

## MET/MSE 413: Phase Equilibria in Materials

### Course Information:

Course title: Phase Equilibria in Materials

Course number: MET/MSE 413

Course credits: 3 credits

Prerequisite: MET/MSE 313

### Instructor Information:

Instructor: Dr. Sunil Patankar

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Office Hours: Open

### Assigned Text:

There is no assigned text for this course. Class notes and subsequent handouts will be made available prior to class.

### Reference Texts:

*Principles of Phase Diagrams in Materials Systems*, Paul Gordon, Krieger Publishing Company (1983).

### Course Scope:

This course is designed to introduce junior/senior students in metallurgical engineering and materials science and engineering to the basics of phase equilibria in materials. The course will address the fundamentals of equilibria in materials systems, including relationship of free energy to phase diagrams.

### Course Learning Goals:

Upon the completion of this course, students should:

1. Possess an understanding of the equilibrium relationships in materials science and metallurgy.
2. Knowledge of thermodynamic foundations of equilibrium phase diagrams.
3. Possess the ability to effectively use phase diagrams to solve engineering problems.

### Course Topics:

1. Phase diagrams
2. Allotropy or polymorphism/High pressure effect
3. Binary solutions
4. Chemical potential of an ideal solution
5. Equilibrium phase diagram in an ideal system
6. Binary isomorphous alloy system
7. Miscibility gap
8. The derivation of eutectic phase diagrams
9. Invariant reactions
10. Iron-carbon phase diagrams

11. Rules for construction of complex phase diagrams

12. Ternary phase diagrams

**Course Calendar/Schedule:**

<b>Lecture</b>	<b>Topic</b>
1	Introduction and Phase diagrams
2	Phase diagrams
3	Phase diagrams
4	Allotropy and Polymorphism/High pressure effect
5	Allotropy and Polymorphism/High pressure effect
6	Allotropy and Polymorphism/High pressure effect
7	Binary solutions
8	Binary solutions
9	Binary solutions
10	Chemical potential of an ideal solution
11	Chemical potential of an ideal solution
12	Chemical potential of an ideal solution
13	EXAM
14	Equilibrium phase diagram in an ideal system
15	Equilibrium phase diagram in an ideal system
16	Equilibrium phase diagram in an ideal system
17	Binary isomorphous alloy system
18	Binary isomorphous alloy system
19	Binary isomorphous alloy system
20	Miscibility gap
21	Miscibility gap
22	Miscibility gap
23	Derivation of eutectic phase diagrams
24	Derivation of eutectic phase diagrams
25	Derivation of eutectic phase diagrams
26	EXAM
27	Invariant reactions
28	Invariant reactions
29	Invariant reactions
30	Iron-carbon phase diagrams
31	Iron-carbon phase diagrams
32	Iron-carbon phase diagrams
33	Rules for the construction of complex phase diagrams
34	Rules for the construction of complex phase diagrams
35	Rules for the construction of complex phase diagrams
36	Methods of obtaining experimental data
37	Methods of obtaining experimental data
38	Methods of obtaining experimental data
39	EXAM
40	Ternary phase diagrams

<b>41</b>	<b>Ternary phase diagrams</b>
<b>42</b>	<b>Ternary phase diagrams</b>
<b>43</b>	<b>FINAL EXAM (Cumulative)</b>

**Grading:**

Exams (3 at 20% each)           60%  
Final exam                           40%  
Homework (2, mandatory but not graded)

\*Standard University of Idaho policies of grading and academic honesty applies.

**Disability Support Services Reasonable Accommodations Statement:**

**Reasonable accommodations are available for students who have a documented disability. Please notify the instructor during the first week of class of any accommodation(s) needed for the course. Late notification may mean that requested accommodations might not be available. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 333.**

- **885-7200**
- **email at <dss@uidaho.edu>**
- **website at <www.access.uidaho.edu> or <www.webs.uidaho.edu/aap>**