Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU

School of Engineering

Mid - Term Examinations -November 2024

Semester: V | **Date**: 04/11/2024

Course Code: EEE2007 | **Time**: 09:30am – 11:00am

Course Name: Control System Engineering | **Max Marks**: 50

Program: B. TECH-EEE | **Weightage**: 25%

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **2Mx5Q=10M**

1	Define the transfer function of a linear time invariant system and describe the poles and zeros of a transfer function	**2 Marks**	**L1**	**CO1**
2	The Mason's Gain Formula (MGF) determines the transfer function of a linear system which is represented as signal flow graph. Recall the MGF.	**2 Marks**	**L1**	**CO1**
3	The performance characteristics of a control system are specified in terms of the transient response to unit step input. The transient response of a practical control system exhibits damped oscillations before attaining the steady state. Define the following performance indices that are used to characterize the step response to a second order system. (a) Delay time (b) Rise time	**2 Marks**	**L1**	**CO2**
4	The error constants Kp, Kv and Ka describe the ability of a system to reduce or eliminate steady state errors. List the expressions for the various error constants and steady state error.	**2 Marks**	**L1**	**CO2**
5	Define the type and order of a system with examples	**2 Marks**	**L1**	**CO2**

Part B

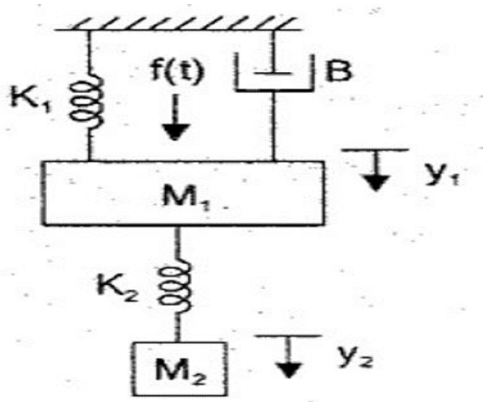
Answer ALL Questions. Each question carries 10 marks. **4QX10M=40M**

6	**6a.** An automobile shock absorber can be represented with single mass, damper and spring with an external force F acting on mass which produces a displacement of x. Identify the various forces acting on the system and develop its transfer function	**5 Marks**	**L3**	**CO1**

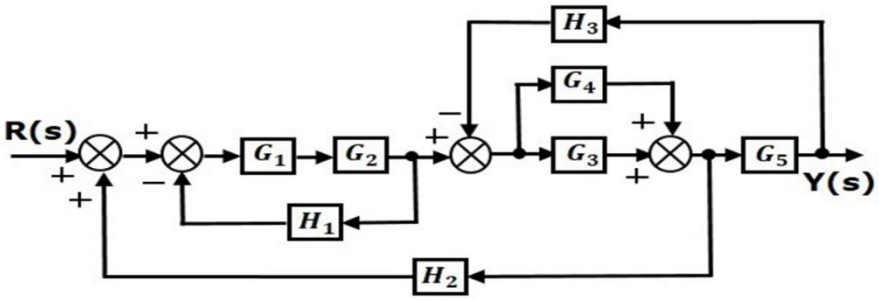
6b. Control theory strongly relies on mathematical models of dynamical systems. Depending on how a dynamical system is modelled, an appropriate control strategy must be selected. Most of the electrical systems can be modelled by three basic elements: Resistor, inductor, and capacitor. Consider a circuit in which these elements are connected in series and outline its transfer function. **5 Marks** **L2** **CO1**

OR

7 Outline the transfer function of the mechanical translational system given below **10 Marks** **L2** **CO1**

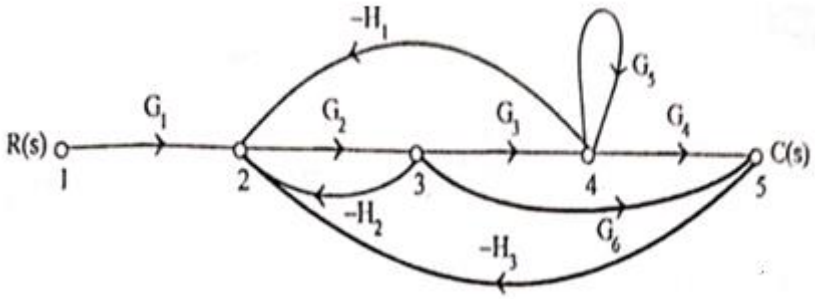


8 Using Block diagram reduction rules reduce the block diagram given below and construct its transfer function **10 Marks** **L3** **CO1**

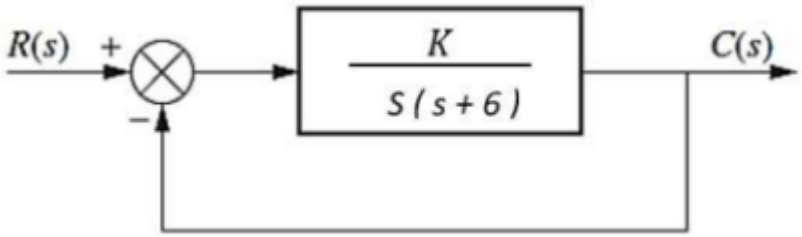


OR

9 For the signal flow graph given below, obtain the transfer function using MGF **10 Marks** **L2** **CO1**



10 Select the value of K for the feedback system given below, so that the system will respond with a 10% overshoot. **10 Marks** **L3** **CO2**



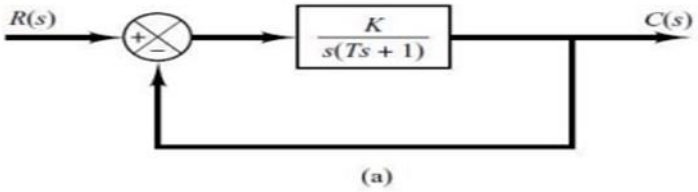
OR

11 For the open loop system whose transfer function is given below **10 Marks** **L3** **CO2**

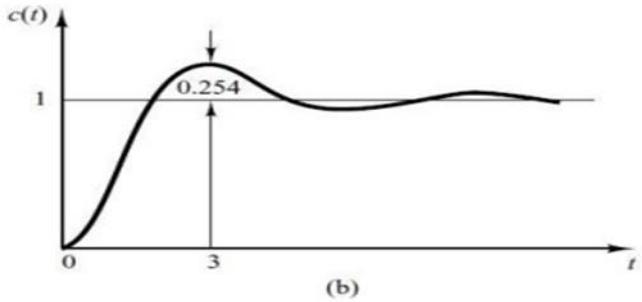
1. Identify the type and order.
2. Find the location of poles and zeros
3. Determine the static error constants for step, ramp and parabolic (acceleration) inputs
4. Determine the steady state errors for step, ramp and parabolic (acceleration) inputs when applied separately.

$$G(s) = \frac{5(s^2+2s+100)}{s^2(s+5)(s^2+3s+10)}$$

12 When the system shown in figure (a) is subjected to a unit-step input, the system output responds as shown in figure (b). Identify the values of K and T from the response curve. **10 Marks** **L3** **CO2**



(a)

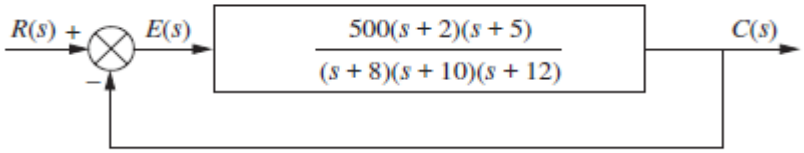


(b)

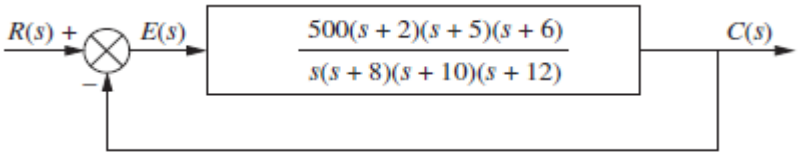
OR

13 Steady-state error is a property of the input/output response for a linear system and defined as the difference between the desired value and the actual value of a system output in the limit as time goes to infinity. The magnitudes of the steady-state errors due to these individual inputs are indicative of the goodness of the system. For the feedback control systems given below, identify the type of **10Marks** **L3** **CO2**

input signal which gives rise to a constant steady state error and evaluate the expected steady state error values.



(a)



(b)