DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Summer Examination – 2023

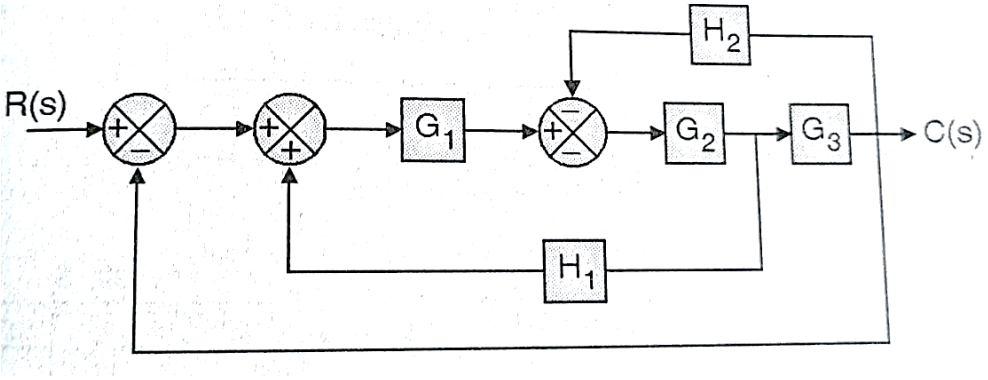
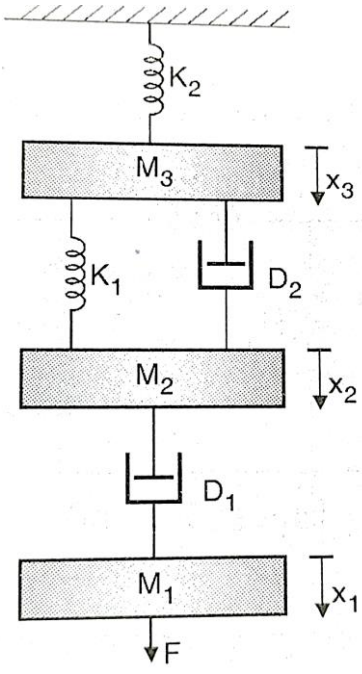
Course: B. Tech. **Branch :Electrical** **Semester :VI**

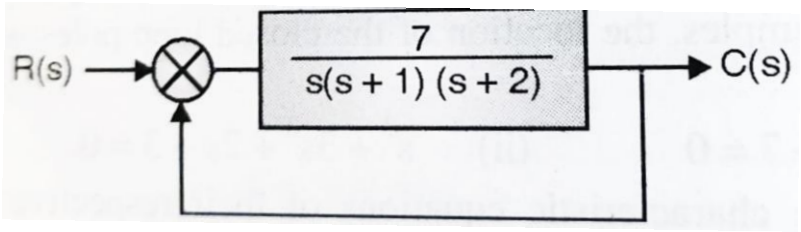
Subject Code & Name: BTEEC603 **Subject: Control system Engineering**

Max Marks: 60 **Date:** **Duration: 3 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**	CO1	**12**
A)	**Explain signal flow graph in detail with the help of Masons gain formula.**	CO1	**6**
B)	**Using the block diagram reduction technique, find the closed loop transfer function of the system whose block diagram is given in figure.** 	CO1	**6**
C)	**Obtained the analogous electrical network for the system shown in figure.** 		**6**

Q.2	**Solve Any Two of the following.**		**12**
A)	**A unity feedback system has G(s) = $\frac{20(s+3)}{(s+1)(s+6)}$ Determine type of system, all error coefficient, error when subjected to a step of magnitude 2.**	CO2	**6**
B)	**Determine the stability using Routh's Criteria : $s^5+2s^4+3s^3+6s^2+2s+1$**	CO2	**6**
C)	**Check whether the given system is stable or not by using Hurwitz criterion.** 	CO2	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	**Derive the transfer function of lead compensator using electrical network.**	CO3	**6**
B)	**Draw the approximate root-locus diagram for close loop system whose transfer function is given by G(s)H(s)=$\frac{k}{s(s+5)(s+10)}$**	CO3	**6**
C)	**Sketch the Bode plot showing the magnitude the decibel and phase angle in degrees as a function of log frequency for the transfer function given below. Determine the gain cross-over frequency ω_{gc} .** $$G(s) = \frac{10}{s(1+0.5s)(1+0.01s)}$$	CO3	**6**
Q.4	**Solve Any Two of the following.**		**12**
A)	**Write a short note on PI controller and PID controller.**	CO4	**6**
B)	**What are the effects of proportional, integral and derivative control on the time response of the system.**	CO4	**6**
C)	**A PI controller is used to control a system. It has the following settings, k_p = 2%, k_i = 3% per minutes, m(0) = 25%. The error signal is found to be 4t + 2. Find the controller output in percent after 2 minutes.**	CO4	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	**Obtain the state model for the system with the transfer function** $y(s) = \frac{3s+4}{s2+5s+6}$	CO5	**6**
B)	**Find the state transition matrix for,** $A = \begin{bmatrix} 1 & 0 \\ -6 & -5 \end{bmatrix}$	CO5	**6**

C)	**A linear time invariant system is characterized by the state variable model. Comment on the controllability and observability of the system.** $\begin{bmatrix}\dot{X}_1\\ \dot{X}_2\end{bmatrix} = \begin{bmatrix}-1 & 0\\ 0 & -2\end{bmatrix}\begin{bmatrix}X_1\\ X_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix} u(t)$ $Y(t) = [1 \quad 2]\begin{bmatrix}X_1\\ X_2\end{bmatrix}$	CO5	**6**
	***** End *****		