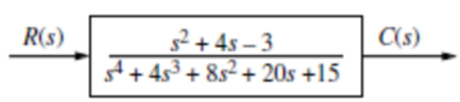
SET A

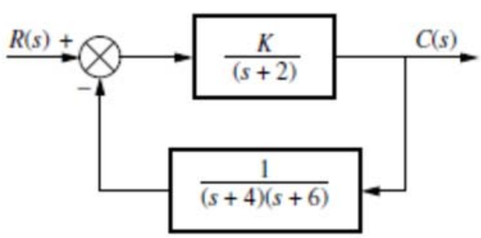
Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May2019

Programme Name: B. Tech Avionics Engg **Semester : VIII**
Course Name : Control System Engineering **Time : 03 hrs**
Course Code :ELEG 271 **Max. Marks : 100**
Nos. of page(s) :
Instructions:

S. No.	All Questions are compulsory.	Marks	CO
	SECTION A		
Q 1	The open loop transfer function of a unity feedback system is given by G(s) = K/s(s+4)(s^2+s+1). Determine the value of K that will cause sustained oscillations in the closed loop system. Also, find the natural frequency of oscillation?	**5**	**CO2**
Q 2	Comment on the stability and location of poles of the given characteristic equation, 1+G(s)H(s)= **$2s^6+5s^5+3s^4+6s^3+5s^2+6s+1$.**	**5**	**CO3**
Q 3	Draw the block diagram of a closed loop control system showing all necessary elements.	**5**	**CO1**
Q 4	Classify the system on various basis and comment.	**5**	**CO12**
	SECTION B		
Q 5	How many poles are in the right half plane, in the left hale plane and on the jw axis for the open loop system?  	**10**	**CO2**
Q6.	Obtain the transfer functions for the following systems with state-space models available as: a. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u\ ;\quad y = \begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + [0]u$	**10**	**CO5**
Q7.	Explain PID controller along with the block diagram and mathematical equation? What are the advantages of PID controller over P, PI and PD controllers?	**10**	**CO4**

Q8	For the system as shown in figure the small piston has a face area of 2 in^2 and receives an external force of 10 lb. the large piston has a face area of 20 in^2. Calculate the force exerted by the large piston?  	**10**	**CO1**
SECTION-C			
Q9.	Design a closed loop Second order system for an analog voltmeter such that: (a). The pointer of the analog meter will final settles at 5 V after some time. (b). For second cycle the peak overshoot measured as 20%. (c). Time duration between first peak time and 4^{th} peak time noticed as 30s. Also determine the output response equations and draw the output and input on same scale.	**20**	**CO2**
Q10	Using the Nyquist criterion ,find the range of K for stability for the system shown in figure?  	**20**	**CO3**

Set 2

Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

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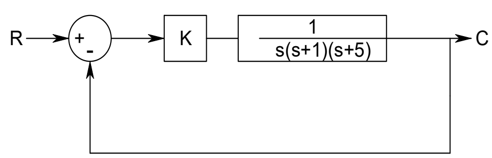
SECTION A

S. No.	All Questions are compulsory.	Marks	CO
Q 1	The open loop transfer function of a unity feedback system is given by $G(s) = K/s(s+4)(s^2+s+1)$. Determine the value of K that will cause sustained oscillations in the closed loop system. Also, find the natural frequency of oscillation?	**5**	**CO1**
Q 2	Comment on the stability and location of poles of the given characteristic equation, $1+G(s)H(s)= 2s^6+5s^5+3s^4+6s^3+5s^2+6s+1$.	**5**	**CO3**
Q 3	Draw the block diagram of a closed loop control system showing all necessary elements.	**5**	**CO2**
Q 4	Classify the system on various basis and comment.	**5**	**CO1**

SECTION B

Q 5	(a).Find the break-away points of the root locus defined for $G(s)H(s)= K/s(s+4)(s+5)$? (b).What will be the value of K so that the closed loop system shown in figure becomes marginally stable?  	**10**	**CO3**
Q6.	A first order closed loop control system is defined by $T(s) = K/(s+2a)$.If a unit step input is applied, the system response reaches 40 % of its steady state value in 20 sec. How much time will it take the response to reach 90% of the steady state value? Plot the curve also?	**10**	**CO2**
Q7.	The open loop transfer system function of a unity feedback system is $G(s)= K/s(1+Ts)$.	**10**	**CO2**

	(a)Find by what factor the gain K be reduced so that the overshoot is reduced by 60% to 50%. (b) Find by what factor the gain K be reduced so that the damping ratio is increased from 0.1 to 0.6		
Q8	Obtain the transfer functions for the following systems with state-space models available as: a. $\begin{bmatrix}\dot{x_1}\\ \dot{x_2}\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u\,; \quad y = \begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + [0]u$	**10**	**CO5**
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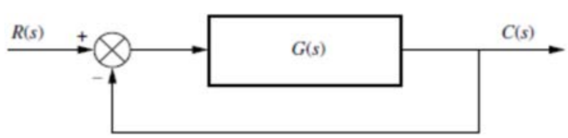
Q9.	Design a closed loop Second order system for an analog voltmeter such that: (a). The pointer of the analog meter will final settles at 5 V after some time. (b). For second cycle the peak overshoot measured as 20%. (c). Time duration between first peak time and 4th peak time noticed as 30s. Also determine the output response equations and draw the output and input on same scale.	**20**	**CO3**
Q10	Let $G(s)$=$\frac{-K(S+1)^2}{S^2+2S+2}$ With K>0 in figure  (a) Find the range of K for closed –loop stability? (b) Sketch the system's root locus? (c) Find the position of the closed –loop poles where K=1 and K=2 ?	**20**	**CO4**