BMME 760
Finite Element Analysis
Course Syllabus

1. *Department*: Joint Dept. of Biom. Engr. *Number*: BMME 760 *Credit Hours*: 3
Title: Finite Element Analysis *Elective*

2. *Course Description*:

The goal of this course is to introduce students to the basic concepts and procedures of finite element analysis (FEA). Emphasis will be placed on the application of the finite element method to static, solid mechanics (stress analysis) problems. It is hoped that the student not only attains a better understanding of the theory of the finite element method, but also develops a greater understanding of the physical phenomenon being modeled as well as practical aspects to applying the finite element procedure. The use of the commercial finite element analysis software package, ANSYS, will be an integral part of the course in terms of in-class examples, homework, and a semester project. As such, it is desired that by the end of the course each student should develop an intermediate-level of user skill in applying ANSYS to physical problems. Finally, the importance of verification of FEA results will be emphasized by describing means to check the accuracy of results.

3. *Prerequisite(s):* BMME 102 or equivalent and permission of instructor.

4. *Textbook(s) and/or other required material*:
Finite Element Analysis: Theory and Application with ANSYS. 2nd Edition; Moaveni, Saeed. Prentice Hall, 2003.

5. *Course objectives. By the end of this course, the student should be able to: (use demonstrative verbs)*

A. Describe and Apply Direct Formulation for 1D Finite Elements
B. Describe and Apply Minimum Total Potential Energy and Weighted-Residual Methods for formulation of 1D, 2D, and 3D Elements.
C. Develop intermediate-level of user skill in applying ANSYS to static and dynamic physical problems.

D. Interpret displacement, strain, and stress data of finite element solutions.
E. Conduct procedures for verification of finite element solutions.

6. *Topics covered (number of lectures per topic, based on 25 75-minute lectures per semester)*:

1.	Basic Steps in FEA	1
2.	Direct Formulation Methods	1
3.	Min Total PE & Weighted Residual Formulations	1
4.	Matrix Algebra and Matlab Review	1
5.	Truss Formulation & Coordinate Transformation	1
6.	ANSYS Overview	1
7.	Formulation of Beams	1
8.	Formulation of Frames	1
9.	1D Shape Functions	1
10.	1D Isoparametric & Numerical Integration	1
11.	1D Heat Transfer & Fluid Mechanics	1
12.	2D Quadrilateral & Triangular Elements	1
13.	2D Axisymmetric,Isoparametric & Numerical Integration	1
14.	Meshing Considerations, Error Estimation	1
15.	Torsion and Plane Stress Formulation	1
16.	Isoparametric & Axisymmetric Formulation for Solid Mechanics	1
17.	ANSYS 2D examples	1
18.	3D Element Formulation	1
19.	3D in ANSYS	1
20.	Dynamics Review	1
21.	Dynamic Formulation for Axial & Beam Members	1
22.	Dynamic Analysis with ANSYS	1

7. *Class/laboratory schedule (sessions per week and duration of each session)*:
Two 75-minutes lectures per week..

8. *Date of preparation and person(s) who prepared this description*:
P.S. Weinhold, November 2, 2005