Sample Paper for Control Systems Engineering

CONTROL SYSTEM EENGEERING

Paper : ECE-302-E

Time Allowed : 3 hours Maximum Marks : 100

Note: Attempt any **five** questions choosing atleast **one** from each section.All questions carry **10** marks each.

SECTION-A

Instruction: Attempt any three questions from this Section.

Question 1. Compare and Contrast Open loop and Closed loop Control Systems.

Question 2. Explain the terminologies associated with Signal Flow Graphs with a suitable example.

Question 3. Discuss the working of a stepper model and derive a suitable mathematical model for it.

Question 4. Discuss the effect of feedback on sensitivity.

SECTION-B

Instruction: Attempt any three questions from this Section.

Question 5. Explain the second order time domain specifications of a Control System.

Question 6. Find the time domain specifications for the system given as:

C(s)/ R(s) = (s^2 +2s+3) / (s^2 + 5s+9)

Question 7. Explain frequency domain specifications of a third order control system.

Question 8. Sketch the root locus for a system having transfer function as

G(s) = k(s+1) / (s+3)

SECTION-C [10 Marks Questions]

Instruction: Attempt any three questions from this Section.

Question 9. Explain the Routh Hurwitz Criteria for determining the stability of a system.

Question 10. Explain the correlation between time domain and frequency domain responses.

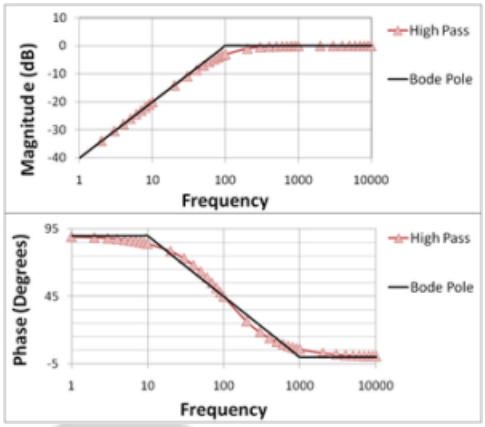
Question 11. The Open loop transfer function of a system is given as follow. And Comment on the stability of the system using Nquist Plot. **G(s) = k/(s+1)**

Question 12. Distinguish between order and type of a system.

SECTION-D[10 Marks Questions]

Instruction: Attempt any four questions from this Section.

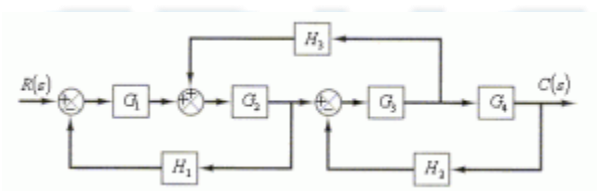
Question 13. Find the transfer function for the Bode Plot given in the figure (a)



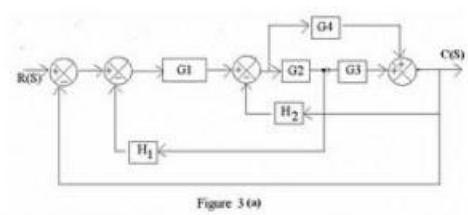
Calculate Transfer Function

Question 14. Obtain the transfer function from following Block Diagram representations.

a) Find the transfer function for the block diagram shown as below:

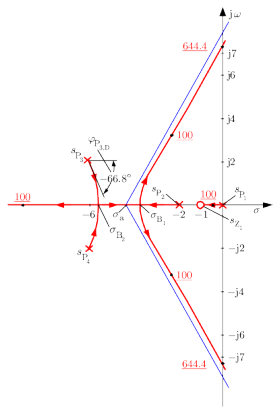


Transfer Function from Block Diagram 2



Transfer Function from Block Diagram 1

Question 15. a) Calculate the Root Locus for the closed loop system shown in figure (c).

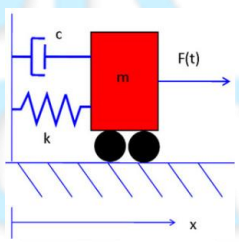


b) For the transfer function below, draw a block diagram with no more than one power of the Laplace transform variable "*s*" in each box.

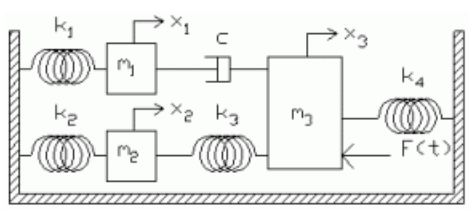
$$T(s) = \frac{s^2}{s^2 + 4s + 29}$$

Transfer Function

Question 16. a) Calculate the suitable transfer function for the mechanical system given in figure:



b) Write the differential equations of motion for the following system



Question 17. a) Write the following differential equation in state equation format. $\ddot{x} + 3\dot{x} + 4x = r(t)$

b) Given the state equations below, write the transfer function for this system. Assume the output variable in the transfer function is y(t) which is equal to the state variable x_1.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -6 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 2u(t) \end{bmatrix}$$

State Equation