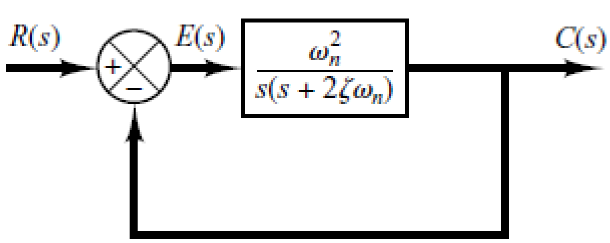
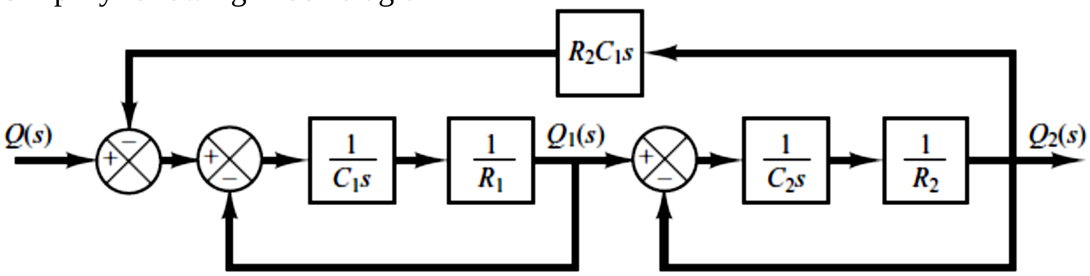
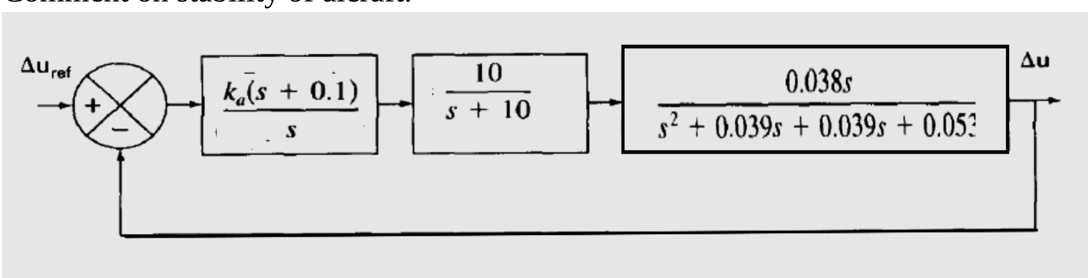
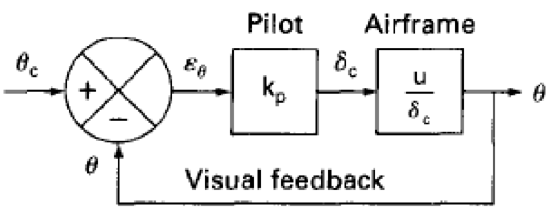
Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2021

Course: Introduction to Automatic Flight Control **Semester: VII**
Program: B.Tech ASE **Time 03 hrs.**
Course Code: ASEG 4015 **Max. Marks: 100**

S. No.	SECTION A [Short Answers] 5x4=20 Marks	Marks	CO
Q 1	Categories different types of flight control systems.	4	CO1
Q 2	List different functions of autopilot in aircraft.	4	CO1
Q 3	Give Block diagram of altitude hold control system using direct flap lift.	4	CO2
Q 4	Give Block diagram of velocity hold autopilot of a typical aircraft.	4	CO2
Q 5	Analyse the stability a control system with following characterisitics equation $s^4 + 2s^3 + 3s^2 + 4s + 5 = 0$	4	CO3
	SECTION B [Long Answers] 10x4=40 Marks		
Q 6	Why closed loop system is preferred over open loop control system. Give two examples for each type.	10	CO1
Q 7	Consider the system shown in Figure below, where $\zeta = 0.7$ and $\omega_n = 6$ rad/sec. Obtain the rise time, t_r, peak time t_p and settling time t_s when the system is subjected to unit step input. 	10	CO3

Q 8	Simplify following Block diagram 	**10**	**CO2**
Q 9	The single degree of freedom pitching motion of an airplane was shown to be represented by a second-order differential equation. If the equation is given as $\ddot{\theta} + 0.4\,\dot{\theta} + 3\,\theta = \delta_e$ Where the θ and δ_e are in radians, estimate the rise time, peak time, and settling time for step input of the elevator angle of 0.1 rad.	**10**	**CO3**
SECTION C [Case Based Study] 2x20=40 Marks			
Q 10	A) Plot root locus for given velocity hold autopilot block diagram [10 Marks] Comment on stability of aicraft.  B) Given the loop transfer function [10 Marks] $$G(s)H(s) = \frac{k}{s(s+2)(s+10)}$$ a) Sketch the root locus plot for G(s)H(s) b) Add a simple pole, (s+3), to G(s)H(s) and examine the resulting toot locus c) Add a simple zero, (s+3), to G(s)H(s) and examine the resulting root locus.	**20**	**CO4**

Q 11	The Wright Flyer was statically and dynamically unstable. However, because the Wright brothers incorporated sufficient control authority into their design they were able to fly their airplane successfully. Although the airplane was difficult to fly, the combination of the pilot and airplane could be a stable system. In [8.5] the closed-loop pilot is represented as a pure gain, k_p, and the pitch attitude to canard deflection is given as follows: $$\frac{\theta}{\delta_c} = \frac{11.0(s + 0.5)(s + 3.0)}{(s^2 + 0.72s + 1.44)(s^2 + 5.9s - 11.9)}$$ Determine the root locus plot of the closed-loop system shown in Figure P8.5. For what range of pilot gain is the system stable? 	**20**	**CO4**