THE DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

AA 331 AEROSPACE STRUCTURES I

WINTER QUARTER

CREDITS AND CONTACT HOURS: 4 credits, Four 50-minute lectures per week.

COORDINATOR: Kuen Y. Lin, Professor of Aeronautics and Astronautics

TEXTBOOK: Aircraft Structures for Engineering Students, 3rd Edition, THG Megson, John Wiley & Sons, 1999

SUPPLEMENTAL MATERIAL:

1. Aerospace Structural Analysis, Allen, D.H. & Haisler, W., John Wiley & Sons, 1985
2. Aircraft Structures, 2nd ed., Peery, D.J. & Azar, J.J, McGraw-Hill, 1982
3. Analysis of Aircraft Structures, 2nd ed., Donaldson, B. K., Cambridge University Press, 2012
4. Advanced Strength and Applied Stress Analysis, 2nd ed, Budynas, R.G. McGraw-Hill, 1999

CATALOG DATA: **AEROSPACE STRUCTURES I**, Required
Analysis and design of aerospace structures. Review concepts of stress, strain, and and equations of elasticity. Plane stress and plane strain. Applications to aerospace structural elements including general bending and torsion of rods and beams, and open and closed thin-walled structures and box beams. Prerequisite: ENGR 220 or CEE 220.

PREREQUISITES BY TOPIC: Mechanics of Materials, Statics.

OUTCOMES:

1. Students will have an understanding of the concepts involved in the theory of linear elasticity.
2. Students will understand stresses and deformations in rods, trusses, beams and thin plates.
3. Students will understand stress analysis methods for thin-walled structures subjected to bending and torsion.
4. Students will understand how to apply these analysis methods and results to real-world aerospace structural problems.

RELATIONSHIP TO STUDENT OUTCOMES:

a) An ability to apply knowledge of mathematics, science, and engineering
e) An ability to identify, formulate, and solve engineering problems
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

TOPICS:

1. Review of statics, free-body diagram, supports, reactions. Determinate and indeterminate structures. Forces and stresses, Deformation and strains. Hooke's Law in 2-D and 3-D solids (4 lectures)
2. Equilibrium equations for stresses. Cauchy's formula. Compatibility equations for strains. Transformation of stresses and strains, Mohr's circles. 2-D and 3-D principal stresses and strains. (8 lectures)

3. Axial Loading, Torsion, Bending of beams, Sectional properties. Simple and multi-axial bending. Beam deflections (10 lectures)
4. Plane stress, plane strain. Airy stress function. Simple elasticity solutions (6 lectures).
5. Shear stresses in solid beams and thin-walled structures of open and closed sections. Shear flow analysis. Shear center (10 lectures).
6. Mid-terms exams (2 classes)