

## ESM 355 Materials and Processes in Manufacturing Design (Required)

### Course Catalog description:

The design of mechanical and electrical systems, material selection, and fabrication processes are surveyed and shown to be essential components of manufacturing engineering. The mechanical and thermal processing of a wide range of metallic and nonmetallic materials is reviewed. Modern computer based materials selection, advanced processing methods, and automation are explored.

*3 credits*

**Pre- or Corequisite(s):** ESG332 Materials Science I: Structure and Properties of Materials or ESG333 Materials Science II: Electronic Properties

### Text(s) or other required material:

Serope Kalpakjian, Manufacturing Engineering and Technology: Fifth Edition, 2006, Addison-Wesley, ISBN: 0131489658

### Course learning outcomes:

- Thorough understanding of a broad array of manufacturing techniques for metallic, ceramic, polymer, electronic, and composite components in products
- Comprehension of the role that materials selection and processing has in meeting property requirements for manufactured components
- Understanding of quality assessment in manufacturing processes
- Appreciation of the use of computer technology in manufacturing
- Enhancement of problem solving skills related to materials science and processing in manufacturing
- Enhancement of written and oral communications skills on technical topics in manufacturing processes

### Topics Covered:

Week 1:	Materials Science Review
Week 2:	Metal Casting
Week 3:	Rolling and Forging
Week 4:	Extrusion and Drawing
Week 5:	Sheet Metal Forming
Week 6:	Powder Metallurgy
Week 7:	Electronics
Week 8:	Ceramics
Week 9:	Polymers
Week 10:	Composites
Week 11:	Joining
Week 12:	Surface Treatment
Week 13:	Quality
Week 14:	Materials Selection

### Class/ Laboratory Schedule:

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### Contribution of Course to **meet requirement of Criterion 5:**

Many of the program outcomes for Engineering Science are addressed in ESM 355. This course applies previous knowledge of math and materials science and engineering to the field of manufacturing. Team work is facilitated through in-class exercises where manufacturing problems are given for teams of 2-4

students to solve. These exercises, along with weekly homework assignments, allow for the students to solve engineering problems. Professional and ethical responsibility and communication skills are developed during individual research projects on manufacturing processes or manufactured products. The project culminates in both a written document and oral presentation which includes consideration of the environmental impacts of the manufacturing. This project also serves to build the skills necessary for independent research during lifelong learning. In addition to understanding processing, this class also focuses on the economics of manufacturing processes and explores contemporary approaches to manufacturing including the incorporation of robotics and computer modeling. Engineering tools in materials selection, namely computer software, are used to demonstrate how materials engineers solve problems in modern engineering practice.

Several program objectives for Engineering Science are addressed in ESM 355. A fundamental understanding of manufacturing processes is essential for the development of new products and technology. ESM 355 gives the students the tools to relate manufacturing technology and materials science and engineering to product development. This knowledge base allows for a career in industry that can respond to emerging markets on regional, national, and global scales through the integrated development of new products. This class bridges the gap between addressing purely materials properties in design and addressing manufacturability. Naturally, this mixture of material science and engineering with mechanical engineering and manufacturing engineering positions the student to work on interdisciplinary research and development teams. To support lifelong learning in their careers, the research paper and presentation allow for in-depth individual analysis into a particular manufacturing process or manufactured product. Part of that project also addresses the issue of public health and safety considering the environmental impact of manufacturing processes.

**Relationship of course to program outcomes:**

a:14% d:8% e:14% f:8% g: 14% h: 8% i:14% j:10% k: 10%

**Person(s) who prepared this description and date of preparation:**

Christopher M. Weyant 2/20/2009