

**ESG 302 Thermodynamics of Materials (Required)****ESG 302 THERMODYNAMICS OF MATERIALS (REQUIRED)****Credit: 3****COURSE CATALOG DESCRIPTION:**

The basic laws and concepts of thermodynamics are elucidated, and the important thermodynamic relationships are systematically developed with reference to the behavior of materials. The thermodynamics of solids is discussed, including the thermodynamics of solutions and the calculation of reaction- free energies and equilibria in condensed phase reactions such as phase transformations, oxidation, and diffusion.

**PRE- OR COREQUISITE(S):** Calculus II (Mat131/132 or equivalent); General Chemistry I (CHE131/133 or CHE 152

**TEXT(S) OR OTHER REQUIRED MATERIAL:** Primary Source: Lecture notes  
 Recommended for Engineering Chemistry and Materials Science: Introduction to the thermodynamics of Materials, David Gaskell, (starting from 3th edition); Atkins' Physical Chemistry -8th edition

| <b>COURSE LEARNING OUTCOMES</b>  | <b>SOS</b>    | <b>ASSESSMENT TOOLS</b> |
|--|---------------|-------------------------|
| Master the basic theory of equilibrium thermodynamics  | a, e, j, h, k | Homework and exams      |
| Apply the theory to problems in heat engines, chemical reactions, phase equilibria, refrigeration and electrochemistry | a, e, h, k    | Homework and exams      |

**COURSE TOPICS:**

- Week 1. Introduction
- Week 2. Definitions of the Terms
- Week 3. First Law of Thermodynamics
- Week 4. Second Law of Thermodynamics
- Week 5. Thermodynamic variables and relations
- Week 6. Application of Thermodynamics to Machinery
- Week 7. Physical Transformation of Pure Substances
- Week 8. Simple mixtures: behavior of gases and liquids
- Week 9. Phase diagrams
- Week 10. Chemical Equilibrium
- Week 11. Equilibrium Electrochemistry
- Week 12. Applications of Thermodynamics in Materials Science
- Week 13. Special topics

**CLASS/ LABORATORY SCHEDULE:**

|     |     |                             |     |     |      |          |          |
|-----|-----|-----------------------------|-----|-----|------|----------|----------|
| ESG | 302 | Thermodynamics of Materials | LEC | 1   | TUTH | 2:20 PM  | 3:40 PM  |
|     |     |                             | REC | R01 | W    | 10:40 AM | 11:35 AM |
|     |     |                             | REC | R02 | W    | 11:45 AM | 12:40 PM |

**CURRICULUM**

This course contributes 4 credit hours toward meeting the required 32 hours of College-level Mathematics and Basic Science.

**STUDENT OUTCOMES (SCALE 1-3):**

| A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 |   |   |   | 3 |   |   | 1 |   | 1 | 3 |

**3 – Strongly supported****2 – Supported****1- Minimally supported****LEAD COORDINATOR(S) WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:**

Alexader Orlov 05/21/10