

Course Syllabus

MECH 6333 Materials Design and Manufacturing

Course Information:

MECH 6333.501, Class Number: 27740, 3 semester hours
Tuesday and Thursday: 5:30pm – 6:45pm
Starts: January 9, 2017

Spring 2017
Lecture Room: FO 2.208
Ends: May 8, 2017

Professor Contact Information:

Arif S. Malik, Ph.D
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Office Hours:

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Description:

This course provides an in-depth analysis of design problems faced in the development and mass manufacture of advanced materials. This course will explore the interplay among mathematical modeling, CAD, mold creation and manufacturing processes for polymers, ceramics and metals. Tradeoffs among various thermomechanical properties, cost and aesthetics will be studied.

Course Pre-requisites co-requisites and/or restrictions:

Students should have credit for MECH 6303 (Computer Aided Design) or equivalent should be taken prior to registration. Department consent required.

Assignments:

Project type assignments and team-based student-centered learning activities constitute the bulk of work in this course. The purpose of the projects and homework assignments is to enhance the students' skills in applying modern software packages to real-world problems in materials design and manufacturing. Therefore, the homework and projects will require use of computer aided design (CAD) and analysis software, such as CREO, SolidWorks, or other CAD/analysis software to generate engineering drawings and perform simulations for materials processing and mechanical/thermal analysis problems involving metals, polymers, ceramics, and composites. Students are expected to make several team presentations to demonstrate their project work and their knowledge & understanding from the reading assignments. Quizzes will also be given regularly to assess background knowledge related to reading assignments.

Course Learning Outcome (CLO):

- Be able to describe the general properties of metals, ceramics, polymers, and composites, including physical, mechanical, thermal, microstructural, chemical, and electromagnetic properties.
- Be able to describe general manufacturing and materials processing methods for metals, polymers, ceramics, and composites, as well as the advantages and disadvantages of different methods for a given material type.
- Be able to perform engineering analyses and computer simulations that help guide the selection an appropriate material type and manufacturing process in the design of a primarily mechanical component.
- Be able to evaluate both technical and non-technical considerations together with Design for X criteria to help guide selection of appropriate material type and manufacturing process in the design of a primarily mechanical component.

Tentative Topics (not necessarily in order of coverage):

- Review of engineering materials: metals, polymers, ceramics, composites
 - Atomic structure of materials, crystalline solids, imperfections, diffusion
 - Metals overview: mechanical properties, strengthening mechanisms, failure, phase diagrams/transformation, applications & processing, traditional & emerging manufacturing processes for metals
 - Mechanical/microstructural/thermal simulation methods and capabilities for design using metals
 - Ceramics overview: structure & properties, applications and processing, traditional & emerging manufacturing processes for ceramics
 - Mechanical/thermal simulation methods and capabilities for mechanical design using ceramics
 - Polymers overview: structure & properties, applications and processing, traditional & emerging manufacturing processes for polymers
 - Mechanical/thermal simulation methods and capabilities for mechanical design using polymers
 - Composites overview: structure & properties, applications and processing, traditional & emerging manufacturing processes for composites
 - Economic, environmental, and societal issues in materials selection for mechanical design
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Grading Policy:

- Quizzes: 15%
 - Midterm Exam: 15%
 - Homework / Projects: 50%
 - Final Exam: 20%
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References and Materials:

- Course materials and grades (UTD login ID and password required)
- <https://elearning.utdallas.edu/webapps/portal/frameset.jsp>
- You can access from off campus via VPN (see <http://www.utdallas.edu/ir/howto/utd-vpn/>)

Required Textbooks:

- Materials Science and Engineering: An Introduction, 9th Ed., Callister, W. (ISBN : 978-1-118-32457-8), Wiley 2014

Recommended Reference Textbooks:

- Manufacturing Processes for Engineering Materials. 6th Ed., Kalpakjian, S., Schmid, S. R. (ISBN-13: 978-0134290553), Pearson, 2016.
- Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Gibson, I., (ISBN: 978-1-4939-2112-6), Springer-Verlag, New York, 2015
- Laser Material Processing 4th Ed., Steen, W., (ISBN-13: 978-1849960618), Springer, 2010

Recommended Software (most available to students at UTD):

- CREO, SolidWorks, or other CAD software
 - ABAQUS, ANSYS, LS-DYNA, SolidWorks or other finite element analysis software
 - MATLAB (or other high level programming language)
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Policies and Procedures for Students:

The University of Texas at Dallas provides a number of policies and procedures designed to provide students with a safe and supportive learning environment. Brief summaries of the policies and procedures are provided for you at <http://go.utdallas.edu/syllabus-policies>, and include information about technical support, field trip policies, off-campus activities, student conduct and discipline, academic integrity, copyright infringement, email use, withdrawal from class, student grievance procedures, incomplete grades, access to Disability/Accessibility Services, and religious holy days.
