UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

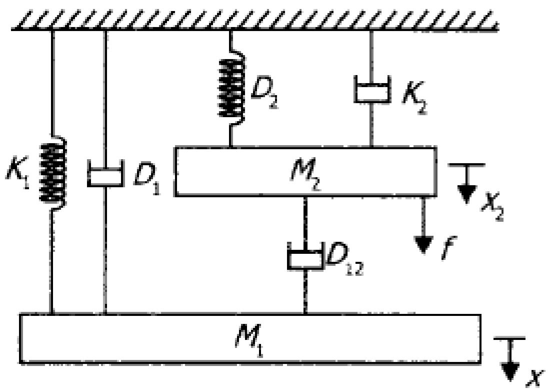
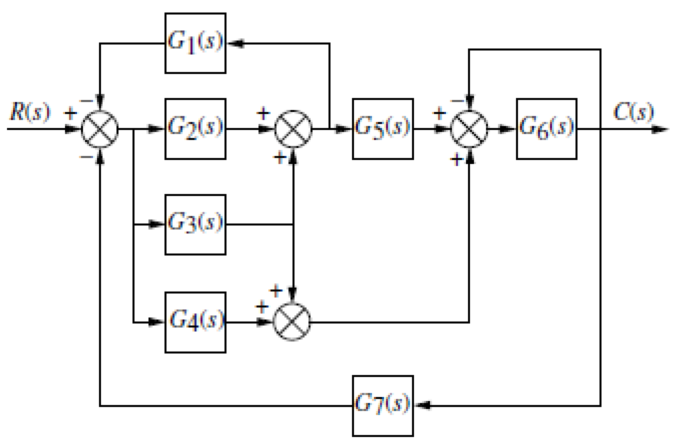
End Semester Examination, May 2023

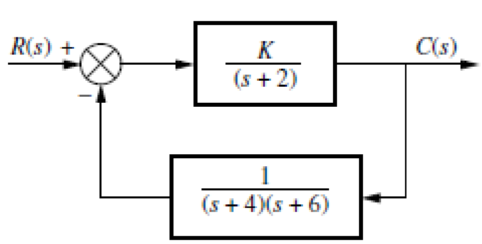
Course: Control System Engineering **Semester: VI**

Program: B. Tech electronics and communication engineering **Time 03 hrs**

Course Code: ECEG 3048 **Max. Marks: 100**

SECTION A (5Q x 4M= 20M)			
S. No.		**Marks**	**CO**
Q 1	Why is negative feedback is important in control system. Write the characteristics of negative feedback	**4**	**CO2**
Q 2	What do you understand by frequency response analysis? What is minimum phase system.	**4**	**CO3**
Q 3	Differentiate between transient and steady state stability?	**4**	**CO1**
Q 4	Elucidate the advantages of Routh Hurwitz stability criterion?	**4**	**CO1**
Q 5	Define the two situations in which compensation is required?	**4**	**CO4**
SECTION B [4Q X 10M=40 M]			
Q 6	Elucidate the mathematical equation of PID controller. What is the advantage of PI controller over PD controller?	**10**	**CO2**
Q 7	The characteristics equation of a system in differential form is $$\ddot{x} - (K+2)\dot{x} + (2K+10)x = 0$$ Find the values of K for which the system is (i) stable (ii) limited stable and (iii) unstable. For stable case, for what values of K is the system (i) underdamped (ii) overdamped	**10**	**CO2**
Q8	Obtain the mathematical modelling of the following system.	**10**	**CO3**

	 Fig 1		
Q 9	Differentiate between regulation and tracking of control with suitable example. **OR** Find the equivalent transfer function T(s)= C(s)/ R(s) for the system as shown in figure?  	**10**	**CO3**
SECTION C [2Q X 20M=40]			
Q 10 (a)	The state equation of Linear Time Invariant system is given below	**10**	**CO4**

(b)	$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ Determine the following (i) The state Transition Matrix (ii) $X_1(1)$ under zero initial conditions and a step input (iii) Controllability and observability of the system The Linear Time Invariant system is characterized by homogenous state equation $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ The initial state is $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ Find the resolvent matrix and state transition matrix of the given equation	**10**	**CO4**
Q 11	Design the complete root locus for $G(s)H(s) = \frac{K}{s(s+2)(s+4)} (K > 0)$ From the root locus plot find the range of value of K for which the system will have damped oscillatory response. **OR** Using the Nyquist criterion ,find the range of K for stability for the system shown in figure? 	**20**	**CO3**