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

PAPER ID : 2056 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) THEORY EXAMINATION 2010-11

CONTROL SYSTEM

Time : 3 Hours *Total Marks : 100*

Note : Attempt **all** questions. Each question carries equal marks.

1. Attempt any **two** parts of the following : **(10×2=20)**

(a) Evaluate $\frac{C}{R_1}$ and $\frac{C}{R_2}$ for a system whose block diagram representation is shown in following Figure 1 (A) using block diagram reduction method.

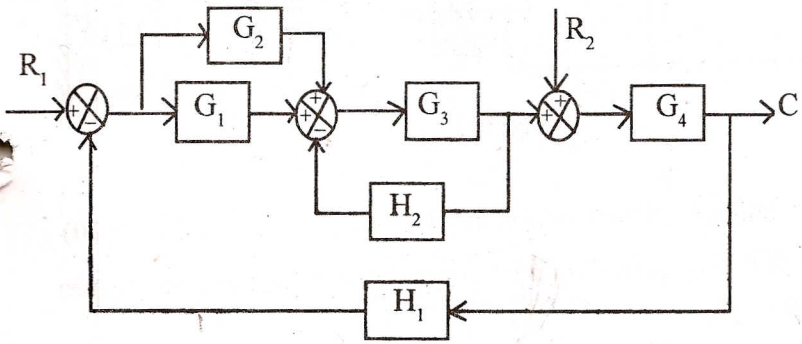

Figure 1 (A)

(b) Obtain signal flow graph representation for a control system whose block diagram is given in the following Figure 1 (B). Find overall transfer function using Mason's gain formula.

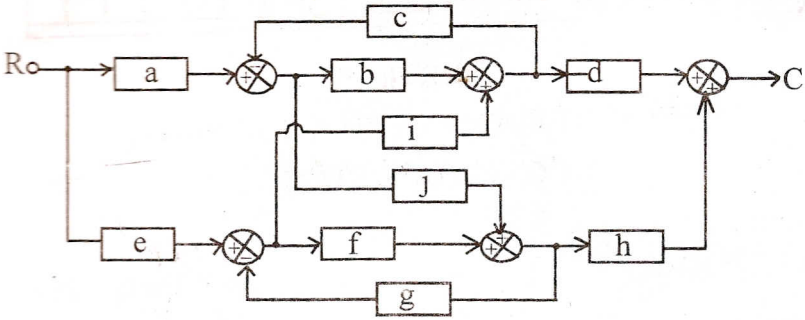

Figure 1 (B)

(c) Find the transfer function X(s)/E(s) for the electromechanical system shown in following Figure 1 (C).

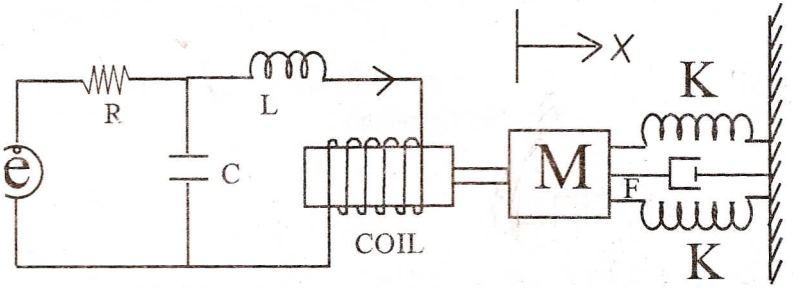

Figure 1 (C)

Attempt any **two** parts of the following : **(10×2=20)**

(a) The overall transfer function of a control system is given by :

$$\frac{C(S)}{R(S)} = \frac{16}{S^2 + 1.6S + 16}.$$

It is desired that the damping ratio is 0.8. Determine the derivative rate feedback constant K_t and compare rise time, peak time, maximum overshoot and steady state error for unit ramp input without and with derivative feedback control.

(b) The maximum overshoot of a unity feedback control system having its forward path transfer function as G(S)=K/S(1+ST) is to be reduced from 60% to 20%. The system input is an unit step function. Determine the factor by which K should be reduced to achieve aforesaid reduction.

(c) A control system is shown in following Fig. 2 (C)

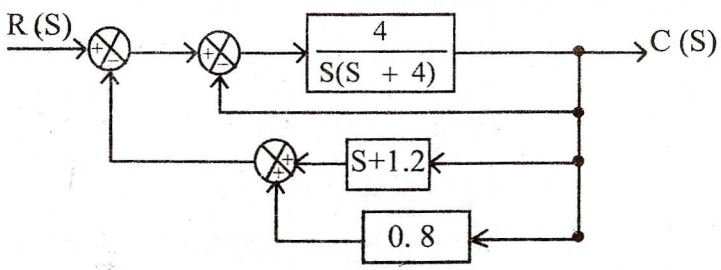

Figure 2 (C)

Determine the transfer function and derive an expression relating the output and time if the input is a step having a magnitude of 2 units.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) Construct the state model for a system characterised by the differential equation :

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 6y = u.$$

Give the block diagram and signal flow graph representation of the state model.

(b) The open loop transfer function of a unity feedback control system is given by :

$$G(S) = \frac{K}{S(1+0.2\,S)}.$$

Design a suitable compensator such that the system will have $K_v = 10$ and P.M. = 50°.

(c) A system is described by the equations :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u.$$

$$y = [1 \quad 1 \quad 0]$$

Find if the system is completely observable. If not, find the mode which is not observable.