

Macro Course Descriptions

Macro 410 – Design and Applications of Biomaterials (Fall Term)

Biomaterials and their physiological interactions. Materials used in medicine/dentistry: metals, ceramics, polymers, composites, resorbable, smart natural materials. Material response/degradation: mechanical breakdown, corrosion, dissolution, leaching, chemical degradation, wear. Host responses: foreign body reactions, inflammation, wound healing, carcinogenicity, immunogenicity, cytotoxicity, infection, local/systemic effects.

Macro 412 – Polymeric Materials (Fall Term)

The synthesis, characterization microstructure, rheology, and processing of polymeric materials. Polymers in solution and in the liquid, liquid-crystalline, crystalline, and glassy states. Engineering and design properties including viscoelasticity, yielding, and fracture. Forming and processing methods. Recycling and environmental issues.

Macro 512 – Polymer Physics (Winter Term)

Structure and properties of polymers as related to their composition, annealing and mechanical treatments. Topics include creep, stress relaxation, dynamic mechanical properties, viscoelasticity, transitions, fracture, impact response, dielectric properties, permeation, and morphology.

Macro 514 – Composite Materials (Winter Term)

Behavior, processing, and design of composite materials, especially fiber composites. Emphasis is on the chemical and physical processes currently employed and expected to guide the future development of technology

Macro 515 – Mechanical Behavior of Solid Polymeric Materials (Fall Term)

The mechanical behavior of polymers from linear viscoelastic to yield and fracture are covered. Specific topics include dynamic-mechanical relaxations, creep, yielding, crazing, fatigue, and fracture mechanics. The materials include toughened plastics, polymer alloys and blends, and composite materials. Structured design with plastics is also considered.

Macro 517 – Mechanics of Polymers (Every other Winter term, next offered WN 2021)

Constitutive equation for linear small strain viscoelastic response; constant rate and sinusoidal responses; time and frequency dependent material properties; energy dissipation; structural applications including axial loading, bending, torsion; three dimensional response, thermo-viscoelasticity, correspondence principle, Laplace transform and numerical solution methods.

Macro 518 – Organometallic Chemistry (Winter Term)

Systematic consideration of modern aspects of organometallic chemistry including main group and transition metal complexes. The structure and bonding in organometallic compounds are covered. Particular emphasis is placed on applications of homogeneous organometallic catalysis in polymer synthesis, industrial processes, and synthetic organic chemistry.

Macro 530 – Advanced Functional Polymers: Molecular Design & Applications (Fall Term)

Development of global perspective of interdisciplinary issues involved in functional polymers. Learn how to design, synthesize, evaluate, and analyze functional polymers.

Macro 536 – Laboratory in Macromolecular Chemistry (Every other Winter, next offered WN 2022)

Experimental methods for the study of macromolecular materials in solution and in the bulk state.

Macro 538 – Organic Chemistry of Macromolecules (Winter Term)

The preparation, reactions, and properties of high molecular weight polymeric materials of both natural and synthetic origin.

Macro 559 – Foundations of Nanotechnology (Every other Winter term, next offered WN 2022)

This course will cover the synthesis and processing of nano-sized metal, metal oxide, and semiconductor powders. It will also include organic/inorganic and nanobiomaterials. Emphasis will be on particle properties and their use in making nanostructured materials with novel properties.

Macro 690 - Macromolecular Research Rotations (Fall and Winter Terms)

A two-term research rotation in the research groups of participating faculty from different departments. Students will conduct research in a laboratory setting.

Macro 790 - Faculty Activities Research Survey (Fall Term)

This course introduces students to the research activities of Macro faculty with the intent of helping a student to choose his research advisor in the first term.

Macro 800 - Research Seminar (Fall and Winter Terms)

Student presentation of selected seminar topics in Macromolecular Science and Engineering.

Macro 890 - Introduction to Research Techniques (Fall and Winter Terms)

This course is used for research carried out to earn the Master's Degree.

Macro 990 - Dissertation Research Pre-Candidacy (Fall and Winter Terms)

This course is used for doctoral research by students not yet admitted to candidacy.

Macro 995 - Dissertation Research Candidacy (Fall and Winter Terms)

This course is used for doctoral research by students who have been admitted to candidacy.