Mr Mohit Garg

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION-OCTOBER 2017

B.Tech 5th Semester

COURSE CODE: 10B1WEC515 MAX. MARKS:15

COURSE NAME: THEORY AND APPLICATION OF CONTROL SYSTEM

COURSE CREDITS: 4 MAX. TIME: 1Hr

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Make assumptions incase if find any information missing.

---

1. **[5 marks]** The block diagram of an electric train control is shown in Fig. below. The system parameters and variables are

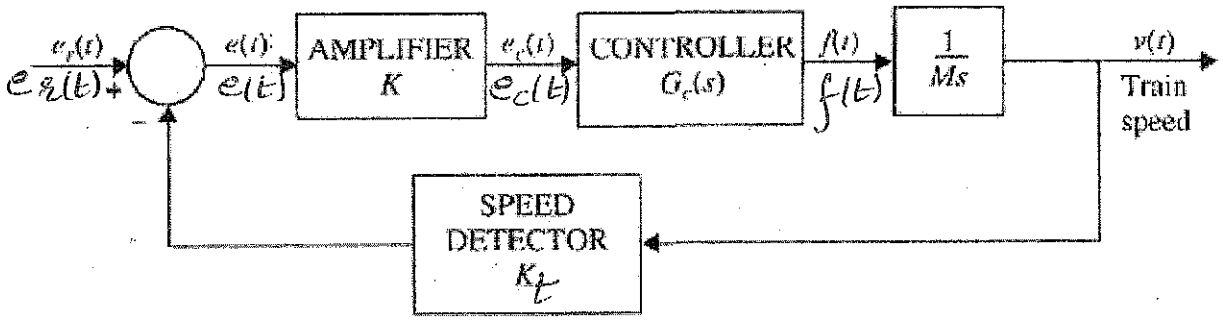
   $e_r(t)$ = voltage representing the desired train speed, V

   $v(t)$ = speed of train, ft/sec

   M = mass of train= $30,000 lb / \sec^2$

   K = amplifier gain

   K_t = gain of speed indicator = $0.15 V/ft / \sec$



   To determine the transfer function of the controller, we apply a step function of 1 volt to the input of the controller, that is, $e_c(t) = u_s(t)$. The output of the controller is measured and described by the following equation:

$$f(t) = 100(1 - 0.3e^{-6t} - 0.7e^{-10t})u_s(t)$$

   (a) Find the transfer function $G_c(s)$ of the controller.

   (b) Derive the forward path transfer function $V(s)/E(s)$ of the system. The feedback path is opened in this case.

   (c) Derive the closed-loop transfer function $V(s)/E_r(s)$ of the system.

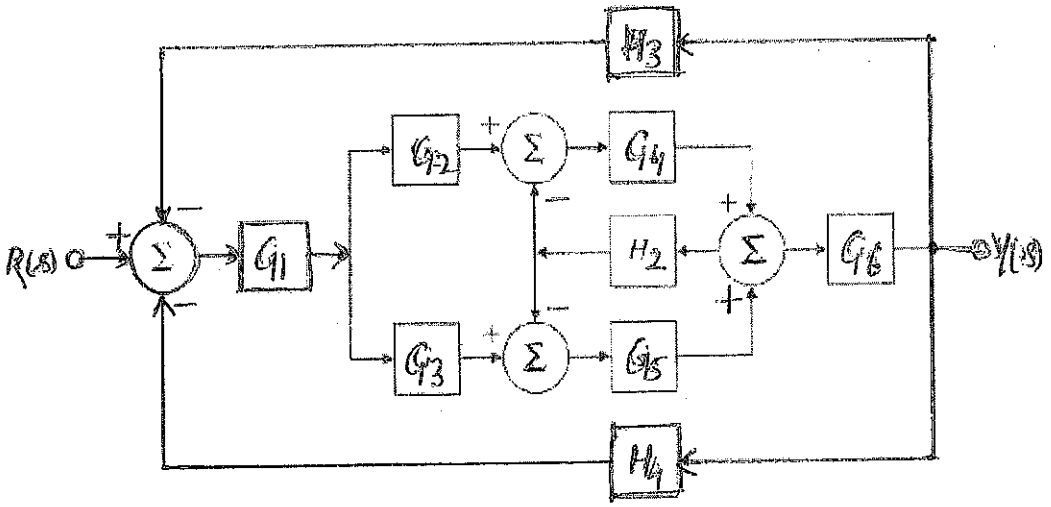
   (d) Determine the value of K for which steady state error to unit step input is less than 5 ft/sec.

---

2. **[2 marks]** Give two examples of feedback control systems in which human acts as a controller.

EC-5, BT

3. **[5 marks]**Use block-diagram algebra or Mason's rule to determine the transfer function between R(s) and Y(s) in Fig. below.



4. **[3 marks]**An electrical system and its signal-flow graph representations are shown in the figure (a) and (b) respectively. Find the values of G_2 *and* H in the given SFG.

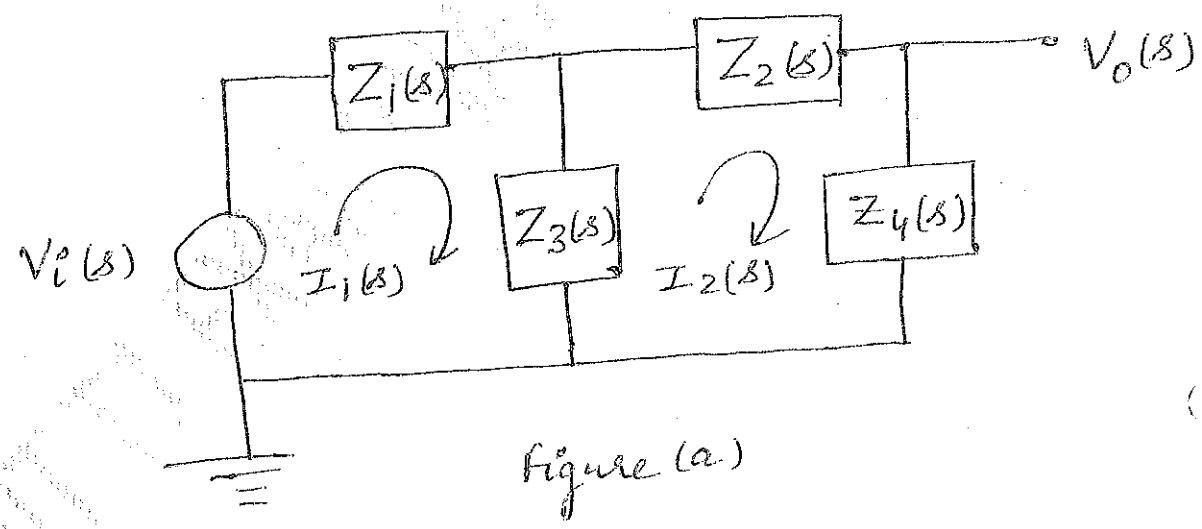


Figure (a)

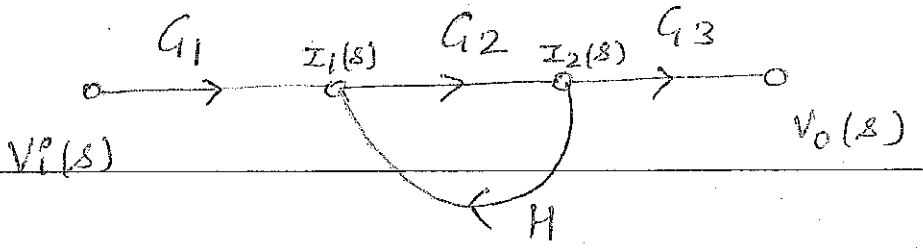


Figure (b)