COURSES FOR METALLURGICAL AND MATERIALS ENGINEERING

Metallurgical and Materials Engineering Courses

MTE501 Introduction to the Fundamentals of Materials Science
Hours 3

The course provides graduate students from non-materials disciplines with a graduate-level introduction to the fundamentals of materials science. This class is not intended for those possessing materials science related degrees. Topics include crystallography, defects, diffusion, basic thermodynamics and kinetics, phase equilibria and transformations, electronic properties and basic microstructure analysis techniques.

Prerequisite(s): Permission of instructor

MTE510 Crystalline Defects in Materials
Hours 3

Advanced work of an investigative nature. Credit awarded is based on the work accomplished. Defects in materials contribute significant to various properties including but not limited to deformation mechanisms, phase transformation pathways, and transport properties. This course provides a fundamental and quantitative overview of point, line, and interfacial imperfections in crystalline materials. In particular, the thermodynamic contributions, structure, and migration of these types of defects will be discussed and their impact on material behavior and/or properties.

MTE515 Introduction to Electron and Ion Microscopy
Hours 3

The course provides students an introduction to electron and ion microscopy theory and application to materials science with an emphasis towards scanning and transmission electron microscopy methods.

MTE519 Solidificatn Science
Hours 3

Overview of the principles of solidification processing, the evolution of solidification microstructure, segregation, defects and the use of analytical and computational tools for the design, understanding and use of solidification processes.

MTE539 Metallurgy Of Welding
Hours 3

Thermal, chemical, and mechanical aspects of welding using the fusion welding process. The metallurgical aspects of welding, including microstructure and properties of the weld, are also covered. Various topics on recent trends in welding research.

Prerequisite(s): MTE 380

MTE550 Plasma Processing of Thin Films
Hours 3

This course will cover fundamental technology involved in thin film processing. Plasma deposition and etch technology will be discussed. The basics of plasma processing equipment will be detailed, with special emphasis on sputtering tools. A range of thin film applications will be explored, with examples of magnetics, semiconductor, optical, and medical applications. The fundamentals of process optimization using a Design of Experiments will be taught with a test case of process optimization for the final exam.

Prerequisite(s): PH 105 or with permission of instructor.

MTE556 Advanced Mechanical Behavior
Hours 3

Topics include elementary elasticity, plasticity, and dislocation theory; strengthening by dislocation substructure, and solid solution strengthening; precipitation and dispersion strengthening; fiber reinforcement; martensitic strengthening; grain-size strengthening; order hardening; dual phase microstructures, etc.

Prerequisite(s): MTE 455

MTE562 Metallurgicl Thermodyn
Hours 3

Laws of thermodynamics, equilibria, chemical potentials and equilibria in heterogeneous systems, activity functions, chemical reactions, phase diagrams, and electrochemical equilibria; thermodynamic models and computations; and application to metallurgical processes.

Prerequisite(s): MTE 362

MTE565 Atom Probe Tomography
Hours 3

This course introduces the theoretical background and practical information necessary to investigate materials using atom probe microscopy techniques. Topics will include the origins of the technique through field emission microscopy and its evolution into current atom probe to mography methods and instruments. The fundamentals of field emission, evaporation, desorption and other related behaviors is provided to establish an understanding of the physics of how atom probe microscopy operates. The course will also emphasize processes for assessing atom probe data quality, how to represent such data, advancements and limitations in data interpretation, and proper implementation of advanced data mining algorithms. Course instruction will be through lectures and assignments to assess student progress.

MTE567 Strengthening Mechanisms in Materials
Hours 3

Mechanisms and micromechanics of strengthening in engineering materials. This course covers the physical phenomena that contribute towards high mechanical strength in engineering materials. Principles for designing high strength materials will be addressed.

Prerequisite(s): MTE 455 or equivalent: or permission of instructor

MTE579 Advanced Physical Metallurgy
Hours 3

Graduate-level treatment regarding how metallurgical processing controls phase transformations and its outcomes on microstructure stability and mechanical strengthening mechanisms found in such microstructures.

MTE581 Diffractometry of Materials
Hours 3

The course provides graduate students an introduction to governing principles and equations for quantitative assessment of X-ray, electron, and neutron diffraction.

MTE583 Adv Structure Of Metal
Hours 3

Graduate-level treatments of symmetry, crystallography, crystal structures and defects in crystals. Application of analytical techniques to study crystal structures and textures in materials.

MTE585 Materls At Elevd Temps
Hours 3

Influence of temperatures on behavior and properties of materials.

MTE587 Corrosion Science & Engr
Hours 3

Fundamental causes of corrosion problems and failures. Emphasis is placed on tools and knowledge necessary for predicting corrosion, measuring corrosion rates, and combining this with prevention and materials selection.

Prerequisite(s): MTE 271 and CH 102 or CH 118

MTE591 Special Problems
SP

Hours 1-4

Advanced work of an investigative nature. Credit awarded is based on the work accomplished.

Special Topics Course

MTE592 Special Problems
SP

Hours 1-3

Advanced work of an investigative nature. Credit awarded is based on the work accomplished.

Special Topics Course

MTE598 Non Thesis Research Hours
Hours 1-12

Credit is based on the amount of work undertaken on non-thesis related research in a metallurgical and materials engineering area, the outcome of which is a define result presented in a report, paper, manuscript, or formal presentation at a conference or an MTE seminar. Instructor permission required. No prerequisites required.

MTE599 Thesis Research
Hours 1-12

No description available

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MTE602 Fracture of Brittle Materials
Hours 3

This course explains fracture from atomistic, energy balance and fracture mechanics points of view and directs this knowledge towards the development and application of brittle materials.

MTE610 Defects in Crystalline Materials
Hours 3

Defects in materials contribute significant to various properties including but not limited to deformation mechanisms, phase transformation pathways, and transport properties. This course provides a fundamental and quantitative overview of point, line, and interfacial imperfections in crystalline materials. In particular, the thermodynamic contributions, structure, and migration of these types of defects will be discussed and their impact on material properties.

MTE655 Transmission Electron Microscopy
Hours 3

The course provides graduate students an introduction to electron and ion microscopy theory and application to materials science with an emphasis towards scanning and transmission electron microscopy methods.

Prerequisite(s): MTE 515

MTE670 Scanning Electron Microscopy
Hours 3

Theory, construction, and operation of the scanning electron microscope. Both imaging and x-ray spectroscopy are covered. Emphasis is placed on application and uses in metallurgical engineering and materials-related fields.

MTE680 Advanced Phase Diagrams
Hours 3

Advanced phase studies of binary, ternary, and more complex systems; experimental methods of construction and interpretation.

MTE684 Fund Solid State Engineering
Hours 3

Fundamentals of solid state physics and quantum mechanics are covered to explain the physical principles underlying the design and operation of semiconductor devices. The second part covers applications to semiconductor microdevices and nanodevices such as diodes, transistors, lasers, and photodetectors incorporating quantum structures.

Prerequisite(s): MTE 271 or ECE 332

MTE687 Microstructure Evolution of Materials
Hours 3

The course will cover the fundamentals and state-of-the-art techniques used in mathematical modeling and computer simulation of microstructure formation and control during the solidification and solid state transformations of materials. The concepts and methodologies covered in this course for net-shape casting and ingot remelt processes can be applied, with some modifications, to model other materials processes such as welding, deposition, and heat treatment processes. Modeling and simulation of microstructure evolution requires complex multi-scale computational areas, from computational fluid dynamics macroscopic modeling through mesoscopic to microscopic modeling, as well as strategies to link various length-scales emerged in modeling of microstructural evolution.

MTE691 Special Problems
SP

Hours 1-3

Credit awarded is based on the amount of work undertaken.

Special Topics Course

MTE698 Non Dissertation Research
Hours 1-12

Credit is based on the amount of work undertaken on non-dissertation related research in a metallurgical and materials engineering area, the outcome of which is a define result presented in a report, paper, manuscript, or formal presentation at a conference or an MTE seminar. Instructor permission required.

MTE699 Dissertation Research
Hours 1-12

No description available

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