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Question Paper Code : 51503

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

Fourth Semester

Electrical and Electronics Engineering

EE 2253/EE 44/EE 1253 A/080280033/10133 IC 401 – CONTROL SYSTEMS

(Common to Instrumentation and Control Engineering and Electronics and Instrumentation Engineering)

(Regulations 2008/2010)

(Also common to PTEE 2253 – Control Systems for B.E. (Part-Time) Third Semester – Electronics and Instrumentation Engineering – Regulations 2009 and 10133 IC 401 – Control System for B.E. (Part-Time) Third Semester – EEE – Regulations 2010)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What are the advantages of AC servomotor ?
2. Why negative feedback is preferred in control systems ?
3. What do you mean by characteristic equation ? Why that name ?
4. Why is the derivative controller not used in control systems ?
5. Define relative stability.
6. What are the advantages of Bode plot ?
7. State the Nyquist stability criterion

8. What are the necessary conditions for the stability of control systems ?
9. What is lead compensator? When it is preferred ?
10. Why the frequency domain compensation is normally carried out using Bode plots ?

PART – B (5 × 16= 80 Marks)

11. (a) Obtain the transfer function for the given system shown in figure 11 (a) using Block diagram reduction technique and verify by using signal flow graph. (16)

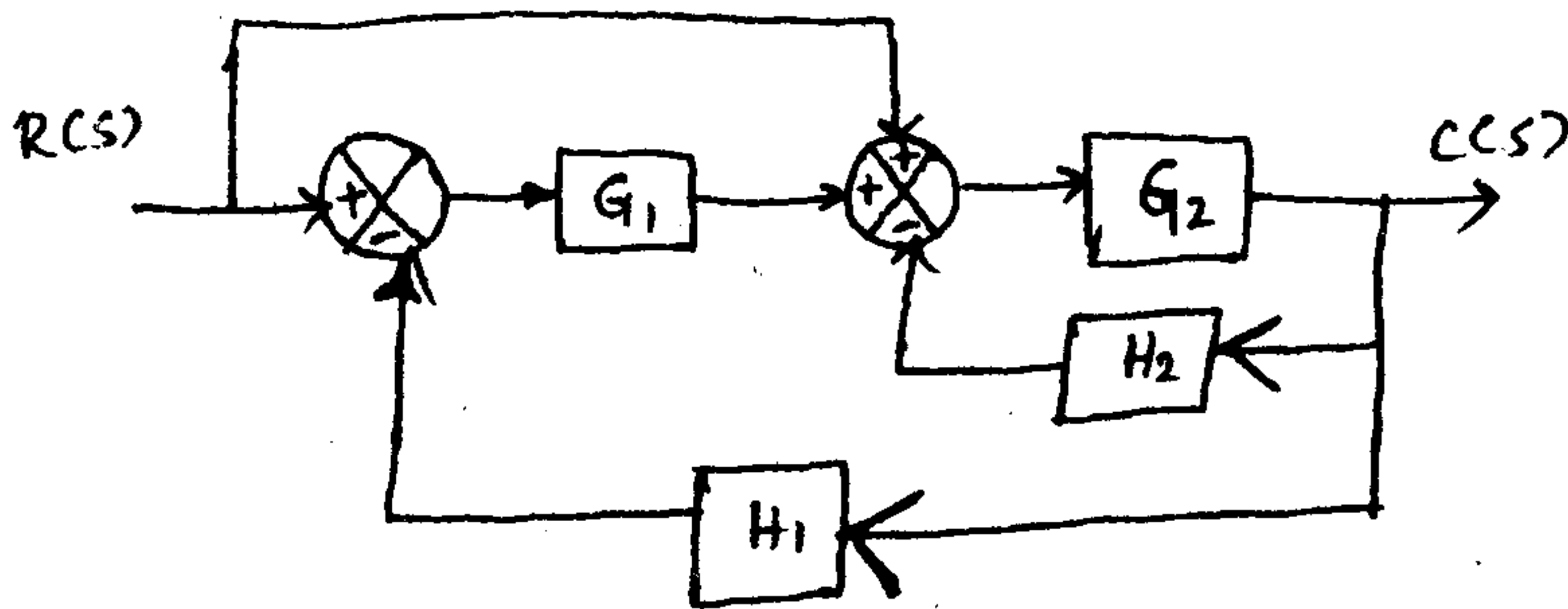


Fig. 11. (a)

OR

- (b) Write the differential equations governing the mechanical system shown in figure (11.b). Draw the force current and force voltage analogy and verify it by writing mesh and nodal equations. (16)

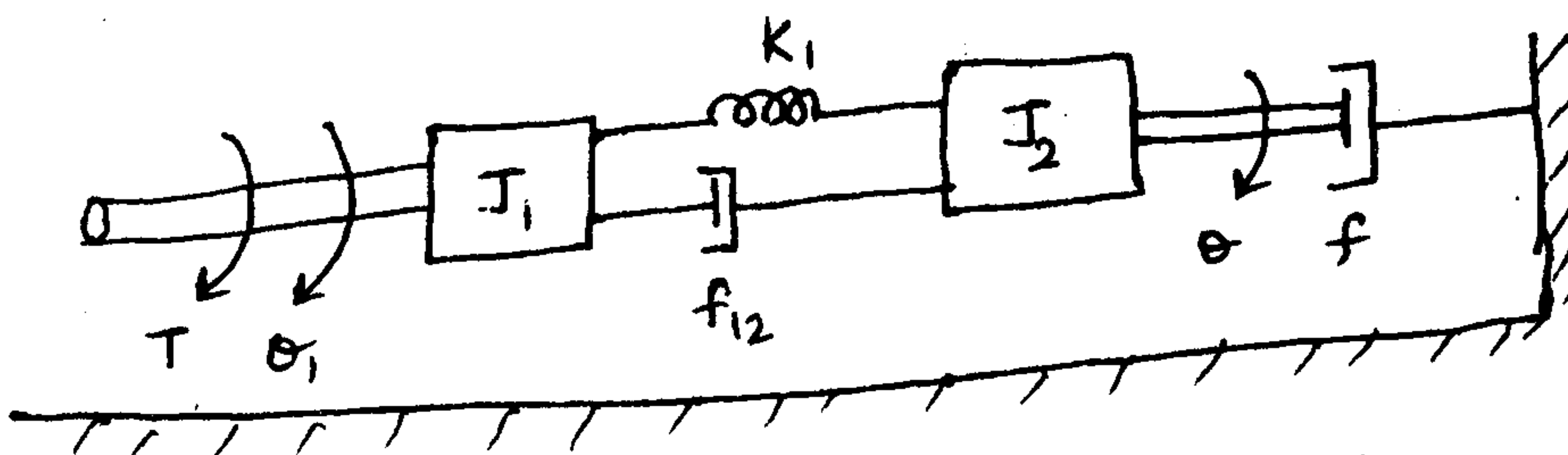


Fig. 11. (b)

12. (a) Determine the values of K and T of the closed loop system shown in figure 12(a). So that the maximum overshoot in unit step response is 20 % and the peak time is 1.5s. Assume that $J = 1 \text{ kg-m}^2$ (16)

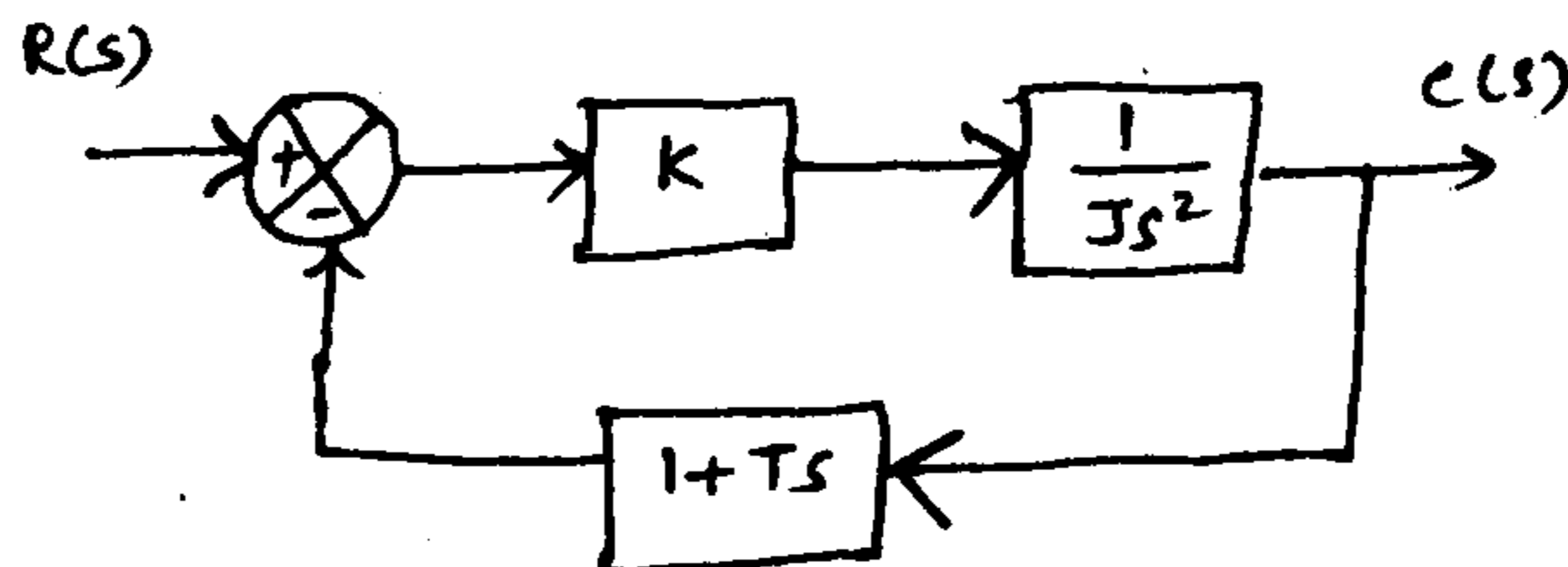


Fig. 12. (a)

OR

- (b) A unity feedback system has $\frac{10}{s^2(s+2)}$. Find the steady-state error and generalised error coefficients for $r(t) = 6t^4 + 5t^3 + 4t^2 + 2t + 3$. (16)
13. (a) Sketch the magnitude and phase of Bode plot. Determine the gain margin and phase margin of the system $G(S) = \frac{10}{s(1+0.5s)(1+0.05s)}$ (16)

OR

- (b) Draw a polar plot $G(s) = \frac{10}{s(s+5)(s+2)}$ (16)
14. (a) A unity feedback control system has an open loop transfer function $\frac{K}{s(s^2+4s+13)}$ Sketch the root locus of the system. (16)

OR

(b) The output of a control system is related to its input by (16)

$(s^4 + 5s^3 + 3s^2 + (3 + K)s + K) C(s) = K(s + 2) R(s)$ Where K represents the positive gain of the amplifier.

- (i) With $K = 8$, and a step input, will the output response be stable ?
- (ii) Determine the limiting positive value that K can have for a stable output response.

15. (a) Write the procedure for the design of lag compensator and lag-lead compensator using bode plot. (8 + 8)

OR

(b) Design a lead compensator for a unity feedback system with an open loop transfer function $G_f(s) = \frac{K}{s(s + 1)}$ for the specifications of $K_v = 10 \text{ s}^{-1}$ and $\phi_m = 35^\circ$. (16)
