**Course number and name: MTSE 3030: Thermodynamics and Phase Diagrams**

**Credits and contact hours:** 3 Credits. Walk in or by appointment

**Instructor’s or course coordinator’s name**: Dr. Jincheng Du

**Text book, title, author, and year**

Thermodynamics in Materials Science, 2nd edition, Robert DeHoff, CRC Press, 2006.

Introduction to Thermodynamics, 5th edition, David Gaskell, Taylor and Francis, 2008.

1. *Other supplemental materials*

None

**Specific Course Information**

1. *Brief description of the content of the course (catalog description)*

First three laws of thermodynamics; phase equilibria, reaction equilibria and solution theory, principle and applications of phase diagrams.

1. *Prerequisites or co-requisites*
2. MTSE 3000, 3001
3. *Indicate whether a required, elective, or selected elective course in the program*

Required

**Specific goals for the course**

*a. Specific outcomes of instruction*

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| **Specific Course Learning Outcome** |
| 1. Understand and use the laws of thermodynamics |
| 2. Interpret and apply thermodynamics relations and Maxwell’s equations. |
| 3. Understand binary phase diagram using solution thermodynamics and phase equilibria theory. |
| 4. Read and apply unary, binary and ternary phase diagrams of different types of materials |
| 5. Understand reaction thermodynamics and Ellingham diagram. |

1. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes that are addressed by the course.*

This course addresses ABET Student Outcome 3

**Brief list of topics to be covered**

1. Importance of thermodynamics in materials science
2. First law of thermodynamics
3. Second law and entropy
4. Heat capacity and the third law of thermodynamics
5. Relationships in thermodynamics and Maxwell’s equations
6. Statistical thermodynamics
7. Thermodynamics and phase equilibria
8. Solution thermodynamics
9. Binary phase diagrams
10. Defects and interfacial thermodynamics
11. Ternary phase diagrams
12. Reaction thermodynamics