

MATERIALS SCIENCE AND ENGINEERING (M S & E)

M S & E 1 – COOPERATIVE EDUCATION PROGRAM

1 credit.

Work experience which combines classroom theory with practical knowledge of operations to provide students with a background upon which to base a professional career.

Requisites: Sophomore standing

Course Designation: Workplace - Workplace Experience Course

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Summer 2023

M S & E 151 – MATERIALS OF THE MODERN WORLD

3 credits.

The properties and structure of everyday materials. A non-mathematical exploration of the relation between structure and resulting properties of metals, plastics, ceramics, glasses, and composite materials. Case studies of important materials in the modern and historical context.

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Elementary

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Summer 2023

M S & E 250 – INTRODUCTION TO MODERN MATERIALS

1 credit.

This course is designed to provide incoming students with an overview of the structure of materials and the relation to properties. Special emphasis is placed on modern materials and recent advancements in their application.

Requisites: None

Repeatable for Credit: No

Last Taught: Fall 2015

M S & E 260 – MATERIALS EXPERIENCE

2 credits.

Provides overview of the field of Materials Science and Engineering, with significant design and hands-on components. Highlights different types of materials, with a focus on describing the extensive impact that Materials Science and Engineering has had on society. Small teams provide hands-on experience in materials design, synthesis, and processing and the fabrication of materials with desired properties and function.

Requisites: (MATH 113, 114, or 171) and (CHEM 103, 109, or 115 or concurrent enrollment)

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 299 – INDEPENDENT STUDY

1-3 credits.

Independent study under faculty supervision.

Requisites: Consent of instructor

Repeatable for Credit: No

Last Taught: Summer 2023

M S & E 330 – THERMODYNAMICS OF MATERIALS

4 credits.

Introduction to thermodynamics of materials, equilibrium constants, solutions, heterogeneous equilibria and electrochemistry.

Requisites: MATH 222 or 276 and (CHEM 104, 109, or 115), or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 331 – TRANSPORT PHENOMENA IN MATERIALS

3 credits.

Basic principles of fluid flow, heat transfer and diffusion are introduced.

Examples relevant to design and processing of materials including metals, semiconductors, glasses, polymers, and ceramics are given.

Requisites: M S & E 330 and (MATH 319, 320, 376, or concurrent enrollment), or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 332 – MACROPROCESSING OF MATERIALS

3 credits.

Topics include: ironmaking and steelmaking; production of Cu, Zn, Al and Mg by electrolysis; solidification processing of alloys by ingot casting, continuous casting and directional solidification; growth of bulk single crystals of semiconductors and ceramics from melts.

Requisites: M S & E 350, 351, or CBE 440, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 333 – MICROPROCESSING OF MATERIALS

3 credits.

Integration of materials science theory and materials engineering practice as applied to the processing of materials at the microscopic level.

Requisites: M S & E 350, 351, or CBE 440, or member of Engineering Guest Students

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2023

M S & E 350 – INTRODUCTION TO MATERIALS SCIENCE

3 credits.

The basic structures and resulting properties of solid materials, including phase equilibria, meta-stability, mechanical properties, failure, corrosion, and materials selection.

Requisites: CHEM 103, 109, 115, graduate/professional standing, or member of Engineering Guest Students. Not open to students with credit in M S & E 351.

Repeatable for Credit: No

Last Taught: Summer 2023

M S & E 351 – MATERIALS SCIENCE-STRUCTURE AND PROPERTY RELATIONS IN SOLIDS

3 credits.

Introduction to: atomic, electronic, and defect structures in materials; diffusional, mechanical and electrical properties of materials; and the role of structure and defects in diffusional, mechanical, and electrical properties.

Requisites: (MATH 222 or 276) and (CHEM 103, 109, or 115), or member of Engineering Guest Students. Students with credit for M S & E 350 may not enroll in M S & E 351.

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 352 – MATERIALS SCIENCE-TRANSFORMATION OF SOLIDS

3 credits.

The basic factors that determine phase equilibria, structural and transformation characteristics of solids. Principles governing the thermodynamics and kinetics of phase transformations and microstructure evolution. Nucleation and growth processes in precipitation, recrystallization, solidification, oxidation, martensitic, ordering and spinodal reactions. Transformation behavior in polymers, biomaterials and nanomaterials.

Requisites: M S & E 350, 351, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 360 – MATERIALS LABORATORY I

2 credits.

Laboratory instruction in sample preparation for and applications of quantitative microscopy, x-ray diffraction, and properties measurement in the context of structure-property relationships in materials.

Requisites: M S & E 350 or (M S & E 351 or concurrent enrollment) and declared in Materials Science and Engineering or Applied Mathematics, Engineering and Physics

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 361 – MATERIALS LABORATORY II

2 credits.

Experimental principles of materials science. Thermal, kinetic, structural, and materials synthesis experiments and associated concepts, data analysis, and presentation.

Requisites: Declared in Materials Science and Engineering or Applied Mathematics, Physics and Engineering) and M S & E 351 and 360

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 362 – MATERIALS LABORATORY III

3 credits.

Experiments in the mechanical and electronic properties of matter in bulk and thin films; computer instrument control; and data analysis.

Requisites: M S & E 361

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 363 – BASIC MATERIALS CHARACTERIZATION TECHNIQUES

2 credits.

The purpose of this course is to familiarize students with a variety of modern characterization techniques. Three general subject areas are covered: Physical Properties: Thermogravimetric analysis (TGA); differential scanning calorimetry (DSC); dynamic mechanical analysis (DMA); gel permeation chromatography (GPC). Spectroscopy, optical and x-ray: Ultraviolet/visible (VIS), molecular-infrared/Raman, Rheology; x-ray crystal and powder diffraction. Microscopy: scanning electron microscopy (SEM); SEM and energy dispersive analysis (EDS).

Requisites: Declared in Materials Science and Engineering or Applied Mathematics, Physics and Engineering) and M S & E 351 and 360

Repeatable for Credit: No

M S & E 401 – SPECIAL TOPICS IN MATERIALS SCIENCE AND ENGINEERING

1-3 credits.

Special topics of interest to students in materials science and engineering.

Requisites: M S & E 350, 351, or graduate/professional standing

Course Designation: Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2023

M S & E/CHEM 421 – POLYMERIC MATERIALS

3 credits.

Polymer chemistry and physics terminologies, structure-property relationship, polymer characterization, polymer synthesis, material requirements for optoelectronics including conjugated polymers, thin film transistors, light emitting diodes, non-linear optical materials, holographic data storage and liquid crystal polymers.

Requisites: CHEM 341, 343, or member of Engineering Guest Students

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E/N E 423 – NUCLEAR ENGINEERING MATERIALS

3 credits.

Fundamentals of fuel and cladding behavior in terms of thermal properties, chemical behavior and radiation damage.

Requisites: M S & E 350 or 351, graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E/N E 433 – PRINCIPLES OF CORROSION

3 credits.

Thermodynamics and kinetics of metallic corrosion. The common forms of corrosion and corrosion susceptibility tests. Electrochemical measurement of corrosion rates. Corrosion prevention, economic considerations. High temperature oxidation and sulphidation. Corrosion case histories.

Requisites: M S & E 330, or graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 434 – INTRODUCTION TO THIN-FILM DEPOSITION PROCESSES

3 credits.

Introduction to major thin-film deposition techniques and properties of thin films. Evaporation, plasma assisted processes with emphasis on sputter deposition, chemical vapor deposition ion beams. Film properties and characterization methods, applications.

Requisites: (M S & E 330 and 351), graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Spring 2022

M S & E 441 – DEFORMATION OF SOLIDS

3 credits.

Elastic and plastic deformation of real solids. Dislocation theory with applications to metals and alloys. Fracture, fatigue, brittle failure and methods for measuring the mechanical properties of materials.

Requisites: M S & E 352 or graduate/professional standing

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 448 – CRYSTALLOGRAPHY AND X-RAY DIFFRACTION

3 credits.

Crystal symmetry, projection methods, X-ray studies of structural problems in the solid state.

Requisites: M S & E 350 or 351, graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 451 – INTRODUCTION TO CERAMIC MATERIALS

3 credits.

Primary objectives are to: 1) analyze how atoms and ions combine to form 3D crystals and glasses; 2) examine phase equilibria to understand the driving forces for the formation of particular ceramic phases; 3) introduce and discuss the nature of defects in ceramics; 4) discuss the migration of matter and of charge in ceramics; and 5) discuss properties and processing technologies of ceramics.

Requisites: M S & E 352 and (M S & E 330 or concurrent enrollment), or graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 456 – ELECTRONIC, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS

3 credits.

Quantitative description of electronic, optical, and magnetic structure-property relationships of materials. Strategies for the development of new materials and introduction to applications of these materials.

Requisites: (M S & E 350 or 351) and (PHYSICS 202, 208, 248, or E C E/PHYSICS 235), graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 460 – INTRODUCTION TO COMPUTATIONAL MATERIALS SCIENCE AND ENGINEERING

3 credits.

An introduction to the theoretical and computational tools for computational materials, with hands on homework and laboratories. Topics may include atomistic simulation (e.g., molecular dynamics), mesoscale simulation (e.g., Phase field method), macroscale simulation (e.g., finite element method), thermodynamic and kinetic modeling (CALPHAD method), informatics (e.g., machine learning), and special topics (e.g., solar cell design, electronic device simulation, etc.)

Requisites: None

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 461 – ADVANCED METAL CASTING

3 credits.

Metallurgical and engineering principles applied in the foundry and related industries, primarily for those interested in foundry engineering.

Requisites: M S & E 350 or 352, graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E/M E 462 – WELDING METALLURGY

3 credits.

Metallurgical principles applied to welding; mechanisms of strengthening, phase equilibria, and microstructure of the weld zone. Modern processes including laser and electron beam welding.

Requisites: None

Repeatable for Credit: No

Last Taught: Spring 2022

M S & E 463 – MATERIALS FOR ELEVATED TEMPERATURE SERVICE

3 credits.

The design, properties, processing and selection of high temperature materials for structural applications. The fundamentals of diffusion, phase transformations, dislocation motion and oxidation governing the high temperature mechanical properties and structural performance of metallic and ceramic materials.

Requisites: M S & E 352, graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 465 – FUNDAMENTALS OF HEAT TREATMENT

3 credits.

Principles of phase transformations, heat transfer and mechanical properties as applied to heat treatment practice. The design, modeling and analysis of heat treatment processes.

Requisites: M S & E 352, graduate/professional standing, or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Fall 2021

M S & E 470 – CAPSTONE PROJECT I

1 credit.

Capstone experiences in materials design, selection, and application for MSE students. Emphasis on creativity and application of fundamental principles of public identification, experimental design, data acquisition and analysis, and presentation of results.

Requisites: Declared in Materials Science and Engineering, M S & E 352, 362, and (M S & E 331, 421, 441, 451, or 456)

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 471 – CAPSTONE PROJECT II

3 credits.

Capstone experiences in materials design, selection and application for MSE students. Emphasis on creativity and application of fundamental principles in problem identification, experimental design, data acquisition and analysis, and presentation of results.

Requisites: M S & E 470

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E/CIV ENGR/G L E/GEOSCI 474 – ROCK MECHANICS

3 credits.

Classification of rock masses, stress and strain in rock, linear and non-linear behavior of rock, failure mechanisms, state of stress in rock masses, lab testing, geological and engineering applications.

Requisites: E M A 201, PHYSICS 201, 207, or 247, or graduate/professional standing, or member of Engineering Guest Students

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 521 – ADVANCED POLYMERIC MATERIALS

3 credits.

This course is directed at graduate and advanced undergraduates with focused interest in polymeric materials. Basic principles of compatibility between macromolecules and small molecules, physical chemistry of blends and concepts in phase separation, and selected topics on materials design using self-assembly concepts.

Requisites: CHEM/M S & E 421, graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 530 – THERMODYNAMICS OF SOLIDS

3 credits.

Thermodynamics of condensed matters as applied to materials science and engineering.

Requisites: M S & E 330, or graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E/E M A 541 – HETEROGENEOUS AND MULTIPHASE MATERIALS

3 credits.

Principles of the mechanics of solid multiphase systems. Role of heterogeneity and anisotropy in determining physical properties including elastic, dielectric and piezoelectric properties. Applications in lightweight structures, ultrastrong materials, materials for protection of the body, and materials for the replacement of human tissues. Materials with fibrous, lamellar, particular, and cellular structures. Heterogeneous materials of biological origin. Biomimetic and bio-inspired materials.

Requisites: E M A 303, M E 306, or M S & E 441, graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 550 – MATERIALS FUNDAMENTALS

3 credits.

Accelerated introduction to foundational materials concepts and the materials paradigm approach to problem solving and research. Atomic scale structure of materials; defects in crystalline materials; alloy phase diagrams, solid-state diffusion, phase transformations, microstructure development, micro/nano/atomic-scale structure-property relationships.

Requisites: Graduate/professional standing. Not open to students with credit in M S & E 350, 351, or 352.

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

M S & E 551 – STRUCTURE OF MATERIALS

3 credits.

Atomic, nanoscale and microscale structure of materials. Course is designed for first year graduate students with interests in materials research.

Requisites: M S & E 451, graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 553 – NANOMATERIALS & NANOTECHNOLOGY

3 credits.

The principal objectives of the course are to: i) introduce advanced processing methods for synthesizing nanomaterials, ranging from single nanoparticles to three-dimensional nanostructures, ii) discuss important thermodynamic and kinetic theories related to such processing, iii) describe methods for characterizing the structure and properties of nanomaterials, iv) discuss current and emerging applications for nanomaterials, and v) illustrate the interdisciplinary nature of nanotechnology and address critical challenges.

Requisites: M S & E 350, 351, or CBE 440, graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 560 – FUNDAMENTALS OF ATOMISTIC MODELING

3 credits.

Introduction to basic concepts of atomistic modeling in materials, including classical and quantum mechanical energy methods, energy optimization, molecular statistics, molecular dynamics, and Monte Carlo. Relevant aspects of thermodynamics, statistical mechanics, quantum mechanics, and computer programming will also be presented.

Requisites: None

Repeatable for Credit: No

Last Taught: Spring 2017

M S & E 570 – PROPERTIES OF SOLID SURFACES

3 credits.

Introduction to structure and electronic properties; surface energy; thermodynamics of surfaces; diffusion. Surface barriers, work function, vibrational and electronic states. Chemical interactions: chemisorption, oxidation, corrosion, absorption kinetics, catalysis. Experimental methods and applications in metals, semiconductors.

Requisites: PHYSICS 205, 241, 244, or (M S & E 351 and 333) or PHYSICS/E C E 235, graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2022

M S & E 648 – ADVANCED X-RAY SCATTERING METHODS IN MATERIALS SCIENCE AND ENGINEERING

3 credits.

Advanced concepts and methods for the use of x-ray scattering, diffraction, and spectroscopy in materials science and engineering. Underpinning fundamental mathematical and scattering concepts, including kinematic and dynamical diffraction, diffuse scattering, and optical coherence in x-ray scattering. Practical aspects of experiments at synchrotron light sources and free electron lasers. Applications, including structure of metals and ceramics, polymeric materials, thin films and nanostructures, and magnetic materials.

Requisites: M S & E 448, graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2022

M S & E 660 – MESOSCALE MODELING OF MATERIALS

3 credits.

Classical theories, analytical and numerical modeling of various kinetic processes in materials. Including but not limited to transport, grain growth, phase separation, solidification, precipitation, chemical reactions, and multiphysics problems involving electrical, optical, mechanical, and magnetic properties of materials.

Requisites: (MATH 319, 320, or 376) and (M S E 350, 351, or CBE 440), graduate/professional standing, or member of Engineering Guest Students

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2023

M S & E 699 – INDEPENDENT STUDY

1-4 credits.

Courses in Metallurgical Engineering.

Requisites: Consent of instructor

Course Designation: Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Summer 2023

M S & E 702 – GRADUATE COOPERATIVE EDUCATION PROGRAM

1-2 credits.

Work experience that combines classroom theory with practical knowledge of operations to provide students with a background on which to develop and enhance a professional career. The work experience is tailored for MS students from within the U.S. as well as eligible international students.

Requisites: Consent of instructor

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Summer 2023

M S & E 748 – STRUCTURAL ANALYSIS OF MATERIALS

3 credits.

Introduction to transmission electron microscopy of materials, including imaging, diffraction, and microanalysis. Knowledge of diffraction [such as M S & E 448] strongly encouraged.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2022**M S & E 750 – IMPERFECTIONS AND MECHANICAL PROPERTIES**

3 credits.

Mathematical theory of dislocations and other crystal imperfections; mechanical properties of crystals in relation to imperfections. Knowledge of crystal structure and dislocations [such as M S & E 551] required.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2016**M S & E 752 – ADVANCED MATERIALS SCIENCE: PHASE TRANSFORMATIONS**

3 credits.

Phase transformations, nucleation theory and the role of structural imperfections, alloy phase equilibria, interface reactions and growth kinetics, continuous transformations. Knowledge of diffusion and reactions [such as M S & E 352] required.

Requisites: (M S & E 530 or concurrent enrollment) and graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2023**M S & E 756 – STRUCTURE AND PROPERTIES OF ADVANCED ELECTRONIC MATERIALS**

3 credits.

Prepares graduate students for research in electronic materials and related areas by examining (1) how does the physical structure of a material affect its electronic structure and properties: and (2) state-of-the-art advance electronic materials. Topics include: molecular and organic semiconductors; carbon nanomaterials (nanotubes, nanoribbons and graphene); advances in conventional bulk zinc-blende and wurtzite semiconductors; polycrystalline, amorphous, and disordered materials; state-of-the-art high- low-k dielectrics; and up-and-coming and next-generation materials. Knowledge of solid state physics [such as PHYSICS 551 or M S & E 456] required.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2021**M S & E 758 – TRANSMISSION ELECTRON MICROSCOPY LABORATORY**

1 credit.

An introduction to the practice of transmission electron microscopy (TEM) and TEM sample preparation through hands-on laboratory training.

Requisites: M S & E 748 or concurrent enrollment**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2022**M S & E 760 – MOLECULAR MODELING OF MATERIALS**

3 credits.

Hands-on experience in modern tools of atomic and molecular modeling, including density functional theory, interatomic potentials, and molecular dynamics. Select additional/advanced techniques like high-throughput calculations, (Kinetic) Monte Carlo, accelerated molecular dynamics, and machine learning.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2021**M S & E 790 – MASTER'S RESEARCH OR THESIS**

1-9 credits.

Under faculty supervision.

Requisites: Declared in Materials Science and Engineering M.S., Ph.D., or doctoral minor**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Summer 2023**M S & E 803 – SPECIAL TOPICS IN MATERIALS SCIENCE**

1-3 credits.

Topics vary.

Requisites: Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Summer 2023**M S & E 890 – PRE-DISSERTATOR'S RESEARCH**

1-9 credits.

Under faculty supervision.

Requisites: Declared in Materials Science and Engineering Ph.D. or doctoral minor.**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Summer 2023

M S & E 900 – MATERIALS RESEARCH SEMINAR

1 credit.

Introduces graduate students to the breadth, wealth and practices of materials research at the University of Wisconsin and in the professional materials research community.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2023

M S & E 990 – RESEARCH AND THESIS

1-9 credits.

Under faculty supervision.

Requisites: Declared in Materials Science and Engineering Ph.D. or doctoral minor.

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Summer 2023

M S & E 999 – INDEPENDENT WORK

1-3 credits.

Independent study under faculty supervision.

Requisites: Consent of instructor

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2000