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

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)**

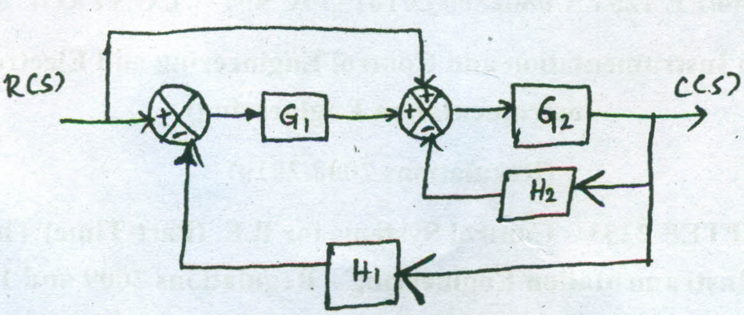

Fig. 11. (a)

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)**

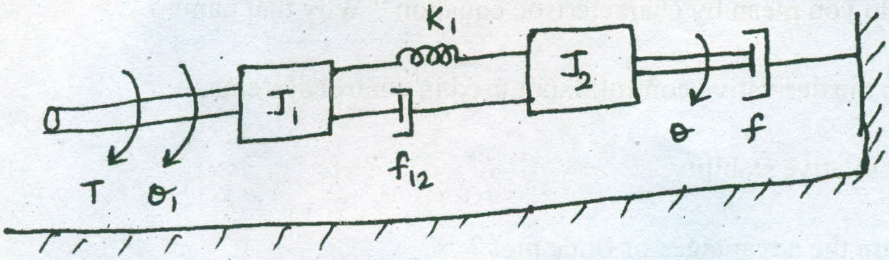

Fig. 11. (b)

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 $J = 1$ kg-m^2 (16)

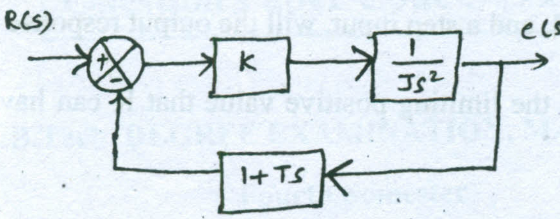

Fig. 12. (a)

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 $K_v = 10\ s^{-1}$ and $\phi_m = 35°$. (16)

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