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**PRESIDENCY  
UNIVERSITY  
BENGALURU**

**Make Up Examinations – December 2025**

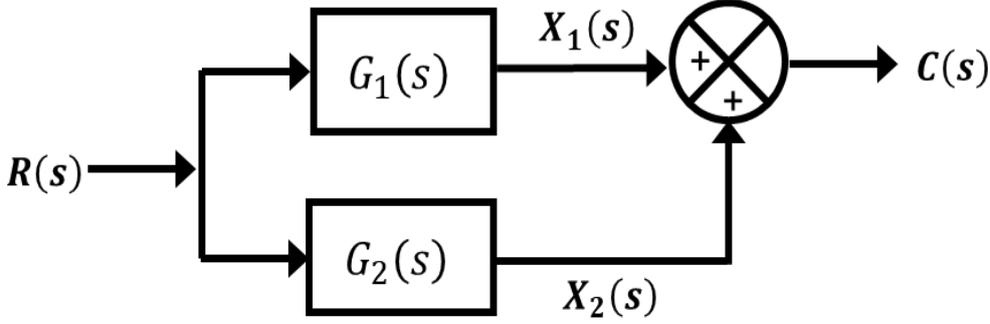
<b>Semester:</b> MK	<b>Date:</b> 26 – 12- 2025
<b>Course Code:</b> ECE3007	<b>Time:</b> 1.00pm to 04.00pm
<b>Course Name:</b> Control Systems	<b>Max Marks:</b> 100
<b>Program:</b> B. Tech	<b>Weightage:</b> 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

**Part A**

<b>Answer ALL the Questions. Each question carries 2marks.</b>		<b>2Mx10Q=20M</b>		
<b>1</b>	<p>In force current analogy, the mathematical equations of the translational mechanical system are compared with the nodal equations of the electrical system. Consider the spring mass damper system shown</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>Determine the force current analogy for the given system.</p>	<b>2 Marks</b>	<b>L1</b>	<b>CO1</b>
<b>2</b>	<p>Positive feedback in a control system is a process where a change in a variable results in a similar change in another variable. Draw a Simple positive feedback system.</p>	<b>2 Marks</b>	<b>L1</b>	<b>CO1</b>
<b>3</b>	<p>In mathematics, the Laplace transform, named after Pierre-Simon Laplace, is an integral transform that converts a function of a real variable to a function of a complex variable. Determine the Laplace transform of <math>2e^{-3t}u(t) + 4e^{-4t}u(t)</math>.</p>	<b>2 Marks</b>	<b>L1</b>	<b>CO2</b>
<b>4</b>	<p>A transfer function is a ratio of the output to the input in a control system, and it's a fundamental concept in control engineering. Find the transfer</p>	<b>2 Marks</b>	<b>L1</b>	<b>CO1</b>

	<p>function of the following circuit</p> 			
5	<p>The root locus of a feedback system is the graphical representation in the complex s-plane of the possible locations of its closed-loop poles for varying values of a certain system parameter. Point out two applications of root locus.</p>	2 Marks	L1	C03
6	<p>There are two types of electrical analogies of translational mechanical systems. Name them.</p>	2 Marks	L1	C01
7	<p>For the following differential equation governing the mechanical system, write the Force-voltage analogy</p> $M \frac{d^2x(t)}{dt^2} + B \frac{dx(t)}{dt} + K x(t) = f(t)$	2 Marks	L1	C02
8	<p>The unit step signal is defined as</p> $u(t) = \begin{cases} 1, & t \geq 0 \\ 0, & t < 0 \end{cases}$ <p>Find the Laplace transform of unit step signal</p>	2 Marks	L1	C02
9	<p>Controllability is a fundamental property of a control system. Define Controllability.</p>	2 Marks	L1	C04
10	<p>Observability is a control theory concept. Define Observability with proper diagram.</p>	2 Marks	L1	C04

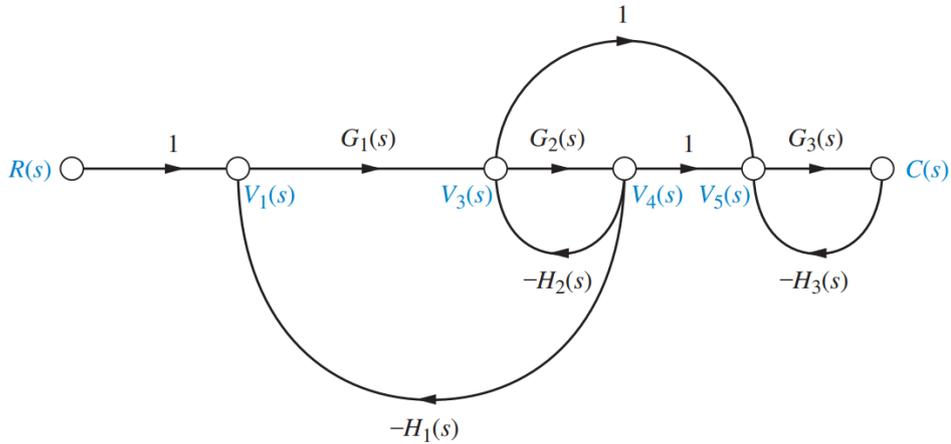
**Part B**

**Answer ALL Questions. Each question carries 20 marks.**

**4QX20M=80M**

**11**

Find the transfer function of the system represented by the signal flow graph



**20  
Marks**

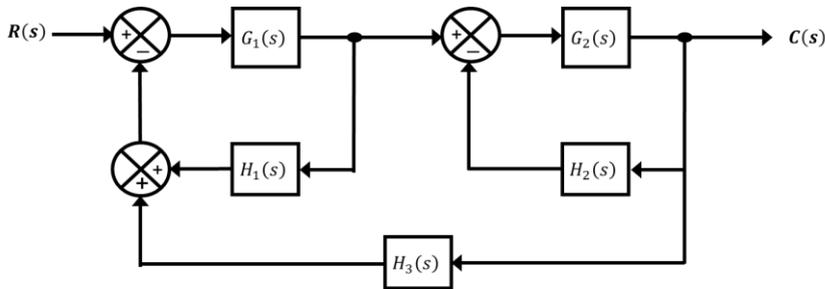
**L2 C01**

**or**

**12**

Reduce the block diagram and hence find the closed loop transfer function

$$\frac{C(s)}{R(s)}$$

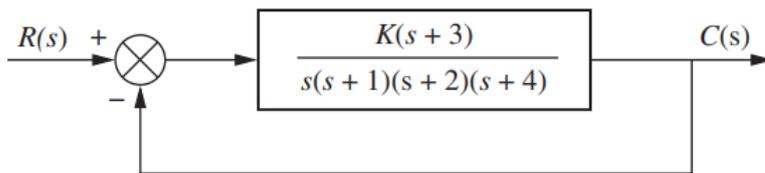


**20  
Marks**

**L2 C01**

**13**

In control theory, the root locus is a graphical method that shows how the poles of a closed-loop system change when a parameter, like gain, is varied. It's a common technique used to design control systems. Determine the root locus of the following system.



**20  
Marks**

**L3 C03**

**or**

**14**

A system whose input output relationship is described by a first order differential equation is known as a first order system

Let the input be represented by  $r(t)$  and the output be represented by  $c(t)$

**20  
Marks**

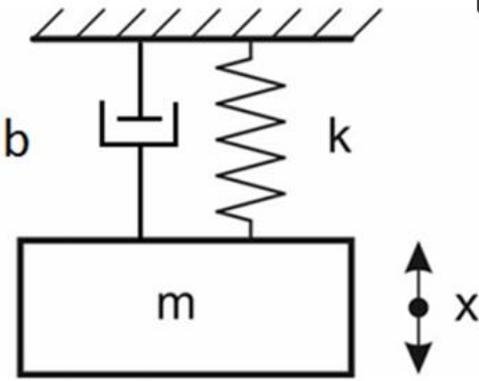
**L3 C02**

	Find the transfer function of a first order system.			
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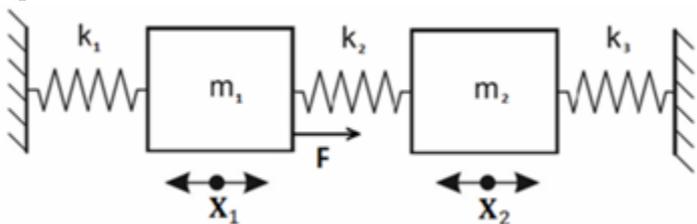
15	Impulse response of a system is the response of the system to a unit impulse input. Find the Impulse Response of a First Order System.	20 Marks	L2	C02
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or

16	The second-order system is the lowest-order system capable of an oscillatory response to a step input. Typical examples are the spring-mass-damper system and the electronic RLC circuit. Find the Step Response of a Second Order System.	20 Marks	L2	C02
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17	<p>In control engineering and system identification, a state-space representation is a mathematical model of a physical system specified as a set of input, output, and variables related by first-order differential equations or difference equations. Find the state space representation of the following setup.</p> 	20 Marks	L3	C04
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or

18	<p>The state space of a dynamical system is the set of all possible states of the system. Each coordinate is a state variable, and the values of all the state variables completely describes the state of the system. Find the state space representation of the following setup.</p> 	20 Marks	L3	C04
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