

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
December, 2024

Level : B.E./B.Sc.  
Year : III  
Time : 2 hrs. 30mins.

Course : COEG 301  
Semester : II  
F. M. : 40

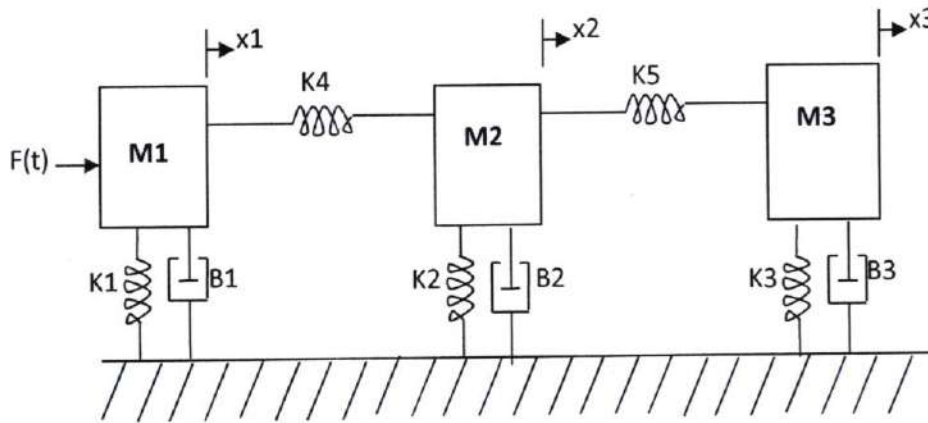
22 DEC 2024

SECTION "B"  
[4Q. × 10 = 40 marks]

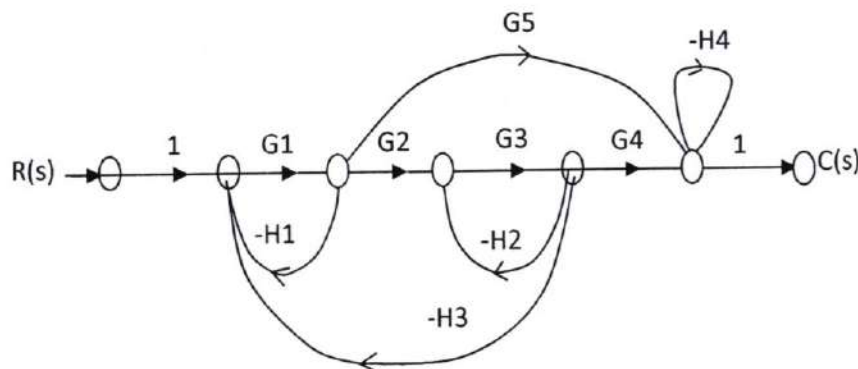
Attempt *ANY FOUR* questions. Assume necessary data if required.

1.

- a. Draw the mechanical equivalent network for the system shown in figure below. Obtain the differential equation governing the behavior of mechanical system. Draw only the force voltage and force analogy analogous electrical network. [5]



- b. For the given signal flow graph find the ratio  $C/R$  using Mason Gain formula. [5]



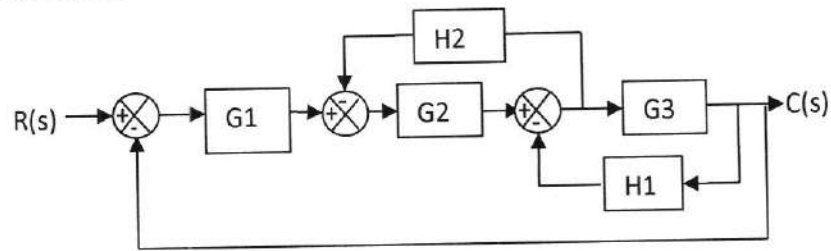
2.

- a. Obtain state space representation of the transfer function. [5]

$$\frac{C(s)}{R(s)} = \frac{104s^2 + 47s + 160}{104s^3 + 104s^2 + 56s + 160}$$

P.T.O.

- b. Determine the overall transfer function for the system show below by block diagram reduction method. [5]



3.

- a. By means of Routh criterion determine the stability of the system represented by the following characteristic equation in the right half of s-plane. [5]
- $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$
  - $s^4 + 2s^3 + s^2 + 4s + 2 = 0$
  - $s^4 + 2s^3 + 8s^2 + 4s + 3 = 0$

- b. Describe about the static error coefficient due to unit step, ramp and parabolic input for a type one system. [5]

4.

- a. Write short notes on [5]
- Open loop and closed system
  - Transient response of second order system
- b. Sketch root loci for the unity feedback system and discuss about stability and oscillation frequency  $G(s) = K / [s(s^2 + 2s + 2)]$ . [5]

5.

- a. "Obtain the transfer function of field controlled DC motor relating the output angular displacement,  $\theta_m(s)$  and the input voltage,  $V_f(s)$ . [3]
- b. Draw the block diagram of a closed loop control system and indicate the following on it: plant, command or reference input, controlled output, actuating signal, feedback element and control element. [3]
- c. Obtain the transfer function of the electrical and mechanical system shown in figure below. Show that these transfer function of the two systems are of identical form and thus they are analogous system. [4]

