

Printed Pages : 4

ME – 605

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4053Roll No.

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B. Tech.

(SEM. VI) EXAMINATION, 2007

AUTOMATIC CONTROLS

Time : 2 Hours]

[Total Marks : 50

*Note : Attempts all questions.*1 Attempt any **four** of the followings : 3.5×4

- (a) List out merits and demerits of open loop control systems.
- (b) Draw a schematic diagram of a PID controller and also draw a graph showing the output of the PID controller for a unit ramp input.
- (c) Find the inverse Laplace transform of

$$F(s) = \frac{s+3}{(s+1)(s+2)}$$

- (d) Determine the transfer function of the R-C network shown below (where V_1 is the input voltage):

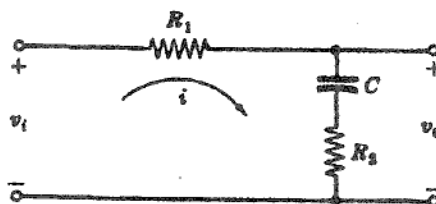


Fig. 1

- (e) Simplify the block diagram:-

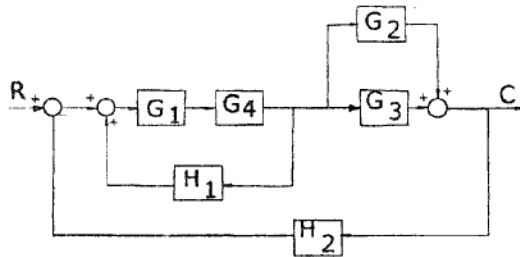


Fig. 2

- (f) Find the transfer function, between the input (x_i) at point 'P' and output (x_o) of the position of the mass, of the given mechanical system.

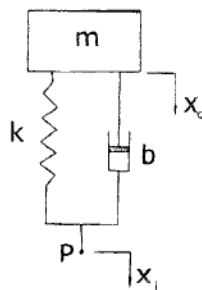


Fig. 3

2 Attempt any **four** of the following : 3×4

- (a) Determine the unit-ramp response of the first-order system shown below:-

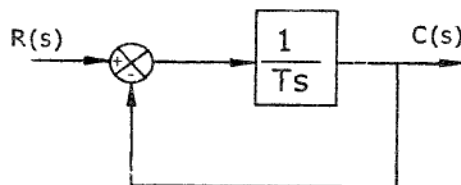


Fig. 4

- (b) Determine the values of 'K' and 'k' of the closed-loop system shown below, so that the maximum overshoot in unit-step response is 25% and the peak time is 2 sec. Assume that $J=1 \text{ Kg-m}^2$.

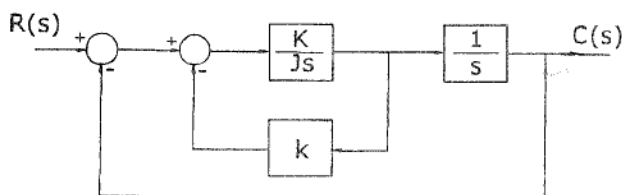


Fig. 5

- (c) Briefly discuss about the step response of a second – order system for the three different cases: under damped ($0 < \xi < 1$), critically damped ($\xi = 1$) and over damped ($\xi > 1$).
- (d) Draw a block diagram of an industrial control system, which consists of an automatic controller, an actuator, a plant (consisting of physical objects like a mechanical device etc.) and a sensor (measuring element). Briefly explain the functions of each element of the block diagram.
- (e) A proportional-plus-derivative controller is used to control a system consisting of an inertial load as shown in the figure below. Find the steady state error for a unit-ramp

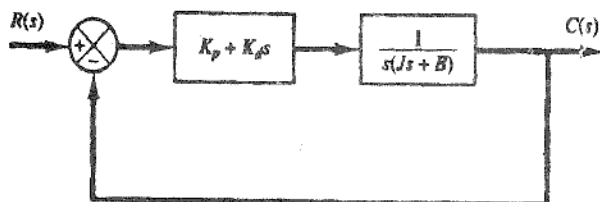


Fig. 6

- (f) Briefly discuss the effects of integral and derivative control actions on system performance.

3 Attempt any **two** of the following : **6×2**

- (a) The characteristic equation of a given system is :

$$s^4 + 6s^3 + 11s^2 + 6s + K = 0$$

Using the Routh stability criterion, determine the range of 'K' for which the system will be stable.

- (b) Discuss the functioning of a hydraulic proportional controller.
- (c) Draw a neat sketch and explain the basic principle for obtaining a pneumatic proportional-plus-derivative controller.

4 Attempt any **two** of the following : **6×2**

- (a) For the control system given by

$$G(s) = k(s+2) / (s^2 + 2s + 3) \text{ and } H(s)=1$$

Find the following:

- (i) The root loci on the real axis
- (ii) The angle of departure
- (iii) The break in point
- (b) Draw the Bode diagram of the following transfer function ($L=0.5$ and $T=1$)

$$G(j\omega) = \frac{e^{-j\omega L}}{1 + j\omega T}$$

- (c) Sketch a polar plot of the second-order transfer function given by :

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