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

Question Paper Code : 20078

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fifth Semester

Aeronautical Engineering

AE 8505 — CONTROL ENGINEERING

(Regulations 2017)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch the electrical equivalent component of dashpot.

2. List the three basic elements of the mechanical translational system.

3. Write down the few limitations of the closed-loop control system.

4. State the basic rule of block reduction technique.

5. Write down the time domain specifications.

6. Define ramp signal.

7. State phase margin.

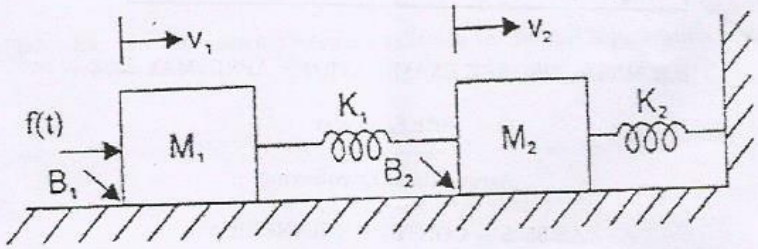
8. Write down the formula for angle of departure in root locus.

9. What are the two types of compensation techniques?

10. When will we use lag-lead compensation?

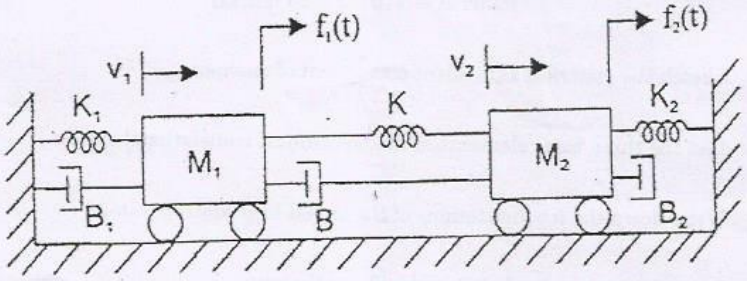
PART B — (5 × 13 = 65 marks)

11. (a) Derive the transfer function and draw the force current analogous circuits for the mechanical system shown below.

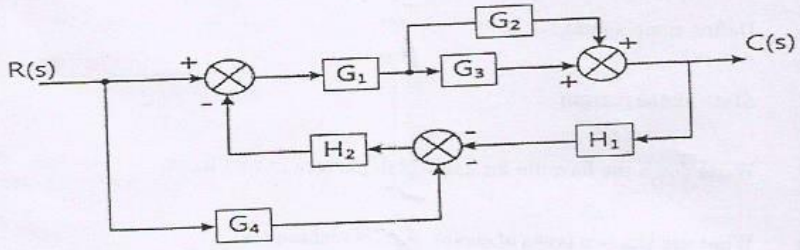


Or

(b) Derive the transfer function and draw the force voltage analogous circuits for the mechanical system shown below.

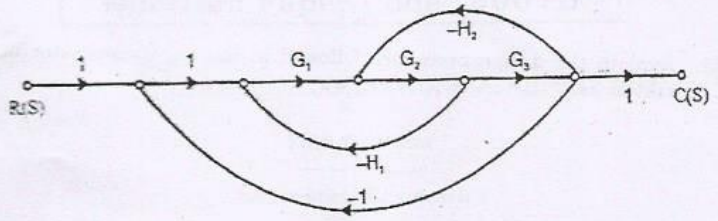


12. (a) Use the block diagram reduction technique to determine the C/R.



Or

(b) Find the overall gain $C(s)/R(s)$ for the signal flow graph show below.



13. (a) Derive the response of the first-order system for a unit step input and draw the time domain response of various values of $t = 0$ to $3T$.

Or

(b) Derive the expression for time-domain specifications

(i) Rise time (t_r) (6)

(ii) Settling time (t_s) (7)

14. (a) A unity feedback control system has an open-loop transfer function

$G(s) = K(s+15)/s(s+3)(s+7)$

Sketch the root locus to find the value of K for which the system is stable.

Or

(b) Sketch the bode plot of the following open-loop transfer function and from the plot determine the phase margin and gain margin

$G(s) = 50(1+0.1s)/(1+0.01s)(1+s)$

15. (a) Using the routh criterion determine the location of the roots of the following characteristic equation and comment on the stability of the systems.

$s^5 + 2s^4 + 24s^3 + 48s^2 - 25s - 50 = 0$

Or

(b) Using the mechanical to the electrical analogue, design the conventional push-pull rod flight control system.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the design procedure followed in the lag compensator using a bode plot.

Or

(b) Explain the design procedure followed in the lag compensator using a root locus.

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