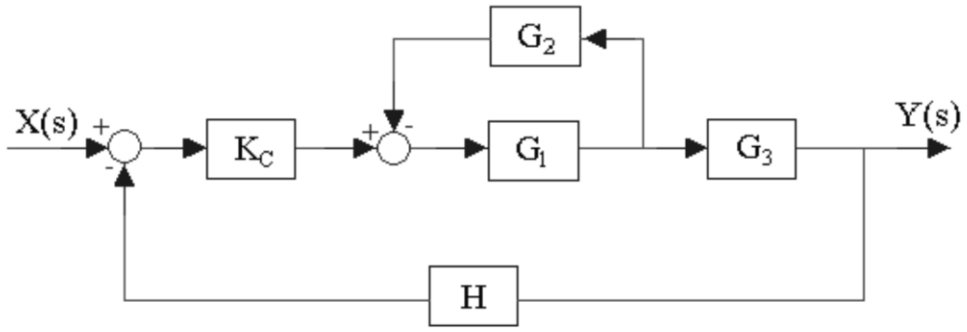
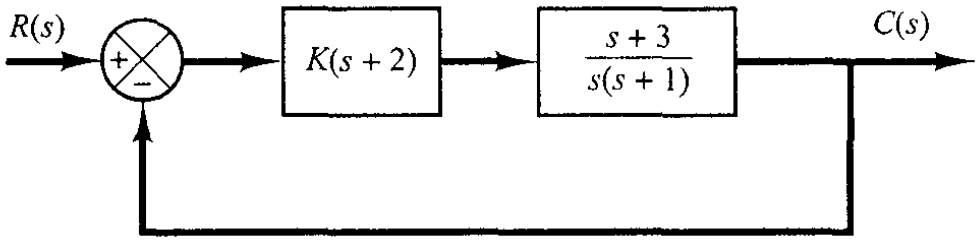
Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

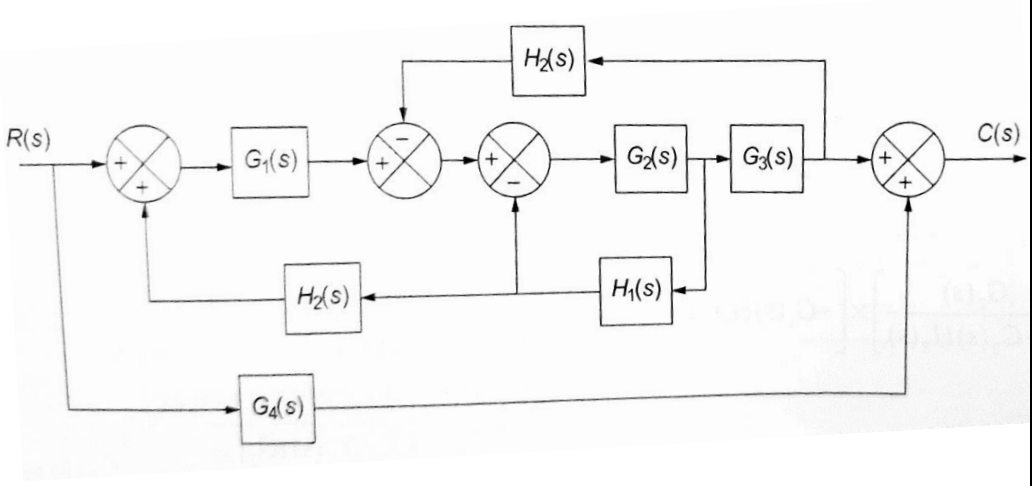
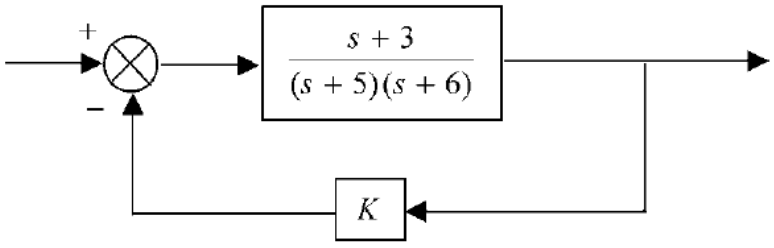
Course: Introduction to Automatic Flight Control **Semester: VII**
Program: B.Tech ASE **Time : 03 hrs.**
Course Code: ASEG4015 **Max. Marks: 100**

SECTION A
5Qx4M=20Marks

S. No.		Marks	CO
Q 1	Differentiate between open-loop and close-loop control system for aircraft pitch angle.	**4**	**CO1**
Q 2	Solve Block diagram given as 	**4**	**CO2**
Q 3	Determine the range of values of ***k*** for which the following systems are stable: $s^4 + 4s^3 + 13s^2 + 36s + k = 0$	**4**	**CO3**
Q 4	Find poles and zeros and angles of asymptotes for root locus of following control system. 	**4**	**CO3**
Q5	Why is Stability augmentation system (SAS) used in aircraft?	**4**	**CO4**

SECTION B
4Qx10M= 40 Marks

Q 1	Explain function of Instrument landing system ILS of aircraft.	**10**	**CO1**

Q2	For the block diagram of the system shown below, determine the transfer function using the block diagram reduction technique.  	**10**	**CO2**
Q3	Plot root locus plot for the loop transfer function $$G(s)H(s) = \frac{k}{(s+8)(s^2+6s+13)}$$	**10**	**CO3**
Q4	Wind-tunnel model is constrained so that it can rotate only about the *z* axis; that is, pure yawing motion. The equation of motion for a constrained yawing motion as follows: $$\Delta\ddot{\psi} - N_r\,\Delta\dot{\psi} + N_\beta\,\Delta\psi = N_\delta\,\Delta\delta_r$$ where $N_\beta = 2.0\ s^{-2}$, $N_r = -0.5\ s^{-1}$ and $N_{\delta_r} = -10\ s^{-2}$. Design a heading control system.	**10**	**CO4**
	SECTION-C **2Qx20M=40 Marks**		
Q 1	For following block diagram:  (1) What is the natural frequency and damping ratio of the open-loop system? (2) Form the CLTF. (3) At K=0, what is the characteristic equation? (4) What are the poles and zeros of the open-loop system? (5) Sketch root locus plot.	**20**	**CO3**

Q2	Assume that the aircraft has only one degree of freedom-a pitching motion about the centre of gravity. The pitching equations have the numerical values $\ddot{\theta} + 0.071\dot{\theta} + 5.49\theta \simeq -6.71\delta_e$ Design stability augmentation control system. Elevator deflection in proportion to the pitch rate and adding it to the pilot's control input. *The elevator deflection in proportion to the pitch rate and adding it to the pilot's control input.* Provide level 1 flying qualities so that $\zeta > 0.3$. **OR** Design an altitude hold control system for STOL transport that has been modified to include direct-lift control surfaces. Unlike conventional high-lift flaps, the direct-lift flaps can be rotated up and down to increase or decrease the lift force on the wing. Assume that the airplane's velocity and pitch attitude are controlled by separate autopilots.	**20**	**CO4**