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Question Paper Code : 20689

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Instrumentation and Control Engineering

IC 6501 — CONTROL SYSTEMS

(Common to Electrical and Electronics Engineering / Electronics and Instrumentation Engineering)

(Regulations 2013)

(Also common to PTIC 6501 – Control Systems B.E. (Part-Time) for Third Semester Electrical and Electronics Engineering Regulations – 2014)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the different types of DC servo motors.

2. What are the disadvantages of block diagram representation?

3. What are the standard tests signals employed for time domain studies?

4. Define : Settling time.

5. Why frequency domain analysis is needed?

6. Show the shape of the polar plot for the transfer function $K/s\ (1+sT_1)(1+sT_2)$

7. Draw the circuit of lead compensator and draw its pole zero diagram.

8. Define asymptotic stability.

9. Define servo mechanism.

10. What is the need for observability test?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain open loop and closed loop systems with suitable examples. (6)

(ii) Derive the transfer function for an armature controlled DC motor. (7)

Or

(b) Obtain the transfer function of the mechanical systems shown in the following Figure 11 (b). (13)

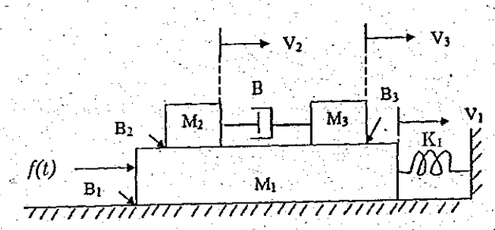

Figure 11 (b)

12. (a) Derive the step response of a second order under damped system. (13)

Or

(b) Sketch the root locus of the system having : (13)

$$G(s) = \frac{k(s+3)}{s(s+1)(s+2)(s+4)}$$

13. (a) Derive the expression for the frequency domain specifications. (13)

Or

(b) Explain how open loop response can be obtained from closed loop response. (13)

14. (a) The open loop transfer function of a unity feedback control system is $G(s) = \frac{k}{s(s+1)(s+2)}$. Design a suitable lag-lead compensator so as to meet the following specifications: static velocity error constant $K_v = 10\,sec^{-1}$, phase margin = 50 degree and gain margin ≥ 10 db. (13)

Or

(b) Consider the unity feedback whose open loop transfer function is $G(s) = \frac{K}{[s(0.1s+1)(0.2s+1)]}$ system to be compensated to meet the following specifications : Static velocity error constant = 30 sec^{-1}, Phase margin ≥ 50 degree, Bandwidth (ω_b) = 12 rad/sec . (13)

15. (a) Explain with neat diagram, the working of AC and DC Servo motors. (13)

Or

(b) Explain with neat diagram, the working of DC and AC tacho generators. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Discuss the correlation between the time and frequency response of second order system.

Or

(b) Sketch the Nyquist plot for the system whose loop transfer function is $G(s)H(s) = \frac{K(s+2)}{[s(s+3)(s+6)]}$ and find the range of K for stability of closed loop. Check your answer with Routh's criterion. (10+5)