

**EML 3005: Mechanical Design**  
Mechanical & Aerospace Engineering Department  
University of Florida  
**Spring 2009**

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Class Time: MWF, Period 9 (4:05-4:55), NEB 100

Office Hours: MWF, 7<sup>th</sup> period, 1:55 – 2:45pm

Textbook: Machine Engineering Design, by Budynas and Nisbett  
8<sup>th</sup> Edition McGrawhill

Scope: This course deals with the mechanical design of machine elements, design process, conceptual design, system and component design, and selection of certain standard parts. Design of machine elements such as journal bearings, rolling-element bearings, shafts, spur and helical gears, springs, fasteners, clutches and brakes will be presented. Kinematics of certain mechanisms and gears will be presented. Background from a diverse group of subjects such as material selection, static and dynamic load determination, strength of materials (stress, strain and deflection), static failure theories, fatigue failure theories, and surface failure theories will be utilized to come up with acceptable design of a variety of machine elements.

1. Design Criteria for Static and Fatigue Loading
  - a. Yield criteria for ductile materials
  - b. Fatigue loading, Effect of mean stresses
  - c. Cumulative fatigue loading
  - d. Design project/Homework
2. Shaft Design
  - a. Bending and torsional loads, Shear and bending stresses
  - b. Failure in combined loading, Design considerations
  - c. Static and fatigue loading, Design implications
  - d. Design project: Shaft design with 3D static and fatigue loading
3. Design of Contact Elements: Cam design
  - a. Hertzian stresses for cylindrical and spherical contacts
  - b. Elastohydrodynamic lubrication of nonconformal contacts
  - c. Design project: Overhead cam design for an automobile
4. Spur and helical Gear Design
  - a. Loading, bending and contact stresses
  - b. Design of spur and helical gears
  - c. Design project: 5-speed automobile automatic transmission design
5. Bearings and Lubrication
  - a. Hydrodynamic lubrication, Journal bearing design
  - b. Nonconformal contacts and Rolling-element bearings
  - c. Design project
6. Brake design: Disc brake design for automobiles
7. Design of Fasteners
  - a. Preloaded fasteners in tension: Design for static and dynamic loading
  - b. Fatigue considerations
  - c. Design project

Design projects/HW: Several detailed problems will be assigned involving practical design of a variety of machine elements. Some design problems will require the use of MATLAB or MATHCAD programs.

**Grading Policy:** The grading for this design class is based entirely on short quizzes, homework assignments, and group design projects. Design groups of 5 members will be formed. Groups must learn to work together. Quizzes and homework assignments will be individual. Design reports will be submitted by the group. A group presentation will be due for the automobile transmission project, for which the groups will choose their cars, get the performance specs from car magazines, etc. Grading for the group projects will involve each member grading the effort of every other member. This individual grading will be taken into account for deciding individual project grade. Individual quizzes will be announced in the previous class. They will be very short (10 mins) and test concepts and will be based on the homework assigned.

Individual Homework + Quizzes	40 %
Group Design Projects	60 %

**Teaching Assistants:** (1) Paul Loschak [loschak@ufl.edu]  
Off hours: Thursday 5th period

(2) 'GREEN,BRIAN C' [EAGLEACE@ufl.edu]  
Off hours: Tuesday 7th period