



VIT

Vellore Institute of Technology
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CHENNAI

Reg. Number: _____

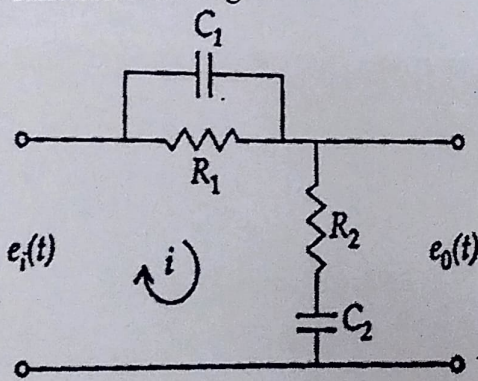
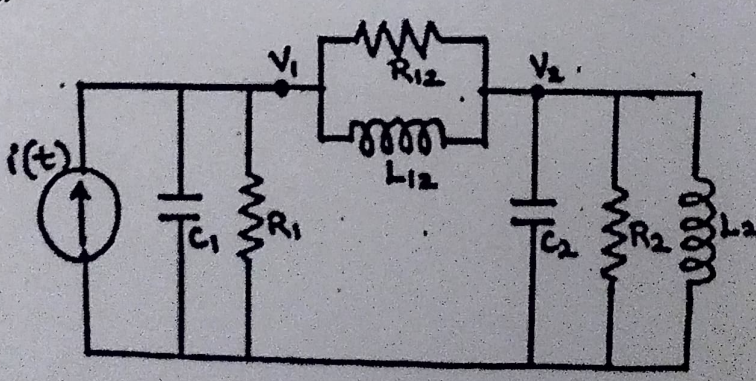
Continuous Assessment Test (CAT) – I - FEB 2024

Programme	: B.Tech. (ECE)	Semester: Winter 2023-24
Course Code & Course Title	: BECE302L & Control Systems	Class Number: CH2023240501029 CH2023240500989 CH2023240500984
Faculty	: Dr. M. Jagannath Dr. Sunil Kumar Pradhan Dr. Ashis Tripathy	Slot: F1+TF1
Duration	: 90 Minutes	Max. Mark: 50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary.
- Use graph sheets supplied from the exam cell as necessary.
- Only non-programmable calculator without storage is permitted.

Answer all questions

Q. No	Sub Sec.	Description	Marks
1	(a)	Give any two real-time examples of open-loop and closed-loop control systems and derive the transfer function of a negative feedback system.	5
	(b)	Determine the transfer function from Figure 1. 	5
2		Write the differential equations governing the electrical circuit as shown in Figure 2. 	5

3	<p>Draw the signal flow graph for a system described by the following sets of equations: (2 Marks)</p> $X_2 = G_1 X_1 + G_2 X_3 + G_3 X_4 + G_4 X_5$ $X_3 = G_5 X_2$ $X_4 = G_6 X_3 + G_7 X_1$ $X_5 = G_8 X_3 + G_9 X_4$ <p>Identify the forward paths with their path gain, individual loops with their loop gain, and possible combinations of the non-touching loops with the loop gain product. (5 Marks)</p> <p>Also, convert the obtained signal flow graph into the block diagram representation. (3 Marks)</p>	10
4	<p>Using Mason's formula, obtain the transfer function $\frac{Y(s)}{X(s)}$ from the Figure 3.</p> <p style="text-align: center;">Figure 3.</p>	10
5	<p>Consider a first-order system with unity feedback, where the forward path transfer function is given by $G(s) = \frac{1}{2s}$.</p> <p>(a) Draw the block diagram of the first-order system, taking into consideration negative feedback. (2 Marks)</p> <p>(b) Obtain the transfer function of the first-order system with a block diagram. (2 Marks)</p> <p>(c) Find out this first-order system's response (in the time domain) with unit step input. (3 Marks)</p> <p>(d) Draw the response curve in the time domain and find out the slope of the curve at time $(t) = 0$ seconds. (3 Marks)</p> <p>(e) A second order system has a closed-loop transfer function, which is given by $G(s) = \frac{25}{s^2 + 8s + 25}$. If the system initially at rest is subjected to a unit step input at $t = 0$, then the 2nd peak in the response will occur at what time? (5 marks)</p>	15