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Printed Pages : 4 ME – 605

(Following Paper ID and Roll No. to be filled in your Answer Book)
PAPER ID : 4053 Roll No.

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):

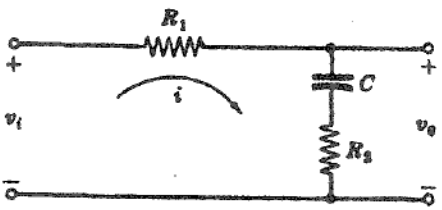

Fig. 1

(e) Simplify the block diagram:-

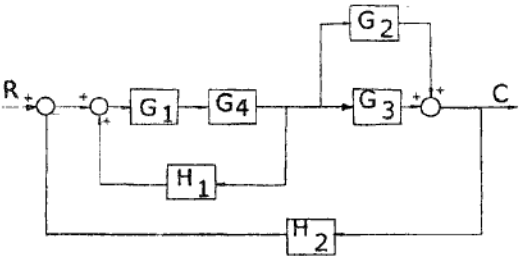

Fig. 2

(f) Find the transfer function, between the input (x_1) at point 'P' and output (x_0) of the position of the mass, of the given mechanical system.

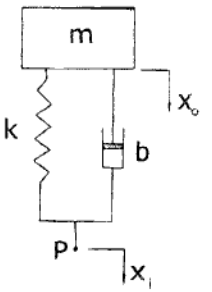

Fig. 3

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

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

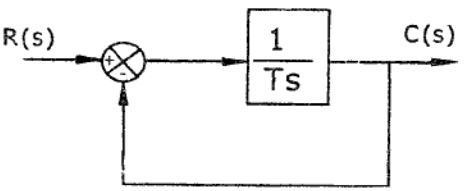

Fig. 4

(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 in 2 sec. Assume that J=1 Kg-m^2.

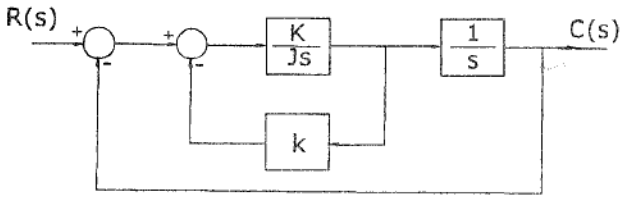

Fig. 5

(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

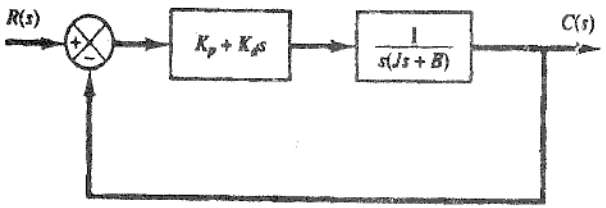

Fig. 6

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(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 :

$$s^4 + 6s^3 + 11s^2 + 65 + K = 0$$

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 :

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