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

Question Paper Code : 33384

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Electronics and Communication Engineering

EC 1304/EC 1353 — CONTROL SYSTEMS

(Regulation 2004/2007)

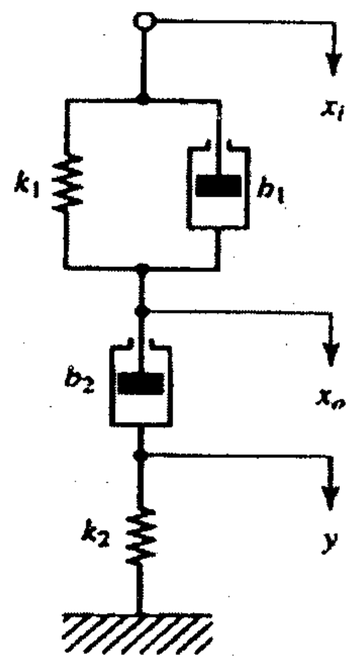
Time : Three hours Maximum : 100 marks

Semi Log Sheets, Polar Charts must be provided.

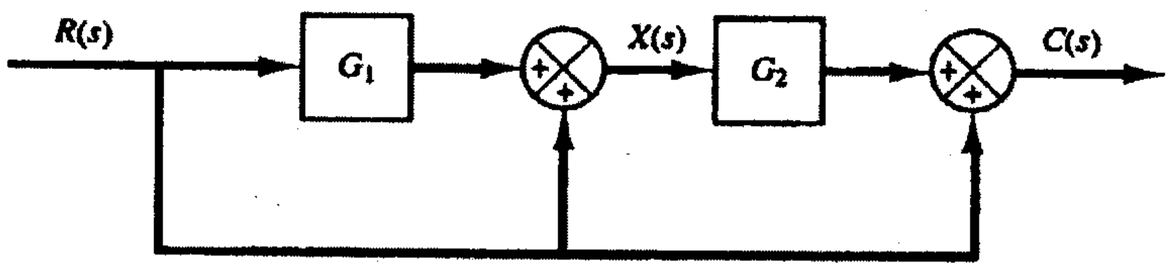
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

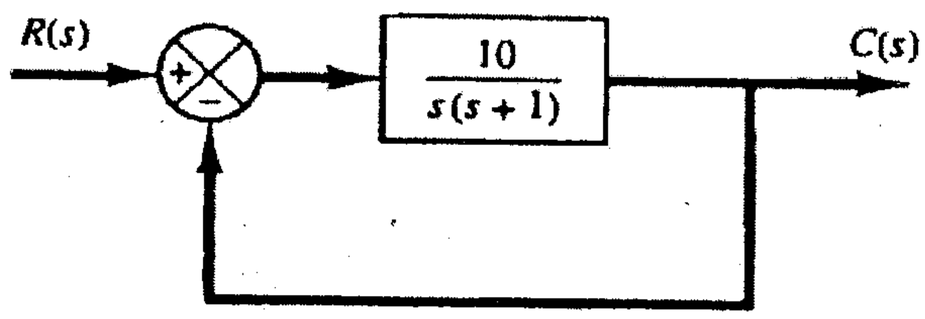
1. Obtain the analogous electrical network using force-voltage analogy.



2. Determine the transfer function for the given block diagram.



3. Find the settling time and Peak time for the given block diagram.



4. The closed loop transfer function of a system is given by the transfer function $C(s)/R(s) = 3(s+2)/(s+4)$. Find the system response to a step input.

5. A Unity feedback system has the transfer function.
$G(s) = 1/s(s+1)(s+1/3)$. Determine the resonant peak M_p and resonant frequency ω_r.

6. Define gain cross over and phase cross over frequency.

7. Draw the pole zero plot of lead network and tag network.

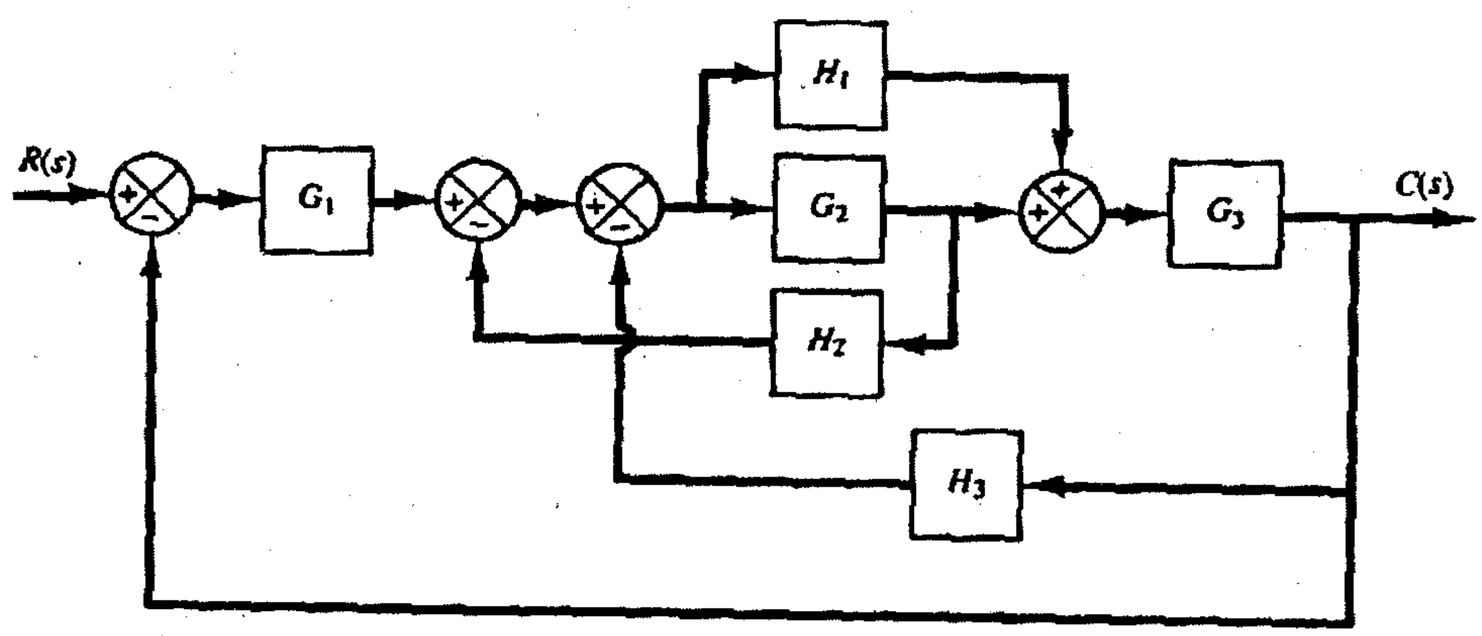
8. The transfer function of lead compensator is $G(s) = 1+0.12s/1+0.04s$. Find maximum phase shift.

9. Write the disadvantages of D.C Tachometers.

10. What is meant by servo mechanism?

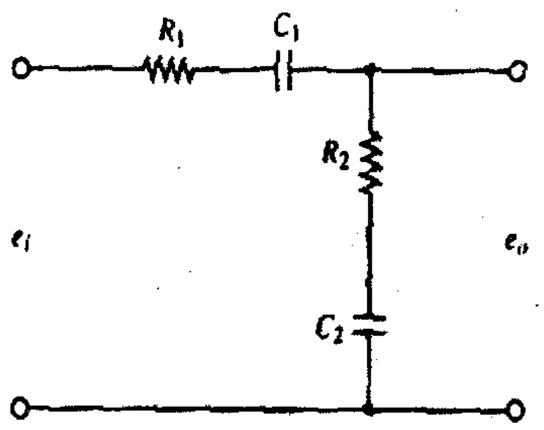
PART B — (5 × 16 = 80 marks)

11. (a) Simplify the block diagram shown in the figure and obtain the transfer function. (16)

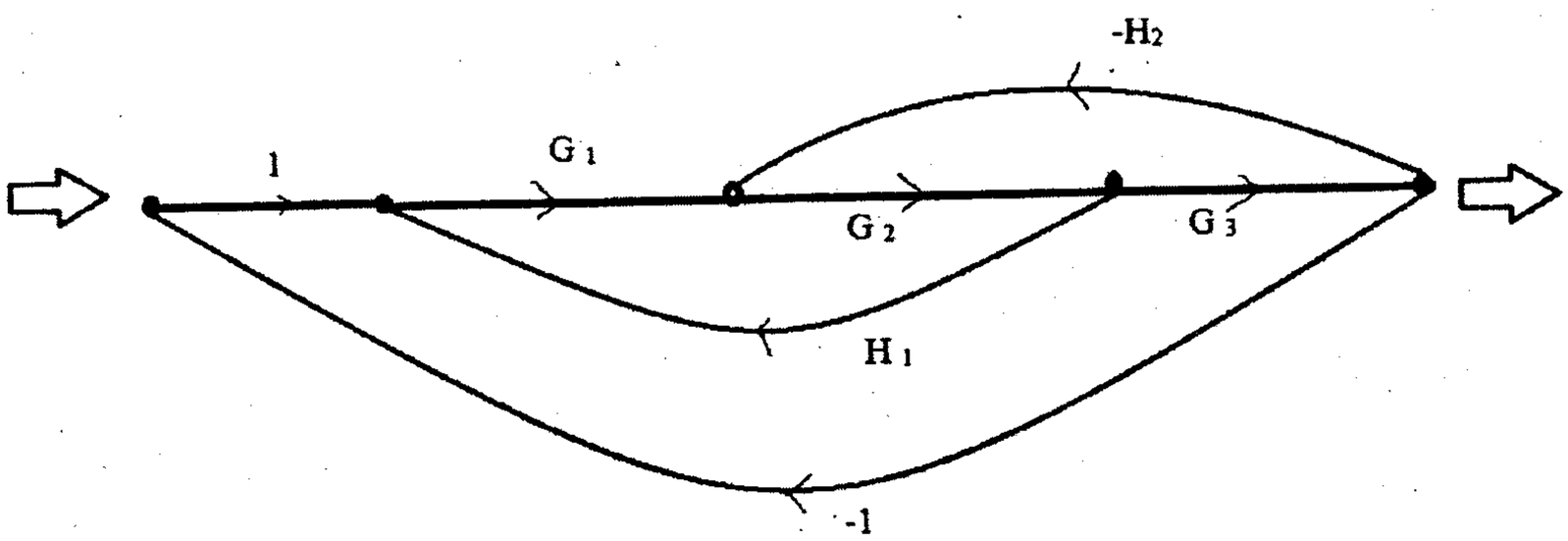


Or

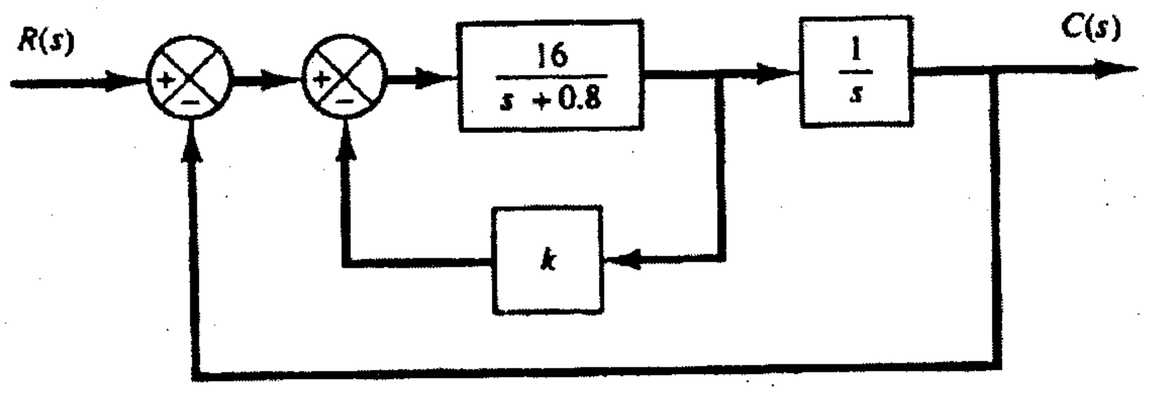
(b) (i) Derive the transfer function of the Electrical system shown in the figure. Also derive the schematic diagram of the mechanical system with force-voltage analogy. (10)



(ii) Determine the overall transfer function of a given signal flow graph using Mason's gain formula. (6)



12. (a) Determine the value of K such that damping ratio is 0.5. Obtain the rise time, peak time, Maximum peak overshoot and settling time in unit step response. (16)



Or

(b) (i) Determine the range of K for stability of unity feed back system whose open loop transfer is $G(s) = K / s(s+1)(s+2)$. (8)

(ii) Consider the unity-feed back control system with open loop transfer function $G(s) = 10 / s(s-1)(2s+3)$. Is the system stable? (8)

13. (a) Draw the Bode plot for the function $G(s) = Ks2/[(1+0.2s)(1+0.02s)]$. Determine the value of K for a gain cross over frequency of 20 rad/sec. (16)

Or

(b) Sketch the Nyquist plot for a feedback system with the open loop transfer function $G(s)H(s) = [K(s+3)(s+5)]/[(s-2)(s-4)]$. Determine the range of K for which the system is stable. (16)

14. (a) Design a phase lead compensator for a system with open loop transfer function.

$G(s)H(s) = K/s(s+2)$ so that the velocity error constant is 20 sec-1, phase margin is at least 500 and gain margin is at least 10 dB. (16)

Or

(b) Design a phase lag compensator so that the system $G(s)H(s) = 100/[s(s+1)]$ will have phase margin of 150. (16)

15. (a) (i) Derive the transfer function of the Field control d.c. motor with necessary block diagram. (12)

(ii) An A.C. servo-motor has both windings excited with 115 V a.c. It has a stall torque of 21b-ft. Its coefficient of viscous friction is 0.2 lb ft-sec. Find its no load speed. (4)

Or

(b) (i) Discuss the working and constructional features of the Synchros and also obtain the expression for emf generated. (12)

(ii) A motor has the following constants :

$K_m = 2$, $F_m = 0.5$, $J_m = 1$. For am input of 10 V, find the steady state speed. (4)