D 20913 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, OCTOBER 2011

EE/PTEE 09. 503—LINEAR CONTROL SYSTEM

(2009 Admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

Each question carries 2 marks.

1. Give one practical example (domestic appliances) of open loop system and closed loop system.
2. Define Transfer function. State its limitations.
3. What are the standard test signals ?
4. List the frequency domain specifications.
5. What is a compensator ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

Each question carries 5 *marks.*

1. State the reasons for choosing closed loop structure for Automatic control system.
2. Simplify the given block diagram in Fig. 1 to obtain the overall transfer function.

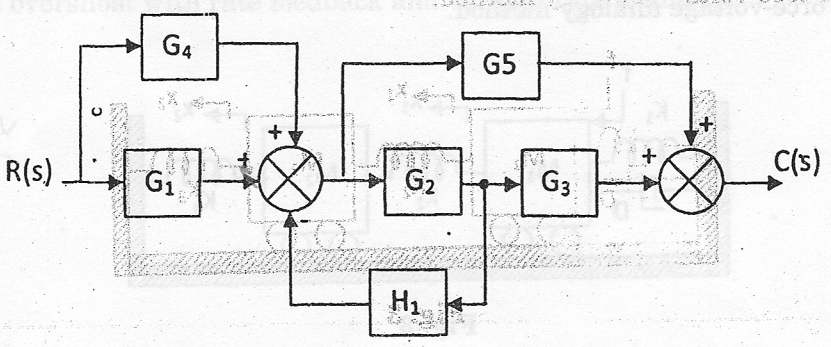

Fig. 1

3. A speed control system is expressed by the transfer function $\frac{\omega(s)}{V(s)} = \frac{100}{2+25s}$. Find the output if an input of 2 volt is applied.

Turn over

4. Given $G(s) = K(s+5)/s(s+6)(s+7)(s+8)$ find the value of K for 10 % steady state error.

5. Given the T.F. $C(s)/R(s) = 5/(s^2+2s+5)$. Find the resonant frequency of oscillations.

6. Draw the BODE plot for Lag compensator and state where this type of compensator is most suited.

(4 × 5 = 20 marks)

Part C

Answer any **four** *questions.*
Each question carries 10 *marks.*

1. Obtain the overall transfer function for the given block diagram in Fig. 2, by converting into a signal flow graph.

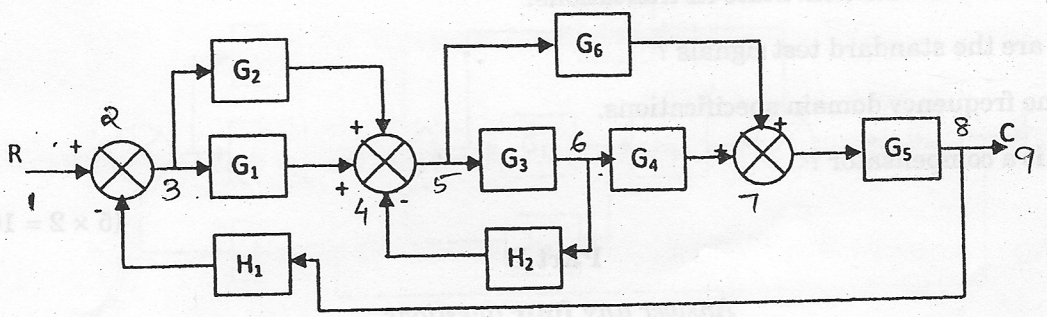

Fig. 2

2. Derive the transfer function for the given mechanical system in Fig. 3. Also find the electrical analogue by Force-voltage analogy method.

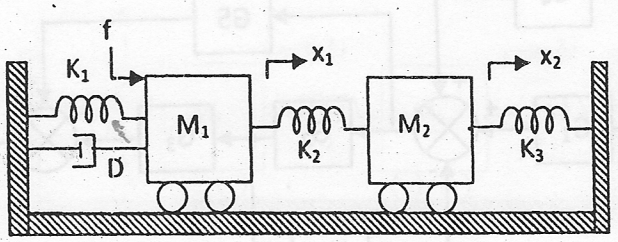

Fig. 3

3. (a) The forward path Transfer Function of a unity feedback system is given by $G(s) = \frac{4}{s(s+3)}$

Determine the time response for the system for the unit step input.

(b) Find the static error constants for the given UFB system $G(s) = 20(s+2)/[s(s+3)(s+4)]$.

4. (a) Determine the % M_p. the time of first overshoot and setting time for the question 3 above.

(b) Obtain the dynamic error coefficients for an unity feedback control system given by $G(s) = 50 / s(1+s)$ subjected to an input of $r(t)\ 1 + t + t^2/2$.

5. (a) Obtain the expression for resonant frequency. Determine the Resonant frequency, Resonant peak, Bandwidth for the system whose transfer function is given by $\frac{C(s)}{R(s)} = \frac{9}{s^2 + s = 9}$.

(b) Differentiate between Minimum phase and Non-Minimum phase systems.

6. (a) Unity feedback system has open loop transfer function $G(s) = \frac{180}{(s+2)(s+3)(s+5)}$.

Determine stability of the closed loop system using BODE plot.

(b) State Nyquist stability criterion.

7. Design the lead compensator for the given system so that the $\zeta = 0.45$ for the dominant roots and velocity error constant is 20. The OLTF of the system is $GH(s) = \frac{K}{s(s+2)}$.

8. Design a PD controller for a plant with $\frac{C(s)}{R(s)} = \frac{16}{s^2 + 1.6s + 16}$ so that overshoot is less than 5 %.

Compare the overshoot with rate feedback and without rate feedback.

(4 × 10 = 40 marks)