AE-6107: Analysis of Aerospace Structural Elements

1 Topics to be covered in this course

The following topics to be covered in this course:

1. *Euler-Bernoulli beam theory.* Review of the basic assumption.
2. *Torsion of beams.* Saint Venant's solution.
3. *Yield criteria.* Introduction to yield criteria. Plastic behavior of trusses. Plastic bending and torsion of beams.
4. *Kirchhoff plate theory.* Theory for isotropic plates. Decoupling into bending and stretching equations. Boundary conditions. Energy methods.
5. *Anisotropic plates.* Classical lamination theory. Governing equations for anisotropic plates.
6. *Classical solutions for plates.* The Navier solution; the Lévy solution. Energy methods for plates.
7. *Mindlin plate theory.* Shearing deformations in plates. Navier solution for shear deformable plates. Energy principles for shear deformable plates.
8. *Von Karman equations.* Governing equations for plates undergoing large displacements and rotations.
9. *Buckling of anisotropic plates.* Compressive and shearing loads. Effects of shearing deformations.
10. *Vibrations of plates.* Effects of shearing deformations and in-plane loads.

2 Grading Policy

The overall numerical grade for this course will be computed using the weighting factors shown in table 1.

10 Homework Assignments	50%
3 Exams	30%
1 Final exam	20%
TOTAL	**100%**

Table 1: Grade weighting factors

3 Weekly homework

Homework will be assigned on a weekly basis. Homework is assigned on Thursdays lectures and is due the next Thursday, in class. Homework is a vital part of the learning process, **and 50% of your final grade.** To make sure no homework is *forgotten*, an aging factor will be built into the grading as shown in table 2.

Date homework is turned in	**Aging factor**
On the due date	actual grade
Up to the Tuesday after due date	actual grade - 1/10
Up to the Thursday after due date	actual grade - 2/10
Never turned in	0/10

Table 2: Aging factor for homework

4 Reference books

The following reference text books are a good source of information for the class: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10].

References

[1] B.K. Donaldson. *Analysis of Aircraft Structures.* McGraw-Hill, Inc., New York, 1993.

[2] Shames I.H. and C.L. Dym. *Energy and Finite Element Methods in Structural Mechanics.* Hemisphere Publishing Corp., 1985.

[3] D.H. Allen and W.E. Haisler. *Introduction to Aerospace Structural Analysis.* John Wiley & Sons, New York, 1985.

[4] J.T. Oden and E.A. Ripperger. *Mechanics of Elastic structures.* McGraw-Hill, Inc., New York, 1980.

[5] J.N. Reddy. *Energy and Variational Methods in Applied Mechanics.* John Wiley & Sons, Inc, New York, 1984.

[6] K. Washizu. *Variational Methods in Elasticity and Plasticity.* Pergamon Press, Oxford, U.K., 1975.

[7] S.P. Timoshenko and S. Woinowsky-Krieger. *Theory of Plates and Shells.* McGraw-Hill, Inc., New York, 1959.

[8] G. Wempner. *Mechanics of Solids with Applications to Thin Bodies.* Sijthoff & Noordhoff, The Netherlands, 1981.

[9] C.Y. Chia. *Nonlinear Analysis of Plates.* McGraw-Hill, Inc., New York, 1980.

[10] S.P. Timoshenko and J.M. Gere. *Theory of Elastic Stability.* McGraw-Hill, Inc., New York, 1961.