Dept. of Mechanical Engineering,
Faculty of Engineering,
Taibah University

Sem1 1442 (2020/2021)
ME 441 System Dynamics. & Control
Project, Time: 1**5 days**

Deadline of submission (upload to BB): 10 December 2020 at 11:59 O'clock.

Project question [10 marks]:

a) Discuss briefly in no more than two pages, how-to mathematical model a liquid level system. Use illustrations as much as you can.

(Hint: you can use the textbook and/or any other references. Please expect a call for discussion). **If noticed, all similar (copied) reports will be punished!**

[4 marks]

b) Consider a process with the following (forward) transfer function of a unity feedback system:

$$G(s) = \frac{1}{(s+1)(s+2)(s+3)}$$

and the controller:

$$G_c(s) = K_d\left(s + \frac{K_p}{K_d}\right),$$

- If the system is designed to satisfy the damping ratio 0.5, use MATLAB to obtain the time constants, *T*, undamped natural frequencies, ω_n, damped natural frequencies, ω_d, derivative gains, K_d, and proportional gains, K_p, for the values of K_p/K_d proposed in Table 1. Show the steps of obtaining the values. Use illustrations as much as you can.
- Fill in the table cells.
- Briefly discuss the effect of K_p/K_d (zero location) on the speed of response.

[6 marks]

Table 1. System and controller parameters

K_p/K_d	0.5	1.5	2.5	3.5
T				
ω_n				
ω_d				
K_d				
K_p				