Reg. No.										

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

IV SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

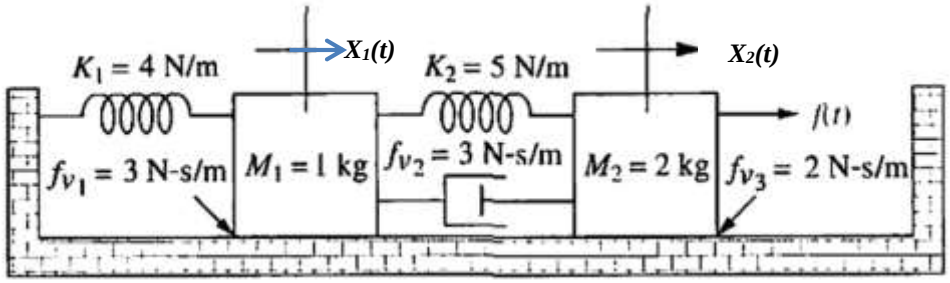
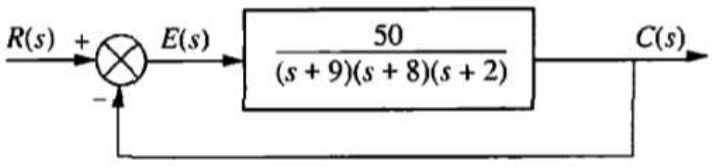
END SEMESTER EXAMINATIONS, JUNE 2018

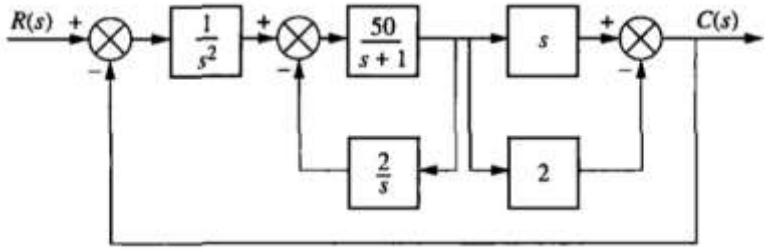
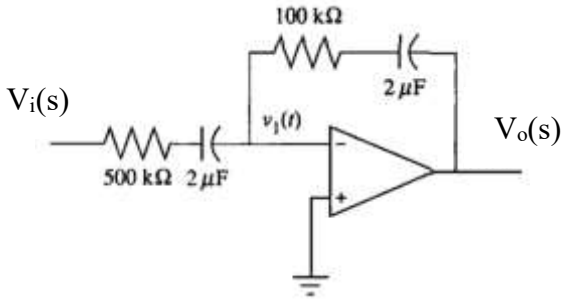
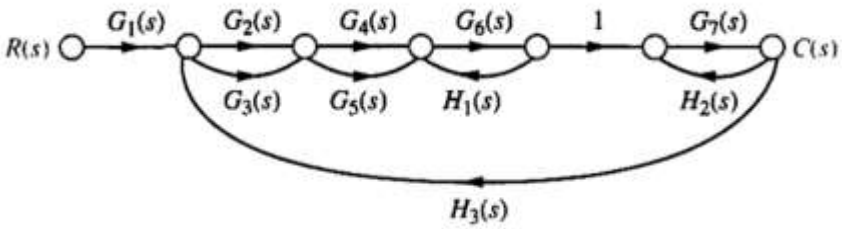
SUBJECT: LINEAR CONTROL THEORY [MTE 2203]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed with justification

1A	For the translational system shown in *Figure 1A*, find the transfer function $X_1(S)/F(S)$.  *Figure 1A*	**04**
1B	For the control system shown in *Figure 1B*, determine the position error coefficient and hence calculate the steady state error.  *Figure 1B*	**03**
1C	For the transfer function given below, Find the locations of poles and zeros and plot them on complex plane. Also write an expression for the general form of the step response without solving for the inverse Laplace transform and identify the nature of response. $$T(s) = \frac{20}{s^2 + 6s + 144}$$	**03**

2A	For the given transfer function below, obtain the transient parameters such as Damping ratio, Natural frequency, Rise time, Peak time, Settling time and Percent overshoot(%OS). $$T(s) = \frac{0.04}{s^2 + 0.02s + 0.04}$$	**04**
2B	Using block diagram reduction techniques, reduce the block diagram shown in *Figure 2B* to a single transfer function.  ***Figure 2B***	**04**
2C	Write a practical example for open loop and close loop systems each. Explain feedback control system design process.	**02**
3A	Explain different types of ideal, non-ideal compensators and the situations where these compensators are used.	**06**
3B	Find the transfer function $V_o(s)/V_i(s)$ of the electrical system shown in *Figure 3B.*  ***Figure 3B***	**04**
4A	For the polynomial $P(s) = s^5 + 6s^3 + 5s^2 + 8s + 20$, find the number of roots lying in the right half, left half and on the jω-axis of complex plane.	**04**
4B	For the signal flow graph shown in *Figure 4B*, apply Mason's Gain Formula to compute the transfer function  ***Figure 4B***	**03**

4C	For the unity feedback system having loop transfer function G(s) given below, determine the range of 'K' to ensure stability. $$G(s) = \frac{K(s+6)}{s(s+1)(s+4)}$$	**03**
5A	Sketch the root locus for the unity feedback system represented by following open loop transfer function. $$G(s) = \frac{K(s+6)}{(s+3)(s+4)(s+7)(s+9)}$$	**06**
5B	Explain the following terms related to Root Locus plot of a system a) Breakaway/Break in point b) Angle of arrival and Departure	**02**
5C	Differenciate between a PI compensator and Lag compensator. Explain with suitable example.	**02**