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Question Paper Code : 91440

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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)

(Regulation 2008/2010)

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the basic elements in control systems?
2. Define: transfer function.
3. What is the type and order of the system?

$$G(S) = \frac{K}{S(TS+1)}$$

4. Write the PID controller equation.
5. Write the expression for resonance frequency and peak in terms of time response specifications.
6. Define: Gain margin.
7. What are the location of roots in S – plane for stability?
8. What is meant by $+20db/dec$ slope change?
9. What is the need for compensators?
10. What are the desired performance criteria specified in compensator design?

PART B — (5 × 16 = 80 marks)

11. (a) With neat diagrams, explain the working of AC and DC servo motors. (16)

Or

(b) Using block diagram reduction rules, convert the block diagram of Fig. 1 to a simple loop.

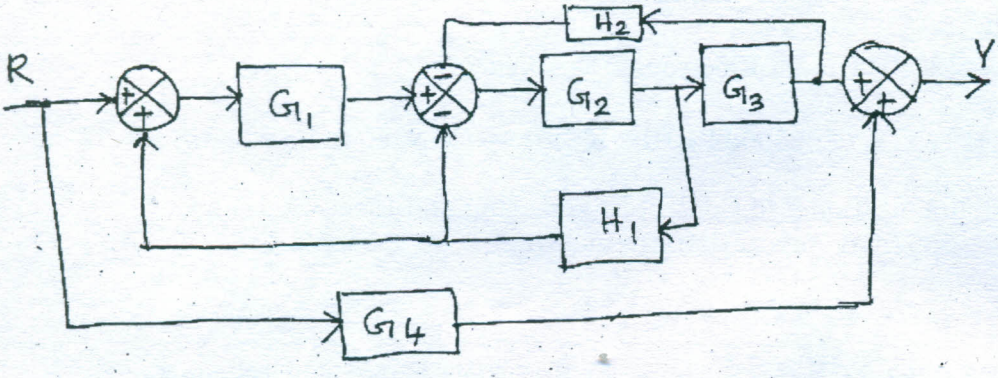

Fig. 1

12. (a) Derive the expression for unit step response of under damped second order system. (16)

Or

(b) Obtain the expression for dynamic error coefficients of the following system $G(S)=\frac{10}{S(1+S)}$. (16)

13. (a) Draw the Bode plot of the following system $GH(S)=\frac{10}{S(0.1S+1)(0.01S+1)}$ and hence obtain gain crossover frequency. (16)

Or

(b) Using polar plot, determine gain crossover frequency, phase crossover frequency, gain margin and phase margin of feedback system with open – loop transfer function (16)

$$G(S)H(S)=\frac{10}{S(1+0.2S)(1+0.002S)}.$$

14. (a) Consider the closed – loop system shown in Fig. 2, determine the range of K for which the system is stable. (16)

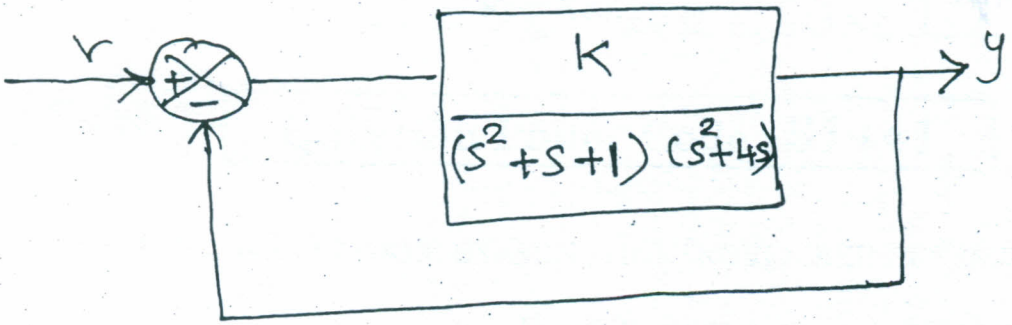

Fig. 2

Or

(b) Draw the root locus of the following system (16)

$$G(S).H(S)=\frac{K}{S(S+1)(S+2)}.$$

15. (a) A unity feedback system has an open loop transfer function

$$G(S)=\frac{5}{S(S+1)(0.5S+1)}$$

Design a suitable compensator to maintain phase margin of at least 40°.

Or

(b) Consider the unity feedback system whose open – loop transfer function is $G(S)=\frac{k}{S(0.1S+1)(0.2S+1)}$

The system is to be compensated to meet the following specifications:

(i) Velocity error constant $k_v = 30$

(ii) Phase margin $\phi m \geq 50°$

(iii) Bandwidth $w_1 = 12\ rad/\sec$.