

ME 3227 – Design of Machine Elements

Credits and Contact Hours: 3 Credits. Three 50 minute or two 75 minute lectures per week.

Instructors: Zhazhan Jia, Ying Li, Thanh Nguyen, Dianyun Zhang

Textbook: *Shigley's Mechanical Engineering Design*, 10th Edition, by R.G. Budynas and K.J. Nisbett, McGraw-Hill, 2015.

Specific Course Information:

- a. Catalog Description: Application of the fundamentals of engineering mechanics, materials and manufacturing to the design and analysis of machine elements.
- b. Prerequisites: CE 3110
- c. Required, Elective or Selected Elective: Required

Specific Goals:

a. Course Outcomes:

After completing ME 3227 students should be able to:

1. Understand the concepts of stress, strain and deflection
2. Understand safety factors and be able to choose the minimum safety factor
3. Understand static and dynamic loading, be able to perform static load analysis and compute force balances applied to distributed stresses.
4. List factors that influence fatigue.
5. Identify failure modes worth evaluating.
6. Identify special features of the involute gear shape.
7. Use free body diagrams as a tool to reduce bending stresses and moments.

b. Relationship of Course Outcomes to Criterion 3 Student Outcomes:

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
This course builds upon the foundations in mechanics of materials with application to mechanical design activities. Knowledge in basic engineering science is applied to analysis and design of machine elements. Through projects and homework, students identify engineering problems and formulate methods for their solution.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
Design projects and homework sets provide the students with experience in the design of systems and components.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
Not Applicable

4. An ability to communicate effectively with a range of audiences.
This course requires students to make oral presentations as well as write reports for their projects.
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
This course includes a review of the canon of ethics for engineers, and a project involving safety and risk analysis.
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
Not Applicable
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
Not Applicable

Topics Covered:

- ◆ Introduction to total life-cycle design (including considerations of liability, ethics, cost, legal and ethical issues, recycling, etc.)
- ◆ Mechanical properties of materials
- ◆ Fatigue
- ◆ Dimensional tolerancing
- ◆ Stress, strain, deflection and torsion
- ◆ Buckling and failure theories
- ◆ Liability
- ◆ Soderberg fatigue analysis
- ◆ Shafts
- ◆ Gears: spur gears and bevel gears
- ◆ Rolling bearings
- ◆ Fasteners
- ◆ Practicing decision making in design