Coatings and Polymeric Materials (CPM)

CPM 194. Individual Study. 1-5 Credits.

CPM 196. Field Experience. 1-15 Credits.

CPM 199. Special Topics. 1-5 Credits.

CPM 291. Seminar. 1-5 Credits.

CPM 292. Global Practicum: Study Abroad. 1-15 Credits.
Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P'or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

CPM 294. Individual Study. 1-5 Credits.

CPM 299. Special Topics. 1-5 Credits.

CPM 379. Global Seminar. 1-6 Credits.
NDSU instructed experience or field study in a foreign country. Conducted in English for residence credit. Pre-requisite: Prior approval by International Student and Study Abroad Services and major department. May be repeated. Standard Grading.

CPM 391. Seminar. 1-3 Credits.

CPM 392. Global Practicum: Study Abroad. 1-15 Credits.
Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P'or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

CPM 394. Individual Study. 1-5 Credits.

CPM 397. FE/Coop Ed/Internship. 1-4 Credits.

CPM 399. Special Topics. 1-5 Credits.

CPM 436. Biopolymers and Biocomposites. 3 Credits.
Structure/properties/synthesis of biopolymers, biomaterials and engineered biocomposites derived from plant based materials. An interdisciplinary course designed for undergraduate students. Introduction to science and engineering of converting biorenewable resources into novel biobased materials and products. Introduction to principles and concepts critical to successful design of polymeric biomaterials, coatings, and biocomposites. Understanding environmental impacts through life cycle analysis (LCA). Prereq: CHEM 122 and at least junior standing. Cross-listed with CHEM 436 and ME 436. {Also offered for graduate credit - See CPM 636.}.

CPM 451. Laboratory, Chemical, Radiation, and Biological Safety. 1 Credit.
Hazards and safe practices in chemical, radiation and biological laboratories, applicable to all studies at NDSU. Recognized by the University as completion (for credit) of safety training to work in a research laboratory. {Also offered for graduate credit - see CPM 651.}.

CPM 472. Environment and Chemical Industries. 2 Credits.
Environmental issues as they pertain to the chemical industry. Topics to include environmental regulations, the issues with disposal and waste, and designing environmentally compliant processes. Recommended Prereq: CHEM 121. {Also offered for graduate credit - see CPM 672.}.

CPM 473. Polymer Synthesis. 3 Credits.
Chemical synthesis of all types of polymers, including the understanding and tailoring of materials formed by these very high molecular weight molecules. Polymers have unique properties due to their conformation and high molecular mass, and are used in a wide variety of applications from paints to structural, engineering materials. Prereq: CHEM 240 or CHEM 342. {Also offered for graduate credit - see CPM 673.}.

CPM 474. Applied Polymer Science. 3 Credits.
Polymers are used in many important applications such as coatings, adhesives, and composites among others. Beginning with a survey of the main methods of polymer and resin synthesis, the course will emphasize the use of polymers in coatings and other applications including polymer structure - property relationships, formulation concepts, methods of evaluation, and use of solvents. Prereq: CHEM 240 or CHEM 342. {Also offered for graduate credit - see CPM 674.}.

CPM 475. Coatings' Materials Science. 3 Credits.
Materials science of composite materials with a focus on polymeric coatings. Includes properties of component materials, design, testing and application. Specialized topics include corrosion, rheology, appearance science and adhesion. Prereq: CPM 474. {Also offered for graduate credit - see CPM 675.}.

CPM 483. Polymer Practicum. 2 Credits.
Focus on key synthetic methods for polymer synthesis, reaction kinetics, and the characterization methods. Students will be introduced to basic lab skills and the analytical tools used to synthesize and characterize macromolecules. Prereq: CPM 473.) {Also offered for graduate credit - see CPM 683.}.

CPM 484. Coatings I Laboratory. 2 Credits.
Preparation and testing of coatings, synthesis and characterization of resins, characterization of coatings. Laboratory counterpart to CPM 474. Recommended Coreq: CPM 474. {Also offered for graduate credit - see CPM 684.}.

CPM 485. Coatings II Laboratory. 2 Credits.
Formulation and application testing of coatings versus property requirements; color measurement and matching. Laboratory counterpart to CPM 475. 1 six-hour laboratory. Hours flexible. Recommended Prereq: CPM 484. Recommended Coreq: CPM 475. {Also offered for graduate credit - see CPM 685.}.

CPM 486. Corrosion and Materials. 3 Credits.
Corrosion science and engineering: basic electrochemistry of corrosion, measurement of corrosion, choice of materials in engineering design to mitigate corrosion, corrosion control by coatings, evaluation of corrosion protection, and areas of special corrosion problems. Recommended Prereq: CHEM 121 or CHEM 150. Cross-listed with CHEM 486. {Also offered for graduate credit - see CPM 686.}.

CPM 487. Corrosion and Materials Laboratory. 1 Credit.
The laboratory will allow the students to become acquainted with experimental techniques for the study of corrosion processes and the failure of materials. Additionally, the methods for protection of materials will be practiced. Recommended Co-req: CPM 486. {Also offered for graduate credit - see CPM 687.}.

CPM 491. Seminar. 1-5 Credits.

CPM 492. Global Practicum: Study Abroad. 1-15 Credits.
Pre-Arranged study at accredited foreign institutions (study abroad), domestic institutions (National Student Exchange) or on approved study abroad programs. Pre-requisite: Sophomore standing and prior approval by International Student and Study Abroad Services and major department. Graded 'P'or 'F' (Undergraduate), or 'S' or 'U' (Graduate).

CPM 493. Undergraduate Research. 1-5 Credits.

CPM 494. Individual Study. 1-5 Credits.

CPM 496. Field Experience. 1-15 Credits.

CPM 499. Special Topics. 1-5 Credits.

CPM 636. Biopolymers and Biocomposites. 3 Credits.
Structure/properties/synthesis of biopolymers, biomaterials and engineered biocomposites derived from plant based materials. An interdisciplinary course designed for graduate students. Introduction to science and engineering of converting biorenewable resources into novel biobased materials and products. Introduction to principles and concepts critical to successful design of polymeric biomaterials, coatings, and biocomposites. Understanding environmental impacts through life cycle analysis (LCA). Restrictions: A junior standing student can register if accepted to an accelerated graduate program. Cross-listed with CHEM 636 and ME 636. {Also offered for undergraduate credit - See CPM 436.}.

CPM 651. Laboratory, Chemical, Radiation, and Biological Safety. 1 Credit.
Hazards and safe practices in chemical, radiation and biological laboratories, applicable to all studies at NDSU. Recognized by the University as completion (for credit) of safety training to work in a research laboratory. {Also offered for undergraduate credit - see CPM 451.}.

CPM 672. Environment and Chemical Industries. 2 Credits.
Environmental issues as they pertain to the chemical industry. Topics to include environmental regulations, the issues with disposal and waste, and designing environmentally compliant processes. {Also offered for undergraduate credit - see CPM 472.}.

CPM 673. Polymer Synthesis. 3 Credits.
Chemical synthesis of all types of polymers, including the understanding and tailoring of materials formed by these very high molecular weight molecules. Polymers have unique properties due to their conformation and high molecular mass, and are used in a wide variety of applications from paints to structural, engineering materials. {Also offered for undergraduate credit - see CPM 473.}.

CPM 674. Applied Polymer Science. 3 Credits.
Polymers are used in many important applications such as coatings, adhesives, and composites among others. Beginning with a survey of the main methods of polymer and resin synthesis, the course will emphasize the use of polymers in coatings and other applications including polymer structure - property relationships, formulation concepts, methods of evaluation, and use of solvents. {Also offered for undergraduate credit - see CPM 474.}.

CPM 675. Coatings' Materials Science. 3 Credits.
Materials science of composite materials with a focus on polymeric coatings. Includes properties of component materials, design, testing and application. Specialized topics include corrosion, rheology, appearance science and adhesion. Prereq: CPM 674. {Also offered for undergraduate credit - see CPM 475.}.

CPM 683. Polymer Practicum. 2 Credits.
Focus on key synthetic methods for polymer synthesis, reaction kinetics, and the characterization methods. Students will be introduced to basic lab skills and the analytical tools used to synthesize and characterize macromolecules. Prereq: CPM 673. {Also offered for undergraduate credit - see CPM 483.}.

CPM 684. Coatings I Laboratory. 2 Credits.
Preparation and testing of coatings, synthesis and characterization of resins, characterization of coatings. Laboratory counterpart to CPM 674. Recommended Coreq: CPM 674. {Also offered for undergraduate credit - see CPM 484.}.

CPM 685. Coatings II Laboratory. 2 Credits.
Formulation and application testing of coatings versus property requirements; color measurement and matching. Laboratory counterpart to CPM 675. 1 six-hour laboratory. Hours flexible. Recommended Prereq: CPM 684. Recommended Coreq: CPM 675.{Also offered for undergraduate credit - see CPM 485.}.

CPM 686. Corrosion and Materials. 3 Credits.
Corrosion science and engineering: basic electrochemistry of corrosion, measurement of corrosion, choice of materials in engineering design to mitigate corrosion, corrosion control by coatings, evaluation of corrosion protection, and areas of special corrosion problems. Cross-listed with CHEM 686. {Also offered for undergraduate credit - see CPM 486.}.

CPM 687. Corrosion and Materials Laboratory. 1 Credit.
The laboratory will allow the students to become acquainted with experimental techniques for the study of corrosion processes and the failure of materials. Additionally, the methods for protection of materials will be practiced. Recommended Co-req: CPM 686. {Also offered for undergraduate credit - see CPM 487.}.

CPM 690. Graduate Seminar. 1 Credit.

CPM 695. Field Experience. 1-15 Credits.

CPM 696. Special Topics. 1-5 Credits.

CPM 771. Modern Methods of Polymer Characterization. 3 Credits.
Understanding the physical properties of polymers and methods for their characterization. Focusing on the significance and interplay of physical parameters and the underlying physics of the characterization methods.

CPM 773. Organic Chemistry Of Coatings. 3 Credits.
Synthesis of polymers used in coating systems, polymers having tailored and defined architectures; crosslinking reactions used in coatings. Recommended Prereq: CHEM 741.

CPM 775. Color And Appearance. 3 Credits.
Topics in color and appearance in coatings, Colorimetry, Color and Gloss Measurement, Optical Properties of Pigments, Opacity, CIE and LAB Color Spaces, Color Matching. Recommended Prereq: CPM 675.

CPM 776. Computational Characterization of Materials and Experimental Design. 3 Credits.
The course includes introduction to cheminformatics and computational chemistry methods to analyze, predict properties and design new chemicals, polymeric and nano- and hybrid materials. The study of computational chemistry approaches together with cheminformatics encompasses the design, creation, organization, management, retrieval, analysis, dissemination, visualization and utilization of chemical information. The primary goal of this course is to teach students how to solve chemical problems computationally and analyze properties. Experimental design methods in relation to chemical experiments also will be given as an important part of chemical information use to obtain and treat experimental data effectively. Prereq: CPM 675 or CPM 636 or CHEM 636 or ME 636.

CPM 778. Physical Chemistry of Polymers. 3 Credits.
Examines the interrelationships among polymer structure, morphology, physical state and properties. Key aspects include molecular weight, and its distribution, and the organization of the atoms along the polymer chain. Recommended Prereq: CPM 673.

CPM 782. Applied Polymer Colloid Science. 3 Credits.
Thermodynamics of interfaces, transport in coatings, colloid stability, advanced CPVC concepts, film formation, particle size effects, and theories of coating application methods. Coreq: CPM 674 (recommended).

CPM 786. Polymeric Materials Design. 3 Credits.
Utilization of organic, polymer and supramolecular chemistry principles for synthesis and modification of polymeric materials for applications in materials science, surface coatings, nanotechnology, engineering and biomaterials design. Prereq: CPM 673 or equivalent.

CPM 787. Sustainable Product Design. 3 Credits.
Scientists and engineers can fundamentally change the environmental footprint of modernity. To make an effective change, they require tools to identify "better" materials and product designs. This course examines the use of life cycle thinking as well as environmental and cost assessment tools to identify product and system design options that balance environmental and economic performance. Special focus of the course will be on the production of chemicals and polymeric materials. Recommended Prereq: CHEM 121.

CPM 788. Bioinspired Coatings. 3 Credits.
This course deals with the foundational concepts of surface coatings inspired by biological species, including but not limited to lotus leaves, rose petals, butterflies, moths, water striders, cicadas, springtails, and sharks. Emphasis is given to the unique surface functionalities associated with these biological species and the underlying surface composition and morphology. The fundamental understanding will be used to design and fabricate coatings exhibiting varying and tunable wettability for a wide variety of applications such as liquid and colloidal phase separations, microfluidics, spill and stain resistant surfaces, de-icing, anti-fogging, and corrosion and fouling protection. Prereq: CPM 675.

CPM 790. Graduate Seminar. 1 Credit.

CPM 791. Temporary/Trial Topics. 1-5 Credits.

CPM 793. Individual Study/Tutorial. 1-5 Credits.

CPM 795. Field Experience. 1-15 Credits.

CPM 796. Special Topics. 1-5 Credits.

CPM 798. Master's Thesis. 1-10 Credits.

CPM 898. Continuing Enrollment. 1-9 Credits.
For graduate students who have completed all necessary credits of course work including thesis (798) and dissertation (899) on their approved Plan of Study, but who have not yet completed and submitted their thesis or dissertation. This course does not count towards the credit requirements for the degree and is not financial aid eligible. Department consent required to enroll.

CPM 899. Doctoral Dissertation. 1-15 Credits.