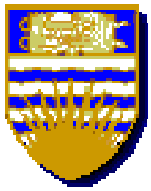
THE UNIVERSITY OF BRITISH COLUMBIA

DEPARTMENT OF MECHANICAL ENGINEERING



MECH – 462
INTRODUCTION TO THE FINITE ELEMENT METHOD

CHAPTER-0
COURSE OUTLINES

January 2009

By
M. S. Gadala

MECH - 462
INTRODUCTION TO THE FINITE ELEMENT METHOD

OBJECTIVES:

- Introduction to basic theory of finite elements in linear analysis.
- Understanding modeling aspects and techniques.
- Use and application of general-purpose FE programs in a project type of work.

COURSE HIGHLIGHTS:

- **Introduction to the FEM:**
  What is FE - Basic assumptions - Element and global equations - Degrees of freedom - Basic procedures – Global assembly – Simple one dimensional elements
- **Modeling Aspects:**
  Introduction to geometric and finite element modeling – Modeling concepts – Degrees of freedom and boundary conditions – Modeling for Linear static, Nonlinear static and dynamic analyses.
- **Background Review:**
  Review of mathematical background - Vectors and matrices - Eigen values and eigen vectors - Stress and strain in three dimensions – Lagrange multipliers and penalty method
- **One and Two Dimensional Elasticity Problems:**
  Direct element formulation – Stiffness transformation – Boundary conditions – Numerical integration – Virtual work formulation – Weighted residual formulation
- **Isoparametric Elements:**
  Need for isoparametric elements – element formulation in one and two dimensions – Programming aspects
- **Heat Transfer Problems:**
  Conduction analysis – Convection and radiation boundary conditions – Transient and steady state response – Various element types.

- **Use and Application of Finite Element commercial program**

PREREQUISITES:

MECH-360 (Strength of Materials or equivalent)

CREDIT HOURS:

3 (three) credit hours:
One lecture (two hours)
One Tutorial (two hours)

STUDENT'S EVALUATION :

Assignments	10 %
Mid-Terms	10 & 15 %
Project(s)	20-30 %
Final exam	35-45 %

TEXT/REFERENCES:

In addition to class notes, students may use one of the following texts as a reference:

1. S. Moaveni, “Finite element analysis: Theory and Application with ANSYS”, Printice-Hall Inc., (1999).
2. K.H. Huebner, D. L. Dewhirst, D. E. Smith and T. G. Byrom,"The finite element method for engineers", 4nd edition, Wiley Interscience Public., (2001).
3. R.D. Cook, D.S. Malkus and M. Plecha, "Concepts and application of finite element analysis", John-Wiley & Sons, 4th Ed., (2002).

RATIONALE:

The course provides a basic introduction to the FEM theory and its applications to engineering problems. Emphasis is placed on providing the students with an understanding of the extent and the limitations of the method in engineering applications. The use of a commercial program in a project type of work will provide the students with an overview of the capabilities and limitations of such programs available in the market.

CALENDAR ENTRY:

Theory and element selection. Development of computer programs for simple problems. Utilization of existing computer packages. Application to mechanical engineering problems. [2-2*-0]
Prerequisite: MECH 360.