NOTES FOR THE FIRST HOUR EXAM

Spring 2016

The first hour exam will be held on Mon., 29 Feb during normal class hours. The exam will be closed note, closed book and all electronic devices (including phones, computers, calculators) must be stored out of sight. I will remind the class of this before handing out exams. I will provide a list of formulae and results (such as equations for Fourier series and Fourier coefficients for both trig and complex series, equations for finding unit vectors and lists of indefinite integrals.) I will expect you to be able to do very elementary integrations such as cos x, sin x and polynomials.

I will provide results for any indefinite integral (apart from the elementary examples mentioned above), although you will need to evaluate them at appropriate limits and if necessary, evaluate Fourier coefficients. Expect to see this information in the form:

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In[28]:= Integrate[{x Cos[n x], x Sin[n x]}, x]
```

$$\text{Out[28]=}\ \left\{\frac{\text{Cos}[n\,x]}{n^2}+\frac{x\,\text{Sin}[n\,x]}{n},\ -\frac{x\,\text{Cos}[n\,x]}{n}+\frac{\text{Sin}[n\,x]}{n^2}\right\}$$

I will give you this information, but you will need to understand the *Mathematica* notation to interpret it, and also know how to evaluate the integrals at the appropriate limits. You will need to be able to determine whether to use the cos(nx)/sin(nx) formulation or the cos(n π x/L)/sin(n π x/L) formulation. If I ask you to find a Fourier series, you may use either the trig or complex version, but you must show all necessary work in either case.

The exam will cover all material discussed in class, computer lab and assigned for reading (in the text and online classnotes). You will be expected to :

- Determine Fourier coefficients and Fourier series for functions that are 2 π or 2 L periodic.
- Use and apply Dirichlet' s theorem, including evaluating series and identifying which functions can (or cannot) be expanded in a Fourier series..
- **Use Parseval' s Theorem.**
- Understand and make use of the 2 π periodicity of trig functions.
- Make use of the property of orthogonality.
- Understand and use the properties of the Kronecker delta and Levi-Civita permutation tensor.

• Find scale factors for a coordinate system given the transformation equations.

• Compute unit vectors and expressions for velocity and acceleration in a coordinate system.

• Identify if a coordinate system is orthogonal.

• I will ask you to write a short Mathematica program. You should know how to use the functions covered in lab including Sin, Cos, Integrate, Do, For, While, If, PrimeQ, Expand, EvenQ, OddQ, Print, Plot, ListPlot and Table. I will answer any question about how to indicate special characters (like ESC or ∫), but will not answer things like "how does a Do loop work?" Syntax, spelling, and capitalization will count toward your score on this question. I will include portions of the Documentation Center such as:

For[*start***,** *test***,** *incr***,** *body***]**
executes *start***, then repeatedly evaluates** *body* **and** *incr* **until** *test* **fails to give True**