**Transformed E&M I materials**

**Mathematical materials**

**(Griffiths Chapter 1)**

**TIMELINE**

Prof A covers this in lectures 1-4.

Prof B. mixes with Chapter 2.

Transformed course covered in lectures 1-4, combined with Chapter 2.

**TOPICS**

* Div, grad, curl
* Line, surface, volume integrals
* Curvilinear coordinates
* Dirac delta function
* Vector fields (potentials)

**LEARNING GOALS**

Students should be able to:

1. Evaluate the integral from negative infinity to infinity of the delta function, d(x)
2. Evaluate the 3-dimensional divergence of 1/r2 in the r-hat direction [4πd3(**r**)]
3. Evaluate the integral of a function times the delta function
4. Be able to evaluate the integral of 1/(x-r)3/2dx
5. Give a geometrical description of the divergence theorem, and fundamental theorem for curls.
6. Change a multidimensional integral in Cartesian coordinates to one in another coordinate system using the Jacobian.

**CLASS ACTIVITIES**

**Visualization**

**Spherical coordinates**

<http://www.math.umn.edu/~nykamp/m2374/readings/sphcoord/>

**Visualization**

**Divergence and curl:**

<http://www.math.umn.edu/~nykamp/m2374/readings/divcurl/>

<http://www.math.umn.edu/~nykamp/m2374/readings/curlcomp/>

**Visualization**

**Several other math concepts**

<http://www.math.umn.edu/~nykamp/m2374/readings/>

**Group Activity**

**Vector in Curvilinear Coordinates**

***Oregon State University***

Students working in small groups find the differential displacement vector in cylindrical and spherical coordinates.

**Tutorial**

**Two dimensional charge distribution**

***Paul van Kampen – Dublin University (In Tutorials 1-8 p. 25)***

Two dimensional charge distributions. Practice in integration in polar coordinates. Calculate net charge on a disk, the problem is broken into pieces (find dA, write dQ, write out the integral, evaluate), and then do it again in Cartesian.

**Kinesthetic Activity**

**Pointing coordinate vectors**

***Oregon State University***

ALso, kinesthetic activity: given an origin in the corner, and defining obvious x/y/z axes in the room, everyone close your eyes and POINT in the direction of yhat, then rhat, thetahat, phihat. (Discussion of which \*should\* be different from each other!