DEPARTMENT OF APPLIED PHYSICAL SCIENCES

Contact Information
Department of Applied Physical Sciences
Visit Program Website (http://aps.unc.edu)
1129 Murray Hall, CB# 3050
(919) 843-9334

Richard Superfine, Chair

The Department of Applied Physical Sciences was created to expand interdisciplinary research and teaching by strengthening an intellectual climate in which science is collaborative and focused on applications. The department has connections among disciplinary departments across the natural sciences. The graduate program in materials science (M.S. and Ph.D.) is housed in the department. The department offers undergraduate courses.

Graduate Programs

• Ph.D. in Applied Physical Sciences (http://catalog.unc.edu/graduate/schools-departments/applied-physical-sciences)

Professors
Theo J. Dingemans, Greg Forest (Mathematics), Jinsong Huang, Peter Mucha (Mathematics), Sorin Mitran (Mathematics), Edward T. Samulski, Richard Superfine, Wei You (Chemistry).

Associate Professors
Ronit Freeman, Rene Lopez (Physics and Astronomy).

Assistant Professors
Daphne Klotsa, Ehssan Nazockdast, Scott Warren (Chemistry).

Affiliated Faculty
Nancy L. Allbritton (Biomedical Engineering and Chemistry), James Cahoon (Chemistry), Joseph M. DeSimone (Chemistry), Jianping Lu (Physics and Astronomy), Laurie E. McNeil (Physics and Astronomy), Jerry Meyer (Chemistry), Thomas Meyer (Chemistry), Lu-Chang Qin (Physics and Astronomy), J. Michael Ramsey (Chemistry), Sergei S. Sheiko (Chemistry), Frank Tsui (Physics and Astronomy), Sean Washburn (Physics and Astronomy), Yue Wu (Physics and Astronomy), Otto Zhou (Physics and Astronomy).

Advanced Undergraduate and Graduate-level Courses

APPL 411. Practical Electronics for Everyone. 1 Credit.
Design and fabrication for practical electronics circuits, including interfacing with sensors and actuators.
Grading status: Letter grade.

APPL 412. Turning Your Entrepreneurial Ideas Into Reality. 3 Credits.
Students will work in groups on a semester project to turn their entrepreneurial ideas into reality.
Requisites: Prerequisite, APPL 110; permission of the instructor for students lacking the prerequisite.
Gen Ed: EE- Field Work.
Grading status: Letter grade.

APPL 413. LabView for Data Acquisition. 1 Credit.
The basics of data acquisition and hardware interfacing using LabVIEW graphical programming.
Grading status: Letter grade.

APPL 420. Introduction to Polymer Chemistry. 3 Credits.
Chemical structure and nomenclature of macromolecules, synthesis of polymers, characteristic polymer properties.
Requisites: Prerequisite, CHEM 261 or 261H; pre- or corequisites, CHEM 262 or 262H, and 262L or 263L.
Grading status: Letter grade
Same as: CHEM 420.

APPL 421. Synthesis of Polymers. 3 Credits.
Synthesis and reactions of polymers; various polymerization techniques.
Requisites: Prerequisites, CHEM 251 and 262 or 262H.
Grading status: Letter grade
Same as: CHEM 421.

APPL 422. Physical Chemistry of Polymers. 3 Credits.
Polymerization and characterization of macromolecules in solution.
Requisites: Prerequisites, CHEM 420 and 481.
Grading status: Letter grade
Same as: CHEM 422.

APPL 423. Intermediate Polymer Chemistry. 3 Credits.
Requisites: Prerequisite, CHEM 422.
Grading status: Letter grade
Same as: CHEM 423.

APPL 460. Optical Instrumentation for Scientists and Engineers. 3 Credits.
This course introduces principles of optical system design, covering a broad variety of imaging and microscopy instruments. The material will include computational methods for optical signal processing and basic principles governing light-matter interactions. The course will include theory and hands-on experience to implement and test methods. We will discuss recent publications and state-of-the-art optical systems which are task-driven, controlled by computers, tailored to specific applications, and optimized to monitor or manipulate complex systems.
Requisites: Prerequisite, MATH 383; permission of the instructor for students lacking the prerequisite.
Grading status: Letter grade

APPL 470. Fundamentals of Materials Science. 3 Credits.
Crystal geometry, diffusion in solids, mechanical properties of solids, electrical conduction in solids, thermal properties of materials, phase equilibria.
Requisites: Prerequisite, CHEM 482 or PHYS 128. Pre- or corequisite, PHYS 441.
Grading status: Letter grade
Same as: CHEM 470.

APPL 472. Chemistry and Physics of Electronic Materials Processing. 3 Credits.
Permission of the instructor. A survey of materials processing and characterization used in fabricating microelectronic devices. Crystal growth, thin film deposition and etching, and microlithography.
Requisites: Prerequisite, CHEM 482 or PHYS 117 or 119.
Grading status: Letter grade
Same as: PHYS 472, CHEM 472.
APPL 473. Chemistry and Physics of Surfaces. 3 Credits.
The structural and energetic nature of surface states and sites, experimental surface measurements, reactions on surfaces including bonding to surfaces and adsorption, interfaces.
Requisites: Prerequisite, CHEM 470.
Grading status: Letter grade
Same as: CHEM 473.

APPL 475. Design and Fabrication of Fluids Monitoring Devices. 1 Credit.
Review of fluid mechanics including the fundamentals of pressure/flow relationships, fluid properties, and flow regimes. Students will design and create physical prototypes that demonstrate specific concepts and measure defined parameters. Students will use the BeAM makerspace network extensively to make things that illustrate fluid device design. Class time will include exercises to reinforce concepts and a guided design activity to create a physical device. Required preparation: BeAM orientation, laser training, and 3D-printer training.
Grading status: Letter grade.

APPL 490. Special Topics. 1-3 Credits.
Topics vary from semester to semester.
Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 9 total completions.
Grading status: Letter grade.

APPL 491L. Materials Laboratory I. 2 Credits.
Structure determination and measurement of the optical, electrical, and magnetic properties of solids.
Requisites: Prerequisites, APPL 470 and PHYS 351.
Grading status: Letter grade
Same as: PHYS 491L.

APPL 492L. Materials Laboratory II. 2 Credits.
Continuation of PHYS 491L with emphasis on low- and high-temperature behavior, the physical and chemical behavior of lattice imperfections and amorphous materials, and the nature of radiation damage.
Requisites: Prerequisite, APPL 491L or PHYS 491L.
Grading status: Letter grade
Same as: PHYS 492L.

APPL 520L. Polymer Chemistry Laboratory. 2 Credits.
Various polymerization techniques and characterization methods. One four-hour laboratory each week.
Requisites: Pre- or corequisite, CHEM 420 or 421 or 425.
Gen Ed: EE- Mentored Research.
Grading status: Letter grade
Same as: CHEM 520L.

APPL 573. Introductory Solid State Physics. 3 Credits.
Crystal symmetry, types of crystalline solids; electron and mechanical waves in crystals, electrical and magnetic properties of solids, semiconductors; low temperature phenomena; imperfections in nearly perfect crystals.
Requisites: Prerequisite, PHYS 421; permission of the instructor for students lacking the prerequisite.
Grading status: Letter grade
Same as: PHYS 573.

APPL 590. Special Topics in Applied Physical Sciences. 3 Credits.
Advanced specialty topics in applied physical sciences for undergraduates and graduates.
Repeat rules: May be repeated for credit. 12 total credits. 4 total completions.
Grading status: Letter grade.

Material Science (MTSC)
Advanced Undergraduate and Graduate-level Courses
MTSC 615. Structure of Solids. 3 Credits.
Crystallography, reciprocal lattices, Bloch waves, band structure, electronic wave functions, phonons, thermal expansion. Superlattice structures, including liquid crystals. Overview of properties of ceramic, amorphous, polymeric, and composite materials.
Grading status: Letter grade.