**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 for the following **(5-points each)**







1. A feedback control system is given below. The plant transfer function is



1. Write the plant’s differential equation that relates and. **(5-points)**
2. Modify the equation of part (A) to yield the differential equation that relates and. The compensator and sensor transfer functions are given by and. **(5-points)**
3. Derive the system transfer function from the results of part (B) **(5-points)**
4. Derive the system transfer function **(5-points)**
5. The transfer function pole term yields a time constant where is real. Find the time constants for the both the open-loop and closed-loop systems **(5-points)**
6. Repeat Question 3 but with the transfer functions, , and . For part (e), recall that the transfer function underdamped pole terms yields a time constant **(25-points)**.
7. Repeat Question 3 but with the transfer functions, , and **(25-points)**.