**Homework – Block Diagrams**

1. Show the following
2. The transfer function of two systems in parallel, as seen below, is equal to the sum of the transfer functions **(5-points)**



1. The transfer function of two systems in series (cascade), as seen below, is equal to the product of the transfer functions **(5-points)**



1. Calculate the transfer function $C(s)/R(s)$ for the following **(5-points each)**







1. A feedback control system is given below. The plant transfer function is $G\_{p}\left(s\right)=\frac{5}{0.2s+1}$



1. Write the plant’s differential equation that relates $c(t)$ and$ m(t)$. **(5-points)**
2. Modify the equation of part (A) to yield the differential equation that relates $c\left(t\right)$and$ r(t)$. The compensator and sensor transfer functions are given by $G\_{c}\left(s\right)=10$ and$ H\left(s\right)=1$. **(5-points)**
3. Derive the system transfer function from the results of part (B)
4. Given the following block diagram and values, show that the open-loop transfer function is given by **(5 points)**



1. Show that the time constant and settling time for the damped compound pendulum given that and natural frequency **(5 points)**
2. Show that the complex poles will yield and phase angle **(5 points)**