# ECE 3510  homework # 15 corrections  &  Exam 3 Study Guide

Hw 15 Due date changed to:  Thur, 4/6/06

## Corrections

Hint given for 1d) should have been for 2e).

### Answers

1. a) GM $\simeq$ 30·dB      PM $\simeq$ 40·deg      b) yes      c) $0 < g < \dfrac{1}{3}$   ,   $\dfrac{1}{2} < g < \dfrac{3}{2}$    or   $g > 3$

   d) Need 3 CCW encirclements of -1

2. a) yes      b) GM $\simeq$ 2  (30·dB)      PM $\simeq$ 90·deg      c) 4

   d)  4  ,  $3·\cos(t - 90·\deg)$  ,  $-2·\cos(5·t)$      e) $\dfrac{4}{3}$ ,  $\dfrac{3·\sqrt{2}}{2}·\cos(t - 45·\deg)$  ,  $-4·\cos(5·t)$

3. a) $k < \dfrac{1}{2}$  ,  $\dfrac{2}{3} < k < 2$      b) Gain may be increased by $\simeq$ 2dB and reduced by $\simeq$ 5dB.      PM = 10º to 15º

   c) Open loop:  $-4$      Closed loop:  4

4. b)  $(-0.7071 - 0.7071·j)·\omega_c$  &  $(-0.7071 + 0.7071·j)·\omega_c$ ,   $-\omega_c$ & $-\omega_c$   ,   $-0.436·\omega_c$ & $-2.292·\omega_c$
   (double)

# Exam 3 Study Guide     Thur, 4/6/06

1. Root Locus

   Concepts of what a root locus plot is and what it tells you.  Movement of poles

   Good vs bad, fast response vs slow, OK damping vs bad.

   Effects of adding a compensator

   Conclusions, see section 4.4.5, p.82

2. Phase-locked loops

   How does it work

   The loop block diagram

   Material from labs

3. Bode Plots

   Be able to draw both magnitude and phase plots

   I may ask you to start with a circuit

   Basic rules

   Complex poles an zeros            $s^2 + 2·\zeta·\omega_n + \omega_n^2$

   $(s + a)^2 + b^2$   $= s^2 + 2·a·s + a^2 + b^2$            max at   $\omega_n$     $\dfrac{1}{2·\zeta}$

   Bode to transfer function (like problem 5.2b)

   GM & PM

4. Nyquist plots

   You won't be asked to draw one

   Concepts of what a Nyquist plot is and what it tells you.      $Z = N + P$    Make sure you understand problem 5.11

   GM & PM

5. Phase-lead compensator

6. HW 11 - 15

7. Labs 6 - 8