THE UNIVERSITY OF BRITISH COLUMBIA

DEPARTMENT OF MECHANICAL ENGINEERING

MECH – 561
Linear Elasticity

COURSE OUTLINES

September 2009

By
M. S. Gadala

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MECH-561 LINEAR ELASTICITY

September 2009 Dr. M.S. Gadala

COURSE HIGHLIGHTS:

- **Vectors and Tensors:**
  Vector operation and vector calculus; Cartesian tensors; Tensor operation and tensor calculus; Eigen values and eigen vectors; Transformation and change of basis.
- **Analysis of Stress:**
  Three-dimensional stresses and stress invariants; Stress measures; Principal stresses; Equations of motion and equilibrium.
- **Analysis of Strain:**
  Three-dimensional small strain; Kinematics of continuous medium; principal strains; Strain compatibility equations.
- **Elastic Constitutive Equations:**
  Generalized Hook's law; Isotropic and anisotropic materials; Transformation of constitutive tensors; plane stress and plane strain conditions; axisymmetric conditions; Temperature effects.
- **Energy Methods:**
  Virtual work principle; Minimum potential energy; weighted residual methods.
- **Linear Elastic Fracture Mechanics (LEFM):**
  Fracture modes; Stress intensity factor; Fracture toughness; CTOD and J-integral; LEFM in design.
- **Stress Function:**
  Airy stress function; Cartesian and polar forms; Plane stress and plane strain applications; axisymmetric applications.

LECTURES:

Thursday 9:30 am - 12:30 pm; MCLD-219

PREREQUISITES:

MECH-360 (Strength of Materials or equivalent)

CREDIT HOURS:

3 (three) credit hours:

STUDENT'S EVALUATION:

Assignments	10 %

Mid-Term	20-25 %
Term Paper	20-25 %
Final exam	40-50 %

TEXT/REFERENCES:

- J.R. Barber, Elasticity, 2nd ed., 2003, Springer-Verlag,, ISBN 978-1-4020-0964-8
- P. Boresi, K. P. Chong, *Elasticity in Engineering Mechanics*, Elsevier (January 1987)
- Y.C. Fung, "First course in continuum mechanics", Printice Hall Inc., Third Edition, (1994).
- I. Luri , *Theory of Elasticity*, Springer Verlag (August 2005)
- R. B. Hetnarski, J. Ignaczak , *Mathematical Theory of Elasticity*, Routledge (February 2004)
- L. E. Malvern, "Introduction to the mechanics of continuous medium", Printice-Hall Inc., (1969).
- Adel S. Saada, "Elasticity Theory and applications," Florida, Krieger Publication Company, 1993