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

Question Paper Code : 70706

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Electronics and Instrumentation Engineering

IC6501 – CONTROL SYSTEMS

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

(Regulations 2013)

(Also Common to : PTIC6501– Control Systems for B.E. (Part-Time) – Third Semester- Electrical and Electronics Engineering – (Regulations – 2014)

Time : Three hours Maximum : 100 marks

Codes / Tables / Charts to be permitted, if any may be indicated

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define open loop and closed loop control system.

2. What are the basic elements used for modeling mechanical translational system?

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

4. Define: Settling time.

5. Define phase and gain cross over frequencies.

6. What is Lag-Lead compensation?

7. Differentiate between gain margin and phase margin.

8. What is dominant pole?

9. What is meant by 'State' of a dynamic system?

10. When do you say that a system is completely state controllable?

PART B — (5 × 13 = 65 marks)

11. (a) Find the transfer function $\frac{y_2(s)}{f(s)}$.

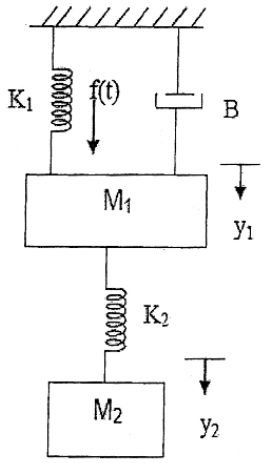

Fig. 11 a

Or

(b) Find the overall gain $C(S)/R(S)$ for the signal flow graph shown in Fig. 11 b.

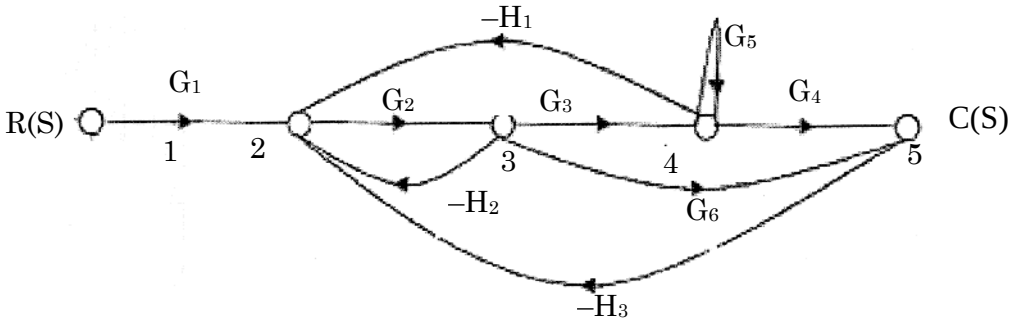

Fig. 11b

12. (a) (i) Outline the time response of first order system when it is subjected to a unit step input. (8)

(ii) Determine the response of the unity feedback system whose open loop transfer function is $G(s) = \frac{4}{s(s+5)}$ and when the input is unit step. (5)

Or

(b) (i) A unity feedback system has the forward transfer, function $G(s) = \frac{K_1(2s+1)}{s(5s+1)(1+s)^2}$ when the input $r(t) = 1 + 6t$, determine the minimum value of K_1 so that the steady error is less than 0.1. (8)

(ii) Derive the transfer function of PID controller. (5)

13. (a) Construct Bode plot for the system whose open loop transfer function is given below and determine (13)

(i) the gain margin,

(ii) the phase margin, and

(iii) closed-loop system stability.

$$G(s) = \frac{4}{s(1+0.5s)(1+0.08s)}$$

Or

(b) (i) Explain the use of Nichol's chart to obtain closed loop frequency response from open loop frequency response of a unity feedback system. (7)

(ii) Describe the correlation between time and frequency domain specifications. (6)

14. (a) (i) Use R–H criterion to determine the location of the roots and stability for the system represented by Characteristic Equation (7)

$$s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$$

(ii) Write the procedure for the design of Lag compensator using Bode plot. (6)

Or

(b) Draw the Nyquist plot for the system whose open loop transfer function $G(S)H(S) = \frac{K}{S(S+2)(S+10)}$ (13)

Determine the range of K for which closed loop system is stable.

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 — ($1 \times 15 = 15$ marks)

16. (a) For the given system, $G(s) = K/s(s+1)(s+2)$, design a suitable lag-lead compensator to give, velocity error constant = 10 sec-1

phase margin = 50°, gain margin ≥ 10dB.

Or

(b) Realize the basic compensators using electrical network and obtain the transfer function.

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