

**COURSE OUTLINE: MASE 6390/MME 5304:**  
**Phase Transformation and Microstructures**

**Professor**

Devesh Misra, Metallurgy M201H, office hours: M, W: 10:30 – 13:00 h or by appointment

**Classroom and Schedule**

CRBL: 202; M, W: 9-10:20 AM

**Summary of Topics (for details, please see last page)**

The topics to be covered include Solidification and Crystalline Imperfections, Thermally Activated Processes and Diffusion in Solids as it relates to Phase Transformation, Phase Diagrams – non-ferrous alloys, Iron-Carbon systems, Diffusion-controlled Transformation, Stress and Strain-induced transformation.

**Course Outcomes:**

1. Introduce basic concepts that are required for fundamental appreciation of phase diagrams and phase transformation in metals and alloys.
2. Describe the fundamental processes and mechanisms that control the rate of transformation.
3. Illustrate crystal interfaces as an essential feature of phase transformation.
4. Demonstrate the characteristics of different types of phase diagrams and their importance in the processing of materials and applications in the real world.
5. Design heat treatment to obtain a specified microstructure.
6. Elucidate mechanisms that are involved in the phase transformation of metals and alloys.

**Assessment of the Course**

The final grade will be determined on the following basis:

(a)	Classroom participation and preparation	20 points
(b)	Tests, quiz, and assignment	40 points
(c)	Exam	20 points
(c)	*Attending classes	10 points*

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100 points  
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\* 10 points to be awarded if you attend 90% of the total classes (for example, if 40 classes are held, then you should have attended a minimum of 36 classes to secure 10 points). If you DO NOT ATTEND 90 % of the total classes, NO GRADE WILL BE GIVEN. The assigned 10 points include your preparation in the class\*.

A – greater than 90 %; B – 80 - 89 %; C – 70 - 79 %; D – 60 - 69 %; F – 59 % and below.

**Attendance and Class Room Policy**

- **Please make sure that you are NOT late to the class by more than 2 minutes. If you are late by more than 2 minutes, you will be marked absent.**
- Please **DO NOT** leave the class room during the duration of the class. If you need to go, please inform prior to the commencement of the class.
- Please turn off cell phones before entering the class room.

Given that this is an online course, attendance is determined by class participation online.

Participation is determined by completion of the following activities:

- Reading/viewing all course materials to ensure understanding of assignment requirements

- Participating in engaging discussion with your peers on the Discussion Boards (grading rubric provided in the “grading information” area of each forum)
- Completing all Module Activities (assignments, quizzes, etc.)
- Completing all Major Assignments

To preserve a student’s GPA, he/she WILL be dropped from the course for failure to turn in two or more major writing assignments.

**Late Work Policy**

- Major Writing Assignments will be due on Sundays at midnight (11:59 PM). No late work will be accepted.  
Quiz and Blog/Discussion Assignments
- All quiz, blog, and discussion board assignments will be due on Saturdays at midnight (11:59 PM). No late work will be accepted.

**Drop Policy**

To drop this class, please contact the [Registrar’s Office](#) to initiate the drop process. If you cannot complete this course for whatever reason, please contact me. If you do not, you are at risk of receiving an “F” for the course.

**Netiquette**

- Always consider audience. Remember that members of the class and the instructor will be reading any postings.
- Respect and courtesy must be provided to classmates and to instructor at all times. No harassment or inappropriate postings will be tolerated.
- When reacting to someone else’s message, address the ideas, not the person. Post only what anyone would comfortably state in a F2F situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space. If students wish to do so, they have the ethical obligation to first request the permission of the writer(s).

**Academic Honesty Policy and Scholastic Integrity**

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones’ own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated.

All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Student Conduct and Conflict Resolution \(OSCCR\)](#) for possible disciplinary action. To learn more [HOOP: Student Conduct and Discipline](#)

In summary, the UTEP Policy on academic honesty will be followed. Copying/Plagiarism include the definitions described in the policy. This applies to assignments and exams.

**Accommodation Policy**

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with

Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#).

### **Student Resources**

UTEP provides a variety of student services and support:

- [UTEP Library](#): Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.
- [University Writing Center \(UWC\)](#): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.
- [History Tutoring Center \(HTC\)](#): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- [Military Student Success Center](#): UTEP welcomes military-affiliated students to its degree programs, and the Military Student Success Center and its dedicated staff (many of whom are veterans and students themselves) are here to help personnel in any branch of service to reach their educational goals.
- [RefWorks](#): A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.

### **COVID-19 PRECAUTIONS**

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to [covidaction@utep.edu](mailto:covidaction@utep.edu), so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID 19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit [epstrong.org](http://epstrong.org)

**\*Students are strongly encouraged to be self-stimulated, take an active role in self-learning, and expected to be intellectually challenged.**

**Contd. on page 4---**

The topics to be covered include:

- 1. Solidification, Crystalline Imperfections and Diffusional Transformation as it relates to Phase Diagrams and Microstructure**
  - Nucleation
  - Eutectic and Peritectic Solidification
  - Solidification of Single Crystals
  - Crystal Imperfections
  - Age Hardening
  
- 2. Thermally Activated Processes and Diffusion in Solids**
  - Atomic Diffusion
  - Steady-state and Non-steady State Diffusion
  - Applications of Steady-state and Non-steady state Diffusion
  - Atomic Mobility
  - Effect of Temperature on Thermal Activation
  
- 3. Phase Diagrams**
  - Phase Diagrams of Pure Systems
  - Gibbs Phase Rule
  - Cooling Curves
  - Binary Isomorphous Phase Diagrams
  - Binary Eutectic Phase Diagrams
  - Binary Peritectic Phase Diagrams
  - Binary Monotectic Phase Diagrams
  - Eutectoid Phase Diagrams and Transformation
  - Peritectoid Phase Diagrams
  - Invariant Reactions
  - Phase Diagrams with Intermediate Phases and Compounds
  - Ternary Phase Diagrams
  - Kinetics of Phase Transformations
  - Materials Selection and Design using Phase Diagrams
  
- 4. Diffusional Transformation in Solids**
  - Homogeneous and Heterogeneous Nucleation
  - Continuous Cooling Transformation Diagrams
  - Time-Temperature-Transformation Diagrams
  - Application of CCT and TTT Diagrams
  
- 5. Diffusionless Transformation and Other Transformations**
  - Characteristics of Diffusional Transformation
  - Martensitic Transformation – Theories of Martensitic Transformation and Growth
  - Tempering of Martensite
  - Bainitic Transformation