ESM 334 MATERIALS ENGINEERING (ELECTIVE)
Credit: 4

COURSE CATALOG DESCRIPTION:
Practical application of basic material and engineering concepts to fundamental and advanced material utilization. To that end, the course is divided into three sections: (1) “Tough stuff,” (2) “Hot stuff,” and (3) “Smart stuff.” Combined, these address issues of material operation and failure under normal and harsh conditions, high-temperature electrochemical devices (e.g. solid oxide fuel cells), thermal barrier coatings, electro-magnetic devices and shape memory alloys.

PRE- OR COREQUISITE(S): ESG332 Materials Science I: Structure and Properties of Materials

M. Ashby et al., Engineering Materials 2, second edition, Butterworth Heineman

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<th>COURSE LEARNING OUTCOMES</th>
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<th>ASSESSMENT TOOLS</th>
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<td>Case-study based property-process-application relations of materials</td>
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<td>Assignments</td>
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<td>Independent literature searching of advanced and modern material topics</td>
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<td>In-depth investigation of experimental data</td>
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COURSE TOPICS
Week 1. Overview of Engineering Materials, Addresses structure, properties and applications and relevance to design and engineering
Week 2. Crystals and Crystal Structure - Review Computer based instruction reviewing bonding and various lattice structures
Week 3. Phases Definitions and examples
Week 4. Phase Diagrams, Control of Structure under Equilibrium Conditions Origin, significance and utility in materials engineering. Study of binary diagrams
Week 5. Non-Equilibrium Structures Equilibrium versus real world situations in materials processing and engineering
Week 6. Mechanical Properties (Effect of Stress on Structure) Computer based instruction of stress strain curves, dislocations etc. Fracture toughness and reliability issues in ceramics. Design implications of structure-property relationships
Week 7. Processing of Metals, Differentiate processing of metals, ceramics and polymers and relevance to design and fabrication
Week 8. Steels and Ferrous Alloys (including examples of applications and utility in design)
Week 9. Non-Ferrous Alloys
Week 10. Ceramics, Overview, Processing, and Applications
Week 11. Polymers, Overview
Week 12. Composites, Overview and Applications
Week 13. Biomaterials

CLASS/ LABORATORY SCHEDULE:

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<th>ESM</th>
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CURRICULUM
This course contributes 3 credit hours toward meeting the required 48 hours of engineering topics.

STUDENT OUTCOMES (SCALE 1-3):

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3 – Strongly supported  2 – Supported 1- Minimally supported

LEAD COORDINATOR(S) WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:
Gary Halada