Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2024

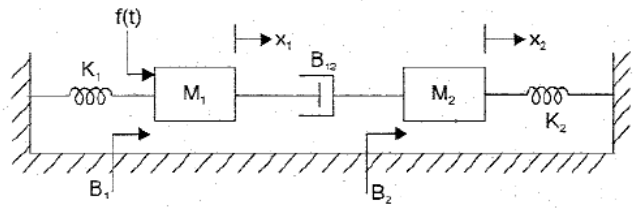
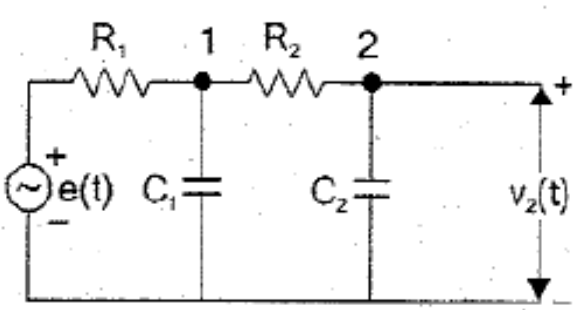
LINEAR CONTROL THEORY [AAE 2223]

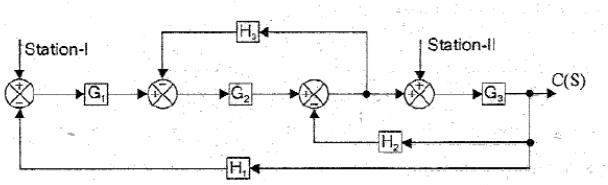
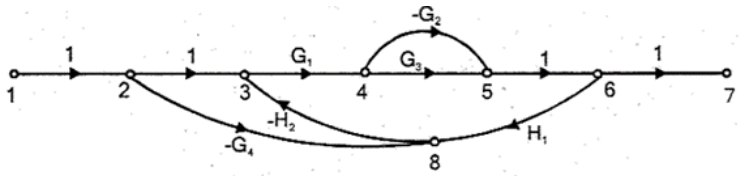
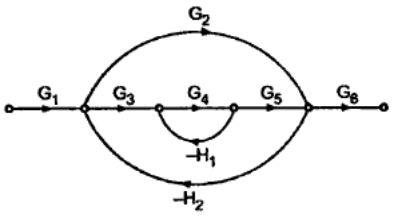
REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 26 JUNE 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

Q.NO	Questions	Marks	CO	BTL
1A.	Determine the Trasfer Fucntion $X_1(s)/F(s)$ and $X_2(s)/F(s)$ for the system shown in the figure below, 	(04)	CO1	L3
1B.	Obtain the Trasfer Function of the electrical network shown in the figure below, 	(03)	CO1	L2
1C.	An automatic washing machine is an example of a closed-loop control system. The machine needs to control the water level, temperature, and agitation speed during the wash cycle. a. Identify the controlled variables, manipulated variables, and disturbances in this system. b. Draw a detailed block diagram representing the control loops involved in the washing machine.	(03)	CO2	L2

	c. Discuss how the feedback mechanism ensures proper washing performance and energy efficiency.			
2A.	For the system represented by the block diagram shown in the figure below, Evaluate the close loop transfer function when the R (input) is at Station-I 	***(04)***	***CO2***	***L3***
2B.	For the Signal Flow Graph shown in the below figure, obtain the Transfer Function C(S)/R(S), 	***(04)***	***CO2***	***L3***
2C.	For the Signal Flow Graph shown in the below figure, obtain the overall Transfer Function using Mason's Gain formula, 	***(02)***	***CO2***	***L3***
3A.	Compute the necessary values required to sketch **Root Locus Plot** for the Open Loop Transfer Function, G(s) H(s)=K/s(s+1)(s+5)	***(05)***	***C04***	***L4***
3B.	Comment on stability for the characteristic equation. $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5$ Using Routh-Hurwitz criteria.	***(03)***	***CO3***	***L3***
3C.	Sketch **Root Locus Plot** in graph sheet for the **Q. No (3A)** and analyse the stability	***(02)***	***CO4***	***L4***
4A.	Compute the necessary values required to draw **Bode Magnitude and Phase Plot** for the Open Loop Transfer Function, G(s) =40/s(s+2)(s+20)	***(05)***	***CO4***	***L4***
4B.	Plot the **Bode Magnitude Plot and Phase plot** for the **Q. No. (4A)** in Semilog sheet and analyse the Stability.	***(03)***	***CO4***	***L4***
4C.	Draw the approximate **Polar plot** and **Nyquist Plot** for the Transfer Function G(S)=10/s(s+0.01)(s+0.02) by observing the Type and Order of the system.	***(02)***	***CO4***	***L4***

5A.	A unity feedback control system has a open loop transfer function $G(S) = \frac{10}{S(S+2)}$. Find (a) Rise Time (b) Percentage of overshoot (c) Peak Time (d) Settling Time for a step unit of 12 units.	***(04)***	***CO3***	***L3***
5B.	Obtain the state space model for the system having transfer function, $\frac{Y(S)}{U(S)} = \frac{1}{S^2 + S + 1}$	***(04)***	***CO5***	***L3***
5C.	Find the steady state error when the input is unit ramp signal for type-1 and type-2 system.	***(02)***	***CO3***	***L3***