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} X$

3 + 6 + 6

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

a) PID Controller

b) Type and Order of a system

c) Analogous system

d) Polar Plot

e) Transient Response and Steady state response.

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