MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

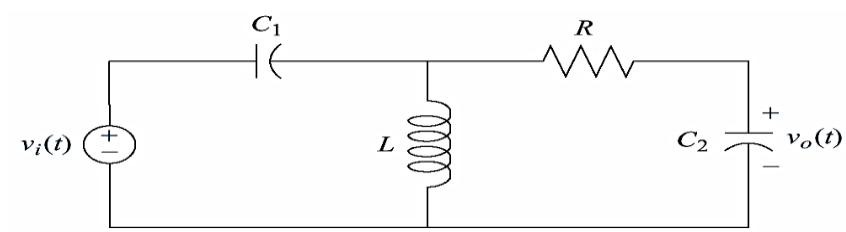
FIFTH SEMESTER B. TECH (ELECTRONICS AND INSTRUMENTATION)

PROCTORED ONLINE END SEMESTER EXAMINATION Dec. 21/Jan. 22

SUBJECT: MODERN CONTROL THEORY (ICE 3153)

TIME: 2.20 – 3.35 PM **DATE: 21.12.2021** **MAX MARKS 20**

Note: Answer All questions.

1	A	Design full order state observer and obtain equation of estimated state for the system using Ackermann's formula, $\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$ and $y = [1 \quad 0]x(t)$; The desired observer poles are at -6 & -6	4 M
	B	For the electrical system shown in Fig. Q. 1B select minimal state variables and find the state model in physical variable form. Take $V_o(t)$ as the output. Also find the characteristic equation of the system  **Fig. Q. 1B**	4 M
	C	Find the complete solution for the state equation for $\dot{x} = 8x + 2u$; $y = x + u$. with step input and initial state x(0)=1	2 M
2	A	Consider the second order system $\dot{x}_1 = \frac{-6x_1}{u^2} + 2x_2$; $\dot{x}_2 = \frac{-2(x_1 + x_2)}{u^2}$, where $u = 1 + x_1^2$. Show that the origin is not globally asymptotically stable for the Lyapunov function, $V(x) = \frac{x_1^2}{1 + x_1^2} + x_2^2$.	5 M

	B	Consider the following nonlinear system, $\begin{aligned}\dot{x}_1 &= -x_2 x_3 + 1 \\ \dot{x}_2 &= x_1 x_3 - x_2 \\ \dot{x}_3 &= x_3^2(1 - x_3)\end{aligned}$. Show that the system has unique equilibrium point. Using linearization method find the stability of the equilibrium point.	3 M
	C	Draw and explain the geometrical meaning of Lyapunov function.	2 M