Week 2 – Activity 01

EE352 AUTOMATIC CONTROL

1. With necessary assumptions, find the State Space representation of system given below

$$\frac{d^n y(t)}{dt^n} + a_{n-1}\frac{d^{n-1}y(t)}{dt^{n-1}} + a_{n-2}\frac{d^{n-2}y(t)}{dt^{n-2}} + \cdots + a_1\frac{dy(t)}{dt} + a_0 y(t) = b_m\frac{d^m u(t)}{dt^m} + b_{m-1}\frac{d^{m-1}u(t)}{dt^{m-1}} + b_{n-2}\frac{d^{m-2}u(t)}{dt^{m-2}} + \cdots + b_1\frac{du(t)}{dt} + b_0 u(t)$$

2. Consider the following transfer function and answer the questions below:

$$G(s) = \frac{s+5}{(s+10)(s^2+s+2)}$$

   a. What is the order of the system?
   b. Where are the poles of the system?
   c. Where are the zeros of the system?
   d. What are the dominant poles of the system?
   e. Use the dominant poles to reduce the system to a second order system
   f. Analytically derive the impulse response of the system $G(s)$
   g. Analytically derive the impulse response of the reduced second order system
   h. Compare the impulse responses of the f and g above.

Deadline: 8:00 am on 1st January 2026