**Reg. No. :** | | | | | | | | | | |

**Question Paper Code: 31532**

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Fifth Semester

Electrical and Electronics Engineering

01UEE502 - CONTROL SYSTEMS

(Regulation 2013)

Duration: Three hours                                                                 Maximum: 100 Marks

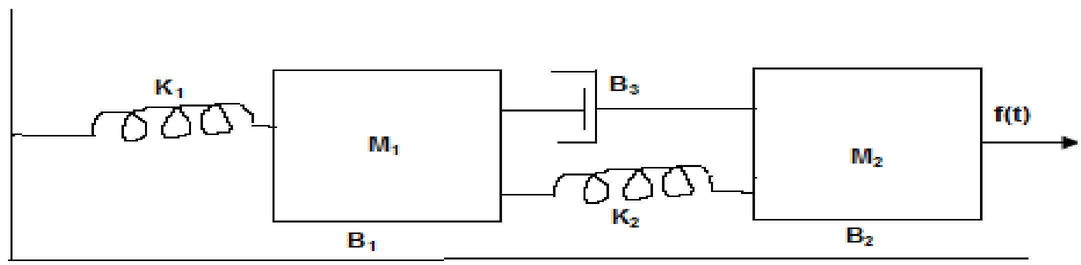
Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define the term transfer function.
2. State Mason's gain formula.
3. Define rise time.
4. What is the drawback of static error coefficients?
5. List out the different frequency domain specifications.
6. Define corner frequency.
7. State Routh Hurwitz criterion.
8. What are the uses of lead compensator?
9. What is controllability?
10. Define state variable.

PART - B (5 x 16 = 80 Marks)

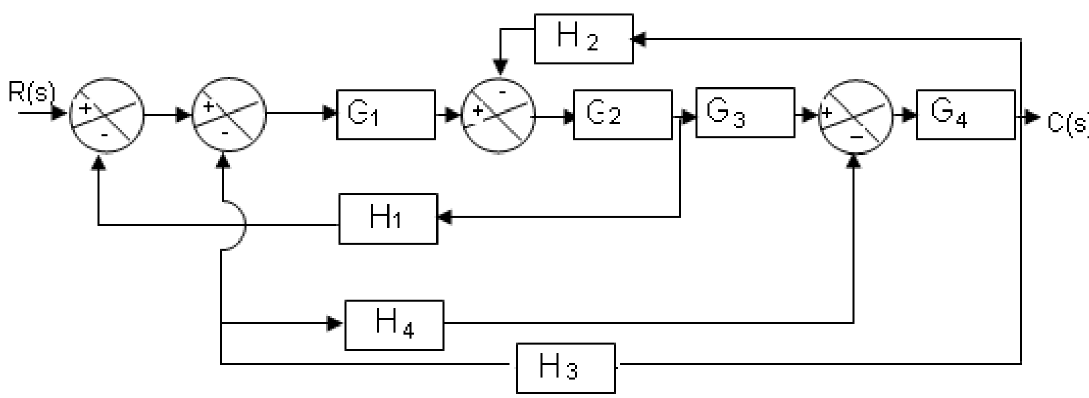
11. (a) (i) Write the differential equations governing the translational mechanical system shown in fig. Also draw the force-voltage and force-current analogous circuits. (12)




(ii) Compare open loop and closed loop control system. (4)

Or

(b) (i) Draw the signal flow graph for the given block diagram and obtain the transfer function using Mason's gain formula. (10)




(ii) Derive the transfer function of field controlled DC servomotor. (6)

12. (a) (i) For a unity feedback control system the open loop transfer function

$G(s) = \frac{10(s+2)}{s^2(s+1)}$. Find

(1) position, velocity and acceleration error constants

(2) Steady state error when the input is $\frac{3}{s} - \frac{2}{s^2} + \frac{1}{s^3}$ (6)

(ii) A unity feedback control system has an open loop transfer function $G(s) = \frac{10}{s(s+2)}$. Determine rise time, peak time, peak overshoot and settling time for a step input of 12 units. (10)

Or

(b) Sketch the root locus for the unity feedback system whose open loop Transfer function is $G(S)\ H(S) = \frac{K(S+1.5)}{S(S+1)(S+5)}$ (16)

13. (a) (i) The unit step response of a second order system results of $M_p$ = 0.2 and $t_p$ = 0.3 ms. Obtain the resonant peak, resonant frequency, bandwidth. (4)

(ii) Sketch the bode plot for the transfer function, $G(s)\ H(s) = \frac{80(s+5)}{s^2(s+50)}$. Determine the gain margin and phase margin. Also determine the value of $K$ for a phase margin of $45^{o}$. (12)

Or

(b) Sketch the polar plot for the given unity feedback system having an open loop transfer function $G(s) = \frac{K}{s(1+0.2s)\ (1+0.1s)}$. Determine the gain margin and phase margin. (16)

14. (a) Draw the Nyquist plot and assess the stability of the closed loop system, whose open loop transfer function is $G(s)\ H(s) = \frac{(6s\ +\ 1)}{s^2(3s\ +\ 1)\ (s+1)}$. (16)

Or

(b) Design a lead compensator for a unity feedback system whose open loop transfer function is $G(s) = \frac{K}{s(s+1)}$ to meet the following specifications

(i) the phase margin = 35°

(ii) the velocity error constant $K_v$ = 10 $sec^{-1}$. (16)

15. (a) A system is characterized by the transfer function $\frac{Y(s)}{U(s)} = \frac{3}{s^3 - 5s^2 + 11s + 6}$.

Identify the first state (in phase canonical form) as the output. Determine whether the system is controllable and observable. (16)

Or

(b) Obtain a state space representation of the system governed by the differential equation $\frac{d^3 y}{dt^3} + 9\frac{d^2 y}{dt^2} + 26\frac{dy}{dt} + 24y = 6U$. (16)

---