Sample Exam III Boyce/10ed Halleck MAT 2680 NYCCT (CUNY) Fall 2013

Sections 3.8, 5.2, 6.1 and 6.2 problems 1-9 **Exam is 1 hour 15 minutes.**

Ok: handwritten notes, calculator (TI 83/84)

Not ok: printouts, book, **TI 89,** laptop, tablet, cell phone or other handheld

1. (20 pts) Given an RLC circuit with R=2 ohms, L=1/10 henries, C=1/260 farads and E(t)=sin60t; find the
   a. differential equation for the current I (remember to use E'(t), not E(t));

   b. the form of the transient current I_p;

   c. the periodic current I_h;

2. (20 pts) Given a mass spring damper with m=1 kg, γ=2Ns/m, k=50N/m, F=20cos(ωt),
   a. find the value of ω that gives practical resonance;

   b. if the damper is removed, then the circular frequency without a forcing function is 5√2. Suppose that the forcing function has circular frequency 7√2 and that the initial conditions give a solution

   $$y(t) = \cos 5\sqrt{2}t - \cos 7\sqrt{2}t$$

   Use the appropriate sum or difference identities to write the solution as a product of 2 trigonometric functions of different frequencies. Sketch a graph over one long period to illustrate the phenomenon of beats.

3. (20 pts) For $y'' - xy' - y = 0, \quad x_0 = 0$
   a. find the recurrence relation of a power series solution.

   b. Use the relation to find the first 3 terms of one of the 2 basic solutions.

4. (20 pts) Given $f(t) = \begin{cases} t, & [0,1) \\ 2-t, & [1,2) \\ 0, & [2,\infty) \end{cases}$

   a. Graph $f(t)$ over [0,3]
   b. classify as continuous, piecewise continuous, or neither
   c. use the definition to find the Laplace Transform

5. (20 pts) Use the table of Laplace Transforms given in class to find the inverse Laplace Transform of

   $$Y(s) = \frac{5s^2 + 3s + 30}{s^3 + 2s^2 + 10s}$$