EE 2101: Quiz 1

Note: Question 1 carries 3 marks. Remaining questions carry 4 marks each.

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1. Consider an LTI system with the transfer function

$$T(s) = \frac{1}{(s+1)(s+4)^2}$$

   (a) Find the unit step response of this system.

   (b) Find the impulse response of this system.

2. (a) Consider a second-order system, referred to as SYSTEM 1, whose unit step response is as shown in Figure 1. Find the transfer function of SYSTEM 1.

   b) Consider another second-order system, referred to as SYSTEM 2. The *percentage overshoot* and the *steady state* value in the unit step response of SYSTEM 2 is *same* as that of SYSTEM 1. However, the *settling time* of SYSTEM 2 is *half* of that of SYSTEM 1. Find transfer function of SYSTEM 2.

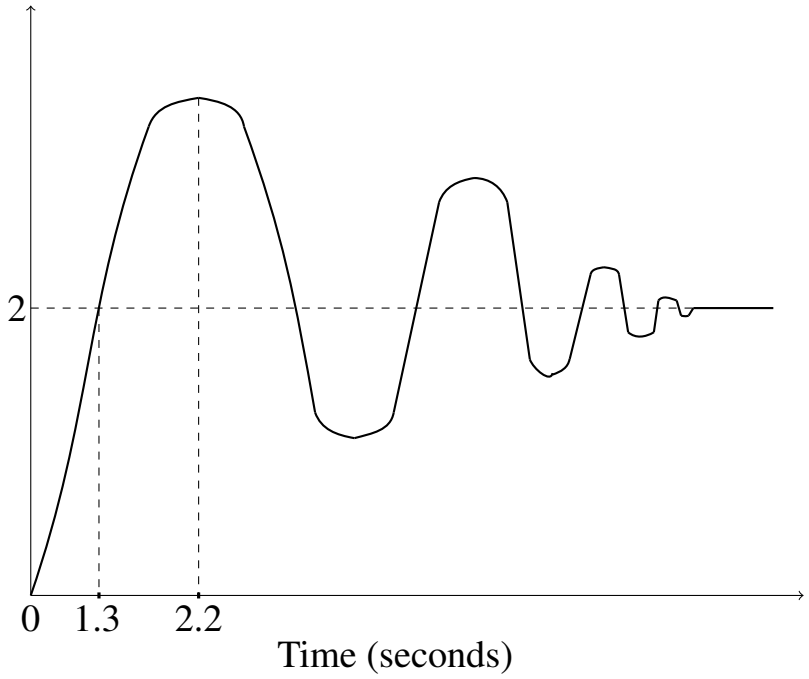

Figure 1: Unit Step Response

3. State whether the following statements are True or False. If the statement is True, give justification. If the statement is False, then give a counterexample. Note that just writing True or False without correct justification/counterexample will get zero marks.

   (a) Consider a unity feedback control system with the forward transfer function $G(s)$. If $G(s)$ has at least one pole in the right-hand side of the complex plane, then the closed-loop system is BIBO unstable.

   (b) The output of a BIBO stable system is always bounded.

4. Find all roots of the polynomial $P(s) = -s^6 + 2s^5 - 3s^4 + 12s^3 + 13s^2 + 10s + 15$

All the Best!