



Course:

Advanced Mechanics of Composite Materials

Instructor: Dr. M. Asgari

Time: Saturday and Monday, 15:00-16:15.

Office hours: Mondays, 9:00- 10:30

Web site: <http://wp.kntu.ac.ir/asgari/courses.html>

Syllabus (Main Topics):

- Introduction to Composite Materials
 - Classifications, Terminology, Applications and Manufacturing methods
- Macro-mechanics of a Lamina
 - Basic equations of tensor algebra and solid mechanics
 - Constitutive equations of composite materials
 - Thermal and Moisture effects
- Micro-mechanical Analysis of a Lamina
 - Prediction of mechanical properties based on fiber and matrix
 - Stiffness, strength and coefficients of thermal and moisture expansion
- Analysis of Discontinuous Fiber-Reinforced Lamina
- Macro-mechanical Analysis of Laminates
 - Classical Lamination Theory
 - Shear Deformation Theories
 - Laminate constitutive relations
 - Symmetric, Unsymmetrical, Balanced and Specially Orthotropic Laminates
 - Hygrothermal Lamination theory
- Failure Theories for Fiber-Reinforced Materials
 - Failure criteria and Damage in composites
- Design of Laminated Composite Structures
 - Sandwich Panel composites
 - Laminated beam, laminated plate and shell, laminated tubes
- Standards and Tests Methods
- *Layerwise, Zigzag and Higher order Shear Deformation Theories*
- *Interlaminar Stresses*

Recommended Text:

- Carl T. Herakovich, Mechanics of Fibrous Composites, Wiley, 1998.
- M. W. Hyer, Stress Analysis of Fiber Reinforced Composite Materials, McGraw Hill, 1998.
- R. Gibson, Principles of Composite Material Mechanics, CRC Press, 2011.
- *Class Notes on Selected Subjects.*

Additional References

- J.N. Reddy Mechanics of Laminated Composite Plates and Shells Theory and Analysis, CRC Press, 2003.
- R.M. Jones, Mechanics of Composite Materials, Taylor and Francis, 1999.
- Isaac M. Daniel and O. Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, 1994.
- E.J. Barbero, Introduction to Composite Materials Design, Taylor & Francis, 1999.
- Autar K. Kaw, Mechanics of Composite Materials, 2005.

Grading

- Homeworks
- Midterm Exam
- Final Exam
- Research Project
- Practical Software Project

Interested Topics for Research Project and Seminars

- Finite element modeling and analysis of composite panels
- Standards and Tests Methods
- Layerwise, Zigzag and Higher order Shear Deformation Theories
- Interlaminar Stresses
- Delamination Analysis
- Micromechanics Theories
- Composite Joints
- Nano Composites
- Cohesive Zone Models for Composite Structures Joints
- Buckling and Vibration of Composite Structures
- Structural health monitoring and non-destructive testing method
- Impact mechanics of composite structures
- Crushing and energy absorption in Composite materials

"Everything should be made as simple as possible, but not simpler "
Albert Einstein