OPTI 421/521

Introductory Opto-Mechanical Engineering

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This is an introductory course that covers the basic principles of opto-mechanical engineering. It is taught for students that are familiar with optical systems, yet may have little mechanical engineering experience. The goals of this class are to provide students with working knowledge of the fundamentals and basic skills for developing practical engineering solutions.

Grades
OPTI 421 (undergraduate)
Grades in this course will be derived half from exams (two mid-terms and a final) and half from regular homework, reports, and quizzes. Some homework solutions will be submitted as complete informal technical reports. These will be graded on presentation as well as content.

OPTI 521 (graduate)
For graduate credit, graduate status and additional work will be required. Additional homework and exam problems may be required. Two additional reports will be assigned over the semester. These will require independent research or design. One class presentation will be required. The 521 grades will use the following weights: 40% homework and quizzes, 20% midterms, 20% final, and 20% for the reports.

Textbooks:
No textbook is required. Class notes will be posted on the class web site www.optics.arizona.edu/optomech. Some references will be provided, including

- K. M. Schwertz and J. H. Burge, *Field Guide to Optomechanical Design and Analysis*, (SPIE Press, 2012): Will be handed out on CD.

- Vukobratovich, D. and S. *Introduction to Opto-Mechanical Design* will be handed out on CD.

Also, the two-volume set *Opto-Mechanical Systems Design, 4th Ed.*, by Yoder and Vukobratovich (CRC Press, 2015), is strongly recommended.

Quizzes
Brief quizzes will be frequently given to evaluate students' comprehension of assigned reading and their ability to work homework problems on their own.

Syllabus

I   Review of optics from a mechanical perspective
- Review of first order optics – emphasizing coupling of imaging relationships to mechanical motion
- Use of fold mirrors and prisms
- Tolerancing of optical systems and mechanical specification of optical components

II   Introductory design and specification for mechanical components
- Mechanical drawings, including introductory Geometric Dimensional and Tolerancing
- Introduction to mechanical modeling with SolidWorks
- Fabrication issues and limitations
- Application and selection of fasteners

III   Introductory engineering mechanics
- Introductory engineering mechanics – statics
- Principles of kinematic constraint
- Introductory engineering mechanics – deflections
- Introduction to finite element modeling
- Introductory engineering mechanics – thermal effects
- Vibration isolation
- Materials – Engineering properties

IV   Topics in optomechanical engineering
- Precision adjustments and motion control
- Mounting of windows and prisms
- Mounting of lenses
- Mounting and interface for mirrors
- Optomechanical system design