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BIEE–021

B. TECH.-VIEP ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

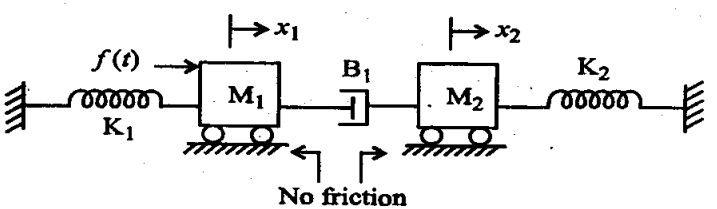
June, 2019

BIEE-021 : CONTROL SYSTEMS

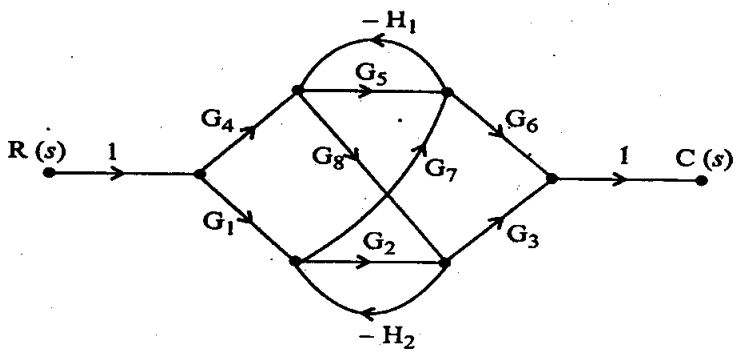
Time : 3 Hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. All questions carry equal marks. Use of scientific calculator is permitted. Use of log paper/ semi log graph is permitted. Assume missing data if any with suitable justification.*

1. (a) Obtain the differential equations of mechanical systems and hence draw the electrical analogous circuit based on force-current analogy : 7



(b) Using Mason's gain formula, find the gain of the following system : 7



2. (a) For unity feedback system having open loop transfer function : 10

$$G(s) = \frac{k(s+2)}{s(s^3 + 7s^2 + 12s)}$$

Find :

(i) Type of the system

(ii) Error coefficient

(iii) Steady state error

when input to system is $\frac{R}{2}t^2$.

(b) Differentiate between transient response and steady state response. 4

3. (a) Derive an expression of maximum peak overshot (% M_p) of a second order system subjected to unit step input. 7

(b) How can Routh's criterion be used to study the relative stability ? Also state the advantages and limitations. 7

4. (a) Sketch the root locus of system : 10

$$G(s)H(s) = \frac{k}{s(s+1)(s+2)(s+3)}.$$

(b) Explain the design in frequency domain of lead compensator. 4

5. (a) What is Nyquist criterion for stability ? Explain how to determine stability. 4

(b) Determine the stability of closed loop control system characteristic equation : 10

$$s^4 + 3s^3 + 2s^2 + 2s + 2 = 0.$$

6. (a) Obtain the state space represented of field controlled DC motor. 4

(b) The open loop transfer function of unity feedback system is : 10

$$G(s) = \frac{ke^{-0.1s}}{s(1+0.1s)(1+s)}$$

Draw the Bode plot, determine the value of k so that phase margin of system is 60°.

7. (a) Write short notes on any ***two*** of the following : 2×4

(i) Potentiometer

(ii) AC servomotor

(iii) Pneumatic controller

(iv) PID controller

(b) Using block diagram reduction techniques, find closed loop transfer function : 6