



Control Systems

Time: 3 Hours

Max. Marks: 100

Note : Answer any five questions choosing one full question from each unit.

Unit - I

- 1 a) Draw the block diagram representation of an open loop and a closed loop control system and explain each block. Indicate two advantages, two demerits and two applications of each type. 8
- b) Find $\frac{C(s)}{R(s)}$ for the system shown in Fig. 1(b) using i) Block diagram reduction ii) Mason's gain formula.



Fig. 1(b)

12

OR

- 2 a) What are block diagram and signal flow graphs? How are they obtained for a system? 8
- b) For the mechanical system shown in Fig. 2(b) obtain: i) Mechanical network ii) Mathematical model iii) f-V analog circuit iv) f-i analog circuit.

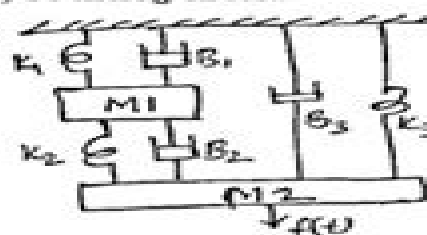


Fig. 2(b)

12

Unit - II

- 3 a) Discuss the effect of damping ratio on the step response of a second order system with relevant equations and graphs. 8
- b) Derive the expressions for the peak time and maximum overshoot of the step response of a second order underdamped system. If the OLTF of a unity feedback system is $G(s) = \frac{4}{s(2s+1)}$ find rise time, peak time and maximum overshoot. 12

OR

- 4 a) Explain the basic PI, PD and PID control actions with relevant transfer functions. 8
- b) Derive the expressions for the position, velocity and acceleration error constants of a unity feedback system. A unity feedback system has the forward path transfer function $G(s) = \frac{K(2s+1)}{s(5s+1)(s+1)^2}$. Find the minimum value of K, so that the steady state error is less than 0.1, when input is $r(t) = 1+6t$. 12

Control Systems N6 Question Paper

**Rebecca J. Pardee, National Institute of
Standards and Technology (U.S.)**

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