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Question Paper Code : 30996

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fourth Semester

Electrical and Electronics Engineering

EE 2253 — CONTROL SYSTEMS

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

(Regulation 2008)

(Also common to PTEE 2253 Control Systems for B.E. (Part-Time) Third Semester – Electrical and Electronics Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

(Graph sheet, semi log sheet and polar sheet may be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare between closed and open loop system.

2. State the basic elements for modeling in translational and rotational systems.

3. What is the effect on system performance when a proportional controller is introduced in a system?

4. Distinguish between type and order of the system.

5. Define Phase crossover frequency.

6. What is the meaning of 6 dB/octave slope in a semi log sheet?

7. State Routh's Hurwitz criterion.

8. What is the effect of pole on the system response?

9. Draw the frequency response of lead compensator.

10. Why is lag compensator not suitable for higher type systems?

PART B — (5 × 16 = 80 marks)

11. (a) Obtain the closed loop transfer function C(s)/R(s) for the system shown in Fig. 11(a) using block diagram reduction technique. Also verify it using Masons gain formula. (8 + 8)

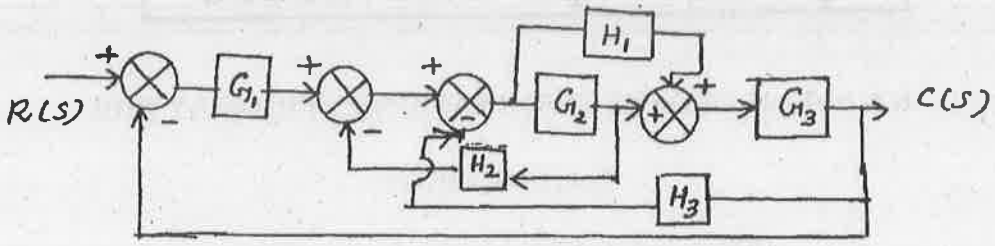


Fig. 11(a)

Or

(b) (i) Draw the force voltage analogy and force current analogy for the mechanical System shown in Fig. 11 (b). (8)

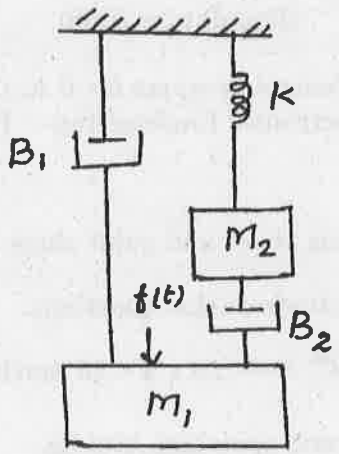
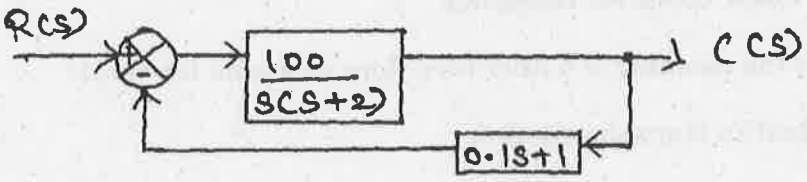


Fig. 11(b)

(ii) Explain armature controlled DC servo motor with relevant block diagram. (8)

12. (a) A positional control system with velocity feedback is shown. Determine the response of the system for unit step input.



Or

(b) Explain the effect by adding P, PI, PD and PID controllers in feedback control systems.

13. (a) Plot the bode diagram for the given transfer function and determine the gain and phase cross over frequencies of $G(s) = 10/[s\ (1 + 0.4s)\ (1 + 0.1\ s)]$.

Or

(b) Draw the polar plot for the open loop transfer function with unity feedback system Given by $G(s) = 1/[s^2\ (1 + s)(1 + 2s)]$. Determine the phase and gain margin.

14. (a) The open loop transfer function of a unity feedback system is given by $G(s)H(s) = \frac{5}{s(s+1)(s+2)}$. Draw the Nyquist plot and hence find out whether the system is stable or not.

Or

(b) Sketch the root locus for a unity feedback system with open loop transfer function $G(s) = \frac{k(s+0.5)}{s^2(s+4.5)}$.

15. (a) The forward path transfer function is $G(s) = \frac{100}{s(s+8)}$. It is desired to have the peak overshoot limited to 9.5% and the natural frequency of oscillation to 12 rad/sec. Design a suitable lead compensator. (16)

Or

(b) The forward path transfer function of a certain unity feedback system is given by $G(s) = \frac{K}{s(s+2)(s+10)}$. The system is to satisfy the following design specifications :

(i) % overshoot $\leq$ 16% for unit step input

(ii) steady state error for unit ramp input $\leq \frac{2}{15}$ radians

Design a suitable lag network using root locus technique. (16)
