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

Question Paper Code : 60503

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Electrical and Electronics Engineering

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

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

(Regulations 2008/2010)

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 closed and open loop system.

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

3. Classify the system based on damping.

4. Write the relation between static error coefficients and generalized error coefficients.

5. Define Phase crossover frequency.

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

7. Write the expressions for gain margin and phase margin.

8. How is pole locations and stability related?

9. Why compensation is needed in feedback control system?

10. Write the transfer function of lag compensator and draw its pole-zero plot.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Obtain the mathematical model of an accelerometer. (8)

(ii) Obtain the differential equation of a mechanical system as shown in Fig. Q. 11(a). (8)

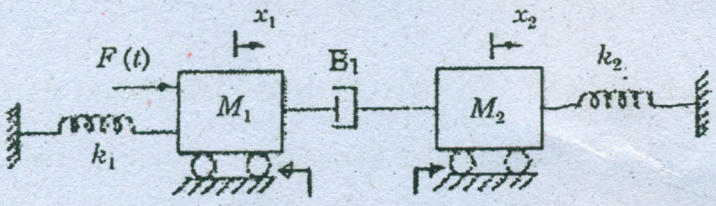


Fig. Q. 11(a)

Or

(b) (i) Obtain the mathematical model of an armature controlled DC motor. (8)

(ii) Write the differential equation for the electric circuit shown in Fig. Q. 11(b) hence find $\frac{E_0(s)}{E_1(s)}$. (8)

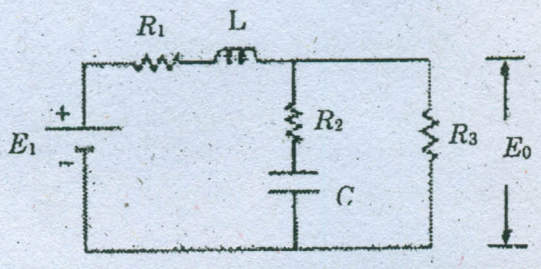
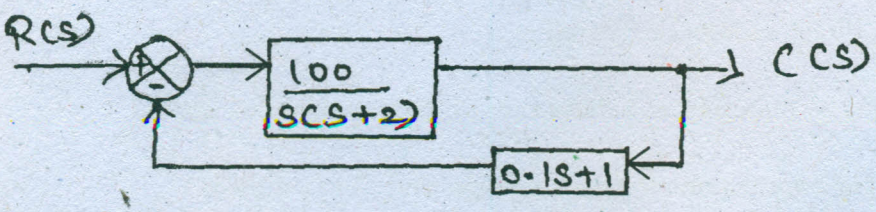


Fig. Q. 11(b)

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) For the following transfer function, sketch the Bode magnitude and phase plot $G(s) = \dfrac{40(1+s)}{(5s+1)(s^2+2s+4)}$. (16)

Or

(b) Obtain the relationship between any three frequency domain specifications in terms of time domain specifications. (16)

14. (a) (i) Explain the concept of stability based on the location of poles. (4)

(ii) Sketch the Nyquist plot and comment on closed loop stability of a system whose open loop transfer function is $G(s) = \dfrac{10}{s^2(s+2)}$. (12)

Or

(b) (i) Test the stability for the system with characteristic equation $s^3 + 5s^2 + 6s + 30 = 0$ using Routh's Hurwitz. (4)

(ii) Draw the root locus for a unity feedback system having open loop transfer function $G(s) = \dfrac{K}{s(s^2+8s+36)}$. (12)

15. (a) Explain the procedure for lag lead compensator using bode plot.

Or

(b) Explain the procedure of lag compensator using bode plot with an example.
