

TEE-502

1162

Odd Semester Examination, 2017-18

B.TECH (SEMESTER-V)

SYSTEM ENGINEERING

Time: 03:00 Hours

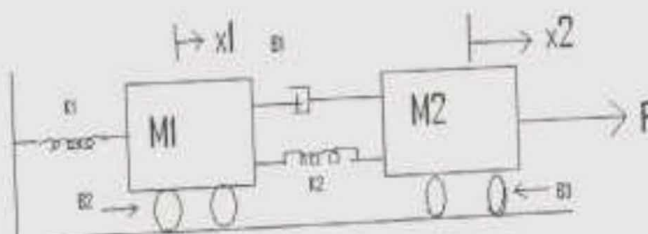
Max Marks: 100

Note: Attempt all questions.

1. Attempt any four questions:

[5x4]

- Define open loop and closed loop systems. Give the advantages and disadvantages of closed loop system.
- Explain the force voltage analogy with relevant diagram and equations.
- Explain the Mason's gain formula in detail.
- Draw the analogous electrical circuit of system using f-v analogy.

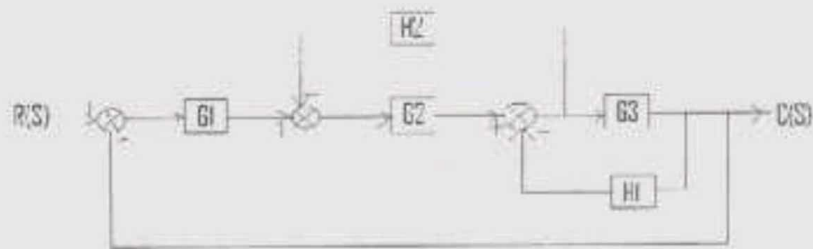


(e) Discuss rotational system.

[5x4]

2. Attempt any four questions:

- Derive the expression for time response of second order control system for unit step input.
- What are the characteristics of P, PI and PID controller?
- Derive the expression for peak time (t_p) and maximum overshoot (M_p)
- Find the ratio $C(s)/R(s)$ of the system shown in fig:

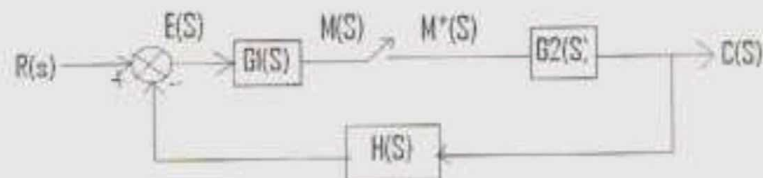


- (e) Consider the unit step response of a unity feedback control system whose open loop transfer function is: $G(s) = 1/s(s+1)$

Obtain the rise time, peak time and maximum overshoot.

3. Attempt any two questions: [10x2]

- (a) Explain sampler and zero order hold circuit used in sampled data control system.
 (b) Derive the Z transform of unit step function and unit ramp function.
 (c) What is pulse transfer function? Find the pulse transfer function of the system shown in fig.



4. Attempt any two questions: [10x2]

- (a) Explain canonical variable diagonalization technique with example.
 (b) Find the time response of the system described by the equation:

$$\dot{x}(t) = \begin{bmatrix} -1 & 1 \\ 0 & -2 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$X(0) = \begin{bmatrix} -1 \\ 0 \end{bmatrix}, u(t) = 1, t > 0$$

(c) A system is described by the matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \quad b = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad c = [1 \ 2 \ 0]$$

Find the transfer function.

[10x2]

5. Attempt **any two** questions:

(a) What is purpose of linearization? Describe the linearization process of the non linear state model.

(b) How stability of non linear system is checked by Lyapunov's stability criteria?

Consider a non linear system described by the equation

$$\dot{x}_1 = x_2, \quad \dot{x}_2 = -x_2 - x_1^3$$

Check the stability of the system by Lyapunov method.

(c) What is the significance of lyapunov function with respect to stability concept?
