C 58330 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2009

EE 2K 603—CONTROL SYSTEMS—I

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

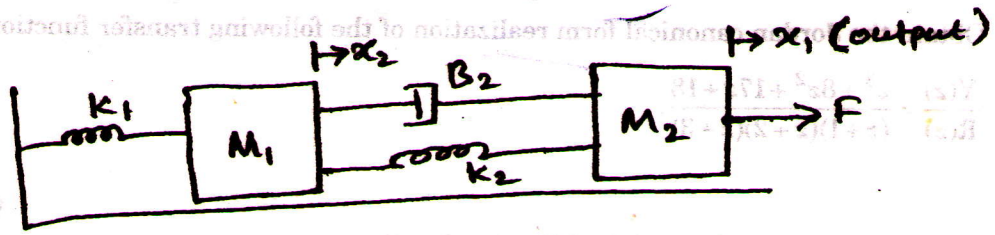
1. (a) Explain the principle of automatic control system with an example.
   (b) Obtain the controllable canonical form representation for the following system :

$$T(s) = \frac{s+3}{s^2+2s+1}.$$

   (c) What do you mean by zero order hold and obtain the transfer function.
   (d) Explain the sampling process and quantisation process.
   (e) Find the time response of a first order system for a unit ramp input.
   (f) Describe the Jury's stability method.
   (g) Define Resonant peak, bandwidth and resonant frequency.
   (h) What are M and N circles ? Explain.

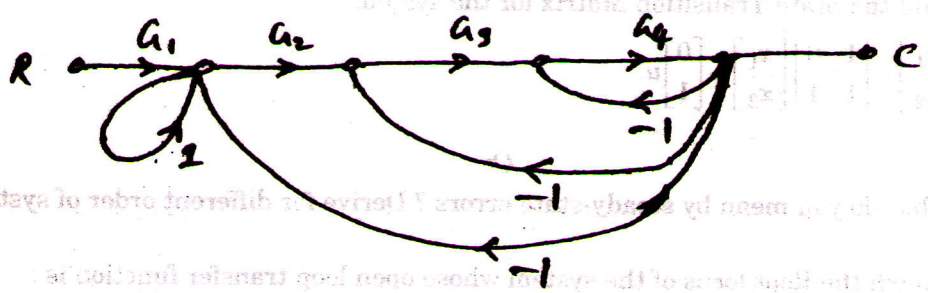
(8 × 5 = 40 marks)

2. (a) (i) Obtain the transfer function of the following mechanical system :



(8 marks)

(ii) Find the transfer function $\frac{C}{R}$ for the signal flow graph shown below :

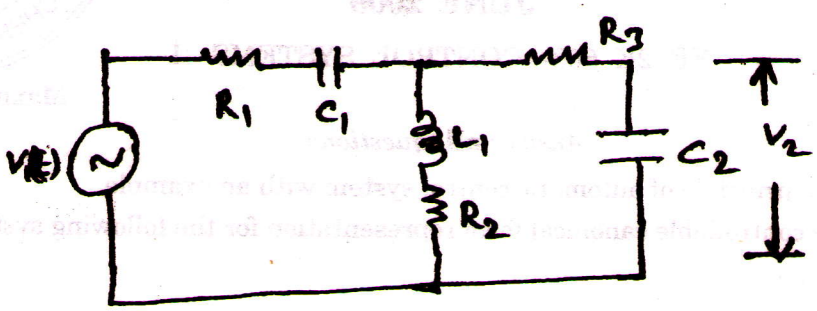


(7 marks)

Or

Turn over

(b) (i) For the electric network shown find the transfer function $\frac{V_2(s)}{V_1(s)}$.



(8 marks)

(ii) Explain the derivation of Transfer function model from state space model. (7 marks)

3. (a) (i) Find the observable canonical form state model of the following system :

$$y(k+2)+3y(k+1)+2y(k)=5r(k+1)+3r(k).$$

(8 marks)

(ii) Find the z-transform of the system which has transfer function :

$$\frac{C(s)}{K(s)}=\frac{1}{s(s+2)(s+3)}.$$

(7 marks)

Or

(b) (i) Obtain the Jordan canonical form realization of the following transfer function :

$$\frac{Y(z)}{R(z)}=\frac{z^3+8z^2+17z+18}{(z+1)(z+2)(z+3)}.$$

(5 marks)
(10 marks)

(ii) Find inverse z-transform of the following function :

$$P(z)=\frac{z+1}{(z+3)(z+6)}.$$

4. (a) (i) Derive the time response of a second order underdamped system for a unit step input.
(10 marks)

(ii) Find the State Transition Matrix for the system :

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

(5 marks)

Or

(b) (i) What do you mean by steady-state errors ? Derive for different order of systems.
(7 marks)

(ii) Sketch the Root locus of the system whose open loop transfer function is :

$$G(s)=\frac{K}{s(s^2+4s+8)}.$$

(8 marks)

5. (a) The open loop transfer function of a unity feedback system is $G(s)=\frac{100(1+0.2s)}{s(1+0.1s)}$. Draw the Bode plot and hence find phase margin and gain margin.

Or

(b) The open loop transfer function of a feedback control system is $G(s)\,H(s)=\frac{K(1+2s)}{s(1+s)\,(1+s+s^2)}$. Sketch the Nuquist plot and hence find the range of K for stability.

(4 × 15 = 60 marks)