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Dr B R Ambedkar National Institute of Technology, Jalandhar

B Tech (Electrical Engineering)

EEPC–303, Control System Engineering

End Semester Examination, Dec 2020

Duration: 02 Hours Max. Marks: 40 Date: 3^{rd} Dec 2020

(Marks Distribution & Mapping of Questions with Course Outcomes (COs))								
Question Number	1	2	3	4	5	6	7	8
Marks	5	5	5	5	5	5	5	5
CO No.	1	1	2	3	3	4	3	5
Learning Level	1	2	2	2	3	3	2	1

Note:

1. Attempt all the questions.
2. Write the answers in hard copy (on A4 sheet) using blue/black pen with your signature on top left and page number on top right corner of each page of the answer booklet.
3. The time allowed for writing examination is 02 hours. Extra 15 minutes are allowed for preparing the PDF file of Answer Booklet and submitting it.
4. Follow the instructions regarding submission of answer booklet as issued by the examination section.

Q 1. Consider the system shown in Figure (1). Derive the expression for the steady-state error when both the reference input R(s) and disturbance input D(s) are present.

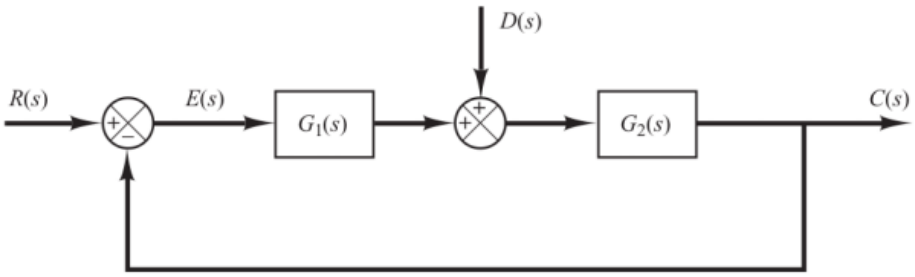

Figure 1:

Q 2. Obtain the transfer functions $X_1(s)/U(s)$ and $X_2(s)/U(s)$ of the mechanical system shown in Figure (2)

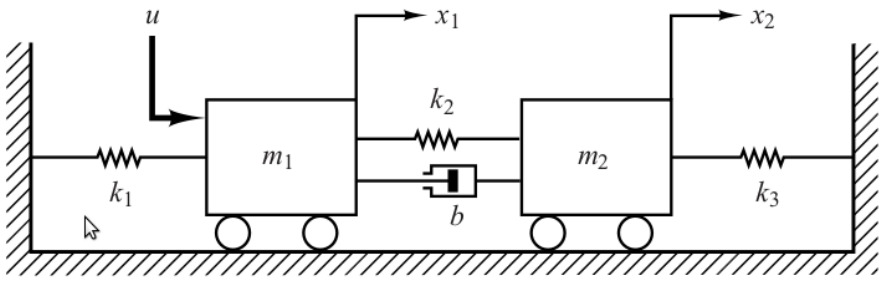

Figure 2:

Q 3. For the system shown in Figure (3) Find the transfer function $G(s) = X(s)/F(s)$ From the transfer

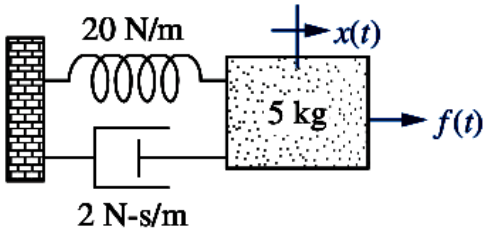

Figure 3:

function find the value of ζ, ω_n, % overshoot and peak time.

Q 4. For a unity feedback system with plant transfer function

$$G(s) = \frac{k}{s(s+1)(s+2)(s+6)}$$

(a) Find the range of k for stability

(b) Value of k for marginal stability

(c) Actual location of the closed loop poles when system is marginally stable.

Q 5. The open loop transfer function of a unity feedback system is given by

$$G(s) = \frac{2(s+\alpha)}{s(s+2)(s+10)}$$

Sketch the root locus as α varies from 0 to ∞. Find the angle and real axis intercept of the asymptotes, breakaway points and the imaginary axis crossing point.

Q 6. Consider a unity feedback system with

$$G(s) = \frac{K}{(s+3)(s+5)}$$

(a) Show that the system can't operate with a settling time of 2/3 second and a percent overshoot of 1.5% with a simple gain adjustment.

(b) Design a lead compensator so that the system meets the transient response characteristics. Specify the compensator's pole and zero.

Q 7. For the bode plot shown in figure (4) identify the system transfer function.

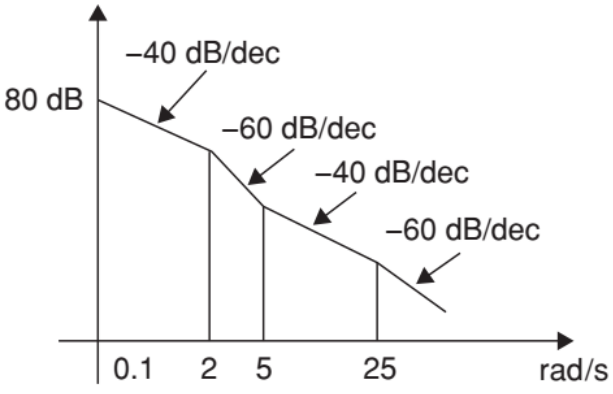

Figure 4:

Q 8. Write a note on the working of any one of the following control component

(a) Synchro Transmitter receiver pair (OR)

(b) AC servomotor

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