

COLLEGE OF PHYSICAL AND MATHEMATICAL SCIENCES



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College of Physical and Mathematical Sciences

The College of Physical and Mathematical Sciences offers programs for students whose interests lie in the basic as well as the applied physical science and mathematical areas. These programs of study and research are offered at both the undergraduate and graduate levels and lead to many career opportunities. In addition, the college provides the core physical science and mathematical education support for the entire university. The college consists of five academic departments: Chemistry, Mathematics, Physics, Statistics, and Marine, Earth, and Atmospheric Sciences. It jointly administers academic programs in Biochemistry with the College of Agriculture and Life Sciences. The Center for Research in Scientific Computation, the Institute of Statistics, the State Climate Office, and the Center for Marine Science and Technology are also associated in whole or in part with the college.

Graduates of the college are in demand and valued for their well-developed analytical thinking and problem-solving skills. They are recruited for technical and administrative positions in industry and laboratories, universities and colleges, non-profit research organizations, and government agencies. A large percentage of the graduates undertake advanced study in medical, law, business, or other professional schools as well as further study leading to the Master of Science and Doctor of Philosophy degrees.

The high school student who enjoys computers, mathematics, statistics, chemistry, geology, marine science, meteorology, or physics; who has an interest in natural phenomena and their fundamental descriptions, and who hopes to make a difference in the quality of life should consider the career opportunities opened by degrees in the physical and mathematical sciences.

Degree Programs

The college offers undergraduate programs of study leading to the Bachelor of Science degree with majors in chemistry, geology, mathematics, applied mathematics, meteorology, natural resources, environmental sciences, physics, and statistics and the Bachelor of Arts degree with majors in geology, chemistry, and physics. In some programs, students may choose to highlight their studies with concentrations in compatible disciplines. For example, they may select an earth systems history concentration in geology; an air quality, geology, or statistics concentration in an environmental sciences curriculum; or marine and coastal resources concentration in a natural resources curriculum.

Curricula within the college have similar freshman years enabling a freshman to change from one department to another in the college without loss of time. A time-limited Physical and Mathematical Sciences Undesignated (PMU) "curriculum" is offered to students who want to major in one of these curricula but have not yet made a decision.

Minors are offered in geology, mathematics, meteorology, physics, and statistics.

Pre-Medical Sciences

Medical and dental schools as well as many other health-related professional schools have long regarded degree programs in the core physical and mathematical sciences as excellent preprofessional curricula. Some professional schools prefer the in-depth knowledge gained by this route over those curricula which offer a cursory view of a variety of topics. For further details, contact Dr. Anita Flick, Director of pre-Health Advising.

Dual Degree Programs

Students may wish to earn bachelor's degrees in two fields within the college. Other students may wish to combine a bachelor's degree in the college with one in another NC State college. With effective planning a number of courses can satisfy core, general education, or elective requirements simultaneously in both degree programs. For example, many students choose to pursue simultaneous degrees in mathematics and mathematics education or one of the physical sciences and science education.

Student Activities

In addition to university-wide extracurricular activities and honor organizations, the College of Physical and Mathematical Sciences has student chapters of the following professional and honor organizations: Sigma Pi Sigma (Physics Honor Society); Society of Physics Students; Pi Mu Epsilon (National Mathematical Honor Fraternity); Society for Undergraduate Mathematics (A Student Chapter of the Mathematical Association of America); Phi Lambda Upsilon (National Honorary Chemical Society); American Chemical Society; Alpha Chi Sigma, national co-ed professional chemistry fraternity, National Organization for the Professional Advancement of Black Chemists and Chemical Engineers; Mu Sigma Rho (Statistics Honorary Society); Statistics Club; American Meteorological Society; Society of Mining Engineers/Society of Exploration Geophysicists (Geology Club); National Association of Environmental Professionals (Student Chapter); and the nation's first chapter of the Society of African-American Physical and Mathematical Scientists. In addition, majors in the college are eligible for induction in the national honor societies: Phi Beta Kappa and Phi Kappa Phi.

Honors Program

All departments in PAMS have active honors programs, designed to encourage excellent undergraduates to pursue a program that will challenge their abilities and better prepare them for their post-graduate career, through a combination of independent research and honors course work, often at the graduate level. Students in an honors program are advised by honors advisers who help students customize their education based on their individual interests, talents and skills and who proactively present opportunities for academic study, research and study abroad. For information on a particular departmental program, please visit the departmental web sites.

Facilities

Faculty and students within the college have access to an extensive array of computational and network services. Extensive use of computers to fulfill the daily task requirements encompasses word processing, e-mail, information access from the library and Internet, and the use of numerous specialized software tools. The college provides a large number of workstations for use by undergraduate and graduate majors and is a participant in the university's campus-wide workstation network. Individual departments either utilize these workstations or provide additional platforms for work with discipline specific programs; for example instruction or research in mathematics, statistics, satellite data acquisition and analysis, weather modeling, chemistry, or physics. Additionally, students have access to university facilities for additional workstations, peripherals, and services. There is a fully staffed help desk to assist students with problems that they might encounter.

Cooperative Education, Field Experience, and Undergraduate Research

The college recognizes the value of career-related work experience to students and encourages its majors to avail themselves of such opportunities whenever possible. That experience may be gained through the university's Cooperative Education Program, department sponsored field experience, academic research, and summer employment. Advisers work with students to develop a plan of study that balances a challenging course load with appropriate extracurricular activities.

Scholarships

College of Physical and Mathematical Sciences majors may be eligible for a variety of freshman and undergraduate college and departmental scholarships in addition to those administered at the university level. The awards are based on a combination of factors, with a strong emphasis on academic excellence. Some scholarships are renewable for up to four years, and some carry opportunities for significant career-related work experience.

Community Outreach

The college of Physical and Mathematical Sciences demonstrates its commitment to community outreach primarily through its Science House. The Science House offers programs for K-12 students and teachers to enhance their understanding of, appreciation for, and involvement in mathematics and physical sciences. The Science House, located on the Centennial Campus, houses classrooms, laboratories and a teaching resource library. Vans from the Science House carry Science on the Road demonstration programs and teaching laboratory equipment to schools across North Carolina.

Tutorial and Audio-Visual Assistance

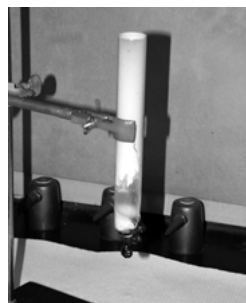
Most of the departments in college offer students some form of free tutorial assistance, including regularly scheduled review sessions and Supplemental Instruction (SI) for selected sections of chemistry, mathematics, and physics. Several departments provide facilities for students to use supplementary videotaped or computer assisted instructional materials on a voluntary basis.

Graduate Study

The Master of Science and Doctor of Philosophy degrees are available with majors in biomathematics, chemistry, marine, earth, and atmospheric sciences, mathematics, applied mathematics, statistics, and physics. The Master of Biomathematics, Master of Chemistry, and Master of Statistics are also offered. The Departments of Statistics, Mathematics, and Physics offer B.S.-M.S. programs that allow students to enroll in up to twelve credit hours of graduate level course work that may be applied toward the requirements of both the bachelor's and master's degrees.

DEPARTMENT OF CHEMISTRY

Dabney Hall, Room 108; Marye Anne Fox Science Teaching Laboratory
phone: (919) 515-2546
www.ncsu.edu/chemistry



Morteza G. Khaledi, Department Chair
Kenneth W. Hanck, Associate Department Chair and Director of Facilities
Philip A. Brown, Director of Undergraduate Studies
Chris Gorman, Director of Graduate Studies

Howard J. Schaeffer Distinguished Professor: B.M. Novak; Glaxo Distinguished University Professor: J.S. Lindsey; Alumni Distinguished Undergraduate Professor: A.J. Banks; Alumni Distinguished Undergraduate Professor Emeriti: F.C. Hentz, Jr., W.P. Tucker; Professors: E.F. Bowden, D.L. Comins, S.F. Franzen, C.B. Gorman, K.W. Hanck, M.H. Khaledi, J.D. Martin, D.C. Muddiman, D.A. Shultz, M-H. Whangbo, J.L. Whitten; Professors Emeriti: R.D. Bereman, C.L. Bumgardner, H.H. Carmichael, L.D. Freedman, F.W. Getzen, S.T. Purrington, A.F. Schreiner, E.O. Stejskal, G.H. Wahl; Associate Professors: M.T. Oliver-Hoyo, A.I. Smirnov; Associate Professor Emeritus: T.C. Caves, D.W. Wertz; Assistant Professors: A. Deiters, R.A. Ghiladi, L. He, Elon Ison, P.A. Maggard, Jr., C. Melander,

A.A. Nevzorov, T.I. Smirnova; L. Sombers Research Assistant Professors: M. Taniguchi, A.G. Tkachenko; Associate Faculty: D.W. Brenner (Materials Science and Engineering); Teaching Associate Professors: P.A. Brown, G.A. Neyhart, K.A. Sandberg, L.E. Sremaniak; Teaching Assistant Professors: R.W. Warren Lecturers: J.C. Folmer, M.T. Gallardo-Williams, A. Ison, L.M. Petrovich, G. Rebah; Laboratory Supervisors: M.L. Belisle, P.D. Boyle, J.L. Burtness, G.L. Hennessee, M.M. Lyndon, S.S. Sankar

Honors Program

To be invited to join the Chemistry Honors Program at the end of the sophomore year, a student must have a GPA of 3.25 or higher. Only students in the Chemistry B.S. program will be invited to join.

Chemistry Honors students must maintain a GPA of at least 3.25 to graduate with honors. In addition, the departmental requirements for students in the Honors Program are the completion of 9 extra credit hours of work that is NOT required for their degree(s). Between 3-6 credit hours can come from research conducted in laboratories in the Department of Chemistry. Research in other laboratories of molecular sciences may also be considered. However, in the latter case, prior approval is required. A 3-page report and a letter from the supervisor indicating the nature of the work, time spent in the lab, and performances are required at the end (before finals week) of the semester, in which the research is conducted. It should be noted that simply working in a research lab does not necessarily meet the requirements of the Honors Program. The nature of the work must be meaningful research. The rest of the credit hour requirements can be met with 500 level or higher courses in chemistry, biochemistry, polymer sciences, materials sciences, biotechnological sciences and pharmacological sciences. Courses in other subject areas may be considered. However, prior approval is required. If you are in doubt as to whether a particular course will count toward the Chemistry Honors Program, please contact Professor Reza Ghiladi.

Curricula

The B.A. program offers a flexible course of studies for students who may not plan to become professional chemists but who desire an interdisciplinary program with an emphasis on chemistry. The proper choice of electives will prepare the graduate for any of the following: medical, veterinary or dental school; work in chemical sales and management; teaching in secondary schools; work in environmental science; or graduate school in an allied science. This route is also an excellent premedical or pre dental program.

The B.S. curriculum, accredited by the American Chemical Society, includes a strong, broad background in mathematics, physics, and the liberal arts. The basic areas of organic, physical, inorganic, and analytical chemistry are stressed. Laboratory and classroom work develop the skills, knowledge, and inquiring spirit necessary for a successful career in chemistry. The advised elective credits allow individual diversity at the junior and senior levels. Many undergraduates participate in current departmental research through part-time employment or research projects. The B.S. curriculum prepares the student to enter the job market directly as a chemist or to enter various graduate schools in chemistry or an allied science.

Specific curriculum requirements are available online: www.ncsu.edu/registrar/curricula

DEPARTMENT OF MARINE, EARTH AND ATMOSPHERIC SCIENCES

Jordan Hall, Room 1125
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www.meas.ncsu.edu

J. C. Fountain, Head
C. J. Thomas, Director of Undergraduate Programs

Langley Professor: R. Tolson; University Distinguished Scholars: R.R. Braham, T.F. Malone; Alumni Distinguished Undergraduate Professors: V.V. Cavaroc, Jr. Emeritus, E.C. Knowles Emeritus; Professors: V.P. Aneja, S.P. Arya, D.J. DeMaster, D.B. Eggleston, R.V. Fodor, D.P. Genereux, J.P. Hibbard, G.C. Janowitz, D.L. Kamykowski, E.L. Leithold, D.A. McConnell, L.J. Pietrafesa, F.M. Semazzi, S. Raman, T.G. Wolcott, L. Xie; Research Professor: C.R. Philbrick; Adjunct Professors: N.E. Blair, S.W. Chang, W.J. Cooper, S.K. Leduc, R.V. Madala, S.T. Rao, R.W. Reynolds, R. Rotunno, J.T. Wells; Professors Emeriti: H.S. Brown, V.V. Cavaroc, J.M. Davis, L.J. Langfelder, C.J. Leith, W. J. Saucier, C. Welby; Research Professors Emeriti: T.S. Hopkins, D.A. Russell; Associate Professors: R. He, M.M. Kimberley, G.M. Lackmann, H. Mitsova, M.D. Parker, M.H. Schweitzer, P.T. Shaw, W.J. Showers, S. Yuter, Y. Zhang; Research Associate Professor: C.J. Thomas; Associate Professors Emeriti: C.E. Knowles, A.J. Riordan, E.F. Stoddard, G.F. Watson, D.L. Wolcott; Adjunct Associate Professors: B.K. Eder, R.S. Harmon, J.C. Reid, C.R. Tomas, R.W. Weiner; Assistant Professors: A. Aiyer, Del Bhonestiehl, J.P. Liu, N. Meskhidze, C.L. Osburn, K.W. Wegmann; Research Assistant Professors: A.J. Newell, M. Peng; Adjunct Assistant Professors: D.M. Checkley, M.J. Childress, C.J. Coats, D.R. Corbett, A.S. Frankel, A.F. Hanna, J.A. Hare, T. Holt, C. Jang, G.T. Kellison, G.J. Kirkpatrick, A.J. Lewitus, J.M. Morrison, J.E. McNinch, P.A. Roelle, B. Subrahmanyam, R.C. Tacker; Adjunct Lecturer: R.M. Wooten; Interinstitutional Adjunct Faculty: P.J. Robinson; Visiting Scholars: J.N. McHenry, D.T. Olerud, J.M. Vukovich, J.O. Young

The Department of MEAS covers a broad range of disciplines with one overarching goal: a deeper understanding of the Earth's environment. MEAS takes an interdisciplinary approach to studying our planet's air, earth and water, combining meteorology, earth science, and oceanography in a single department.

This interdisciplinary viewpoint is particularly important today, in light of accelerating global changes and increasing corporate and public interest in environmental health and wise use of natural resources. Many pressing questions require more than narrow training in a single discipline. MEAS graduates can be equipped for tasks as diverse as improving severe storm forecasting; assessing potential effects of oil exploration; modeling global climate trends or coastal flooding; understanding the transport of tree-killing air pollutants from industrial centers to the North Carolina mountains; developing non-polluting technology for mining; ascertaining dinosaurian physiology and ecological niches; investigating global ozone depletion, or devising plans to minimize erosion and pollution of coastlines.

MEAS offers degrees in meteorology, geology, marine sciences, environmental sciences and natural resources. Marine science majors learn how the oceans, solid earth, and atmosphere interact. Marine sciences courses are highly interdisciplinary and are available in chemical oceanography, physical oceanography, biological oceanography, coastal geology, and marine meteorology. Earth science courses encompass the entire earth, from the core, through the crust, to the minerals, sediments, ground water, and land forms of the surface. Tools learned allow students to understand and characterize the physical and historical earth. Course work in all areas of geology equips students to reduce potential disasters from geological hazards and to ameliorate the negative impact of human society on the geological resources of the earth. Selection of a paleontology focus produces graduates knowledgeable about the evolution of the earth's ecosystems. The meteorology program stresses a quantitative understanding of atmospheric structure and processes. It addresses problems like air pollution, climate changes, and severe weather, such as thunderstorms, tornadoes, winter storms, and hurricanes. Forecasting and climate studies are enhanced by using real-time satellite imagery, radar-data products, and state-of-the-art computer technology. MEAS majors in Environmental Sciences and Natural Resources fill a unique need in today's society as experts who can interpret their science to public policy shapers and decision makers. The training they receive in economics, political science, and policy issues, and management, (for Natural Resources majors) equips MEAS graduates to interact with industry, and with regulatory and conservation agencies.

Planet Earth is MEAS's natural laboratory. While most scientists conduct experiments under controlled conditions designed to replicate some facets of nature, we use ships, submarines, aircraft, satellites, and unattended monitoring instruments to directly and remotely probe the natural environment itself. Computer modeling helps us visualize the real-world information, and to design the next experiments. Field study is an integral part of MEAS educational programs, enabling students to apply concepts learned in the classroom to projects in the field. Summer field courses take students to the Southwest or to the North Carolina coast for intensive training in field methods. Shorter field trips are part of classes in all disciplines.

Opportunities

MEAS undergraduate degree programs provide talented students with the foundation of scientific knowledge for careers in government, industry, or academe. Many students pursue graduate degrees.

Marine Sciences graduates can go on to become oceanographers, to manage our coastal resources, model air-sea interaction, and explore global climate change. They may conduct pure and applied research, serving as environmental consultants for industry and governmental agencies, policy and management experts for governmental agencies, and environmental science educators. Graduates with a Natural Resources degree are versed in the fundamental processes and interdisciplinary nature of the coastal zone. As scientists, managers, administrators, and regulators, they make decisions regarding use and conservation of coastal and marine resources.

Geology graduates address society's needs for dealing effectively with earth processes, such as water supply and water quality (from ecosystem health in rivers and estuaries to residential and industrial supply and disposal), or assessment of stability of land forms. They work for engineering firms and permit-issuing agencies, and they are recruited by industries that rely on geological resources. Paleontologists are familiar with the evolution of ecosystems through time, and provide a perspective on potential long-term reactions of the biosphere to both past and current changes and stresses. Their expertise is used in education, including museums, and in theoretical and practical study of biosphere response. Those with Environmental Science degrees are trained to assess and monitor geological resources like ground water contamination. Marine geologists are experts in the complex issues facing industry, municipalities, and residents in the dynamic and ecologically vulnerable coastal zone.

Meteorology graduates may enjoy careers in areas such as weather forecasting, air quality assessment, development of weather products and services, broadcast communications, and advanced research. Marine meteorologists study ocean-generated weather systems. Their research is yielding practical benefits like refined prediction of storm surge, which has streamlined evacuation efforts during severe storms along the Carolina coast. Environmental Sciences graduates with an air quality emphasis may work for environmental firms, regulatory agencies, and in applied research. Study of air quality and how air pollution is transported and dispersed is a rapidly expanding field in the atmospheric sciences.

MEAS graduates play a key service role for the State of North Carolina, assisting in everything from forecasting severe storms and analyzing the impact of atmospheric pollutants on agriculture and our estuaries, to determining the effects of toxic waste disposal on quality of surface and ground water.

Honors Program

Participants receive enhanced coverage of academic material and are involved in research. Eligibility is based on scholastic achievement. Minimum requirements are a GPA of 3.5 overall and 3.5 in the major, including required mathematics, chemistry, and physics courses taken to date. Students are reviewed for eligibility after the first semester of the sophomore year and again as first semester juniors. Participation is optional. To successfully complete the honors program, a student will acquire a minimum of 9 credit hours of honors work, including 3 to 6 hours of independent study culminating in a written scientific report, and one of the following options: oral presentation in the department, a poster presentation at the Sigma XI Undergraduate Research Symposium, or presentation at a professional meeting. The remaining honors credit is earned in honors' sections of undergraduate courses, and in advanced (graduate) courses. Students must graduate with a 3.4 grade point average overall.

Undergraduate Research, Cooperative Education, and Internships

Examples of past undergraduate research projects include studies of coral reef fish in the Bahamas to understand age, growth, and life history transitions; assessment of Lake Victoria's impact on the climate of East Africa; examination of the relationship between atmospheric ozone and meteorological parameters as measured with instrumented balloons; experiments on generation of oxygen

College of Physical and Mathematical Sciences

from moon rocks to supplement a manned moon station; and reconstruction of events during past volcanic eruptions on Hawaii. Outstanding MEAS students can receive career training with pay through the NC State Cooperative Education program, after completing the first year of undergraduate studies. Co-op and internship students have completed assignments with the National Weather Service, US Geological Survey, US Air Force, US Environmental Protection Agency, NC Museum of Natural Sciences, NC State Climate Office, NC Division of Marine Fisheries, NASA, local environmental consulting firms, and other state and federal agencies. Many students co-op or intern at the internationally renowned Research Triangle Park. After graduation, co-op students often are hired full-time by the same companies or agencies.

Facilities

The home base of MEAS is Jordan Hall, an award-winning structure that accommodates regular and tele-video classrooms, teaching laboratories, computing facilities, and offices of faculty and staff. Jordan Hall has several facilities housing networked computers, some for unstructured student use, and some, like the Weather Analysis and Forecasting Laboratory, for teaching. This laboratory houses 50 workstations providing access to real-time and archived satellite, radar, surface, and upper-air observations plus a wide variety of numerical model fields. From the rooftop Weather Observatory, detailed weather measurements are automatically logged and archived and weather balloons are launched. Other structures include the Research III building on NC State's Centennial Campus, which houses the State Climate Office, where many students gain skills in instrumentation, data acquisition, data analysis, and interaction with the public. For class work and field research in coastal settings, students may travel to NC State's Center for Marine Sciences and Technology on the shore of Bogue Sound, in Morehead City.

Students who attend a research-intensive ("Research I") university benefit from the opportunity to engage in research as undergraduates and to study with professors whose involvement in research keeps their knowledge and enthusiasm fresh. The faculty of MEAS are internationally acknowledged research scientists, and the department maintains an extensive inventory of both laboratory and field research equipment and facilities. As a member of the Duke/UNC Oceanographic Consortium, MEAS has access to the R/V Cape Hatteras, a 135' coastal oceanographic research vessel, which serves as a platform for work on the physics, chemistry, geology, biology and meteorology of the sea offshore. Training cruises on the R/V Cape Hatteras occur each semester, providing practical experience in oceanography for marine science majors.

Specialized equipment in the department supports teaching and research in: geological materials (electron microprobe, X-ray fluorescence spectrometer, an automated X-ray diffractometer, neutron activation analysis), geophysical measurements (GPS, gravimeter, magnetometer, seismic reflection, high-resolution sub-bottom profiler (Chirp Sonar) and swath bathymetric sonar system), and sedimentology (microcomputer-controlled grain-size analysis). Stable- and radio-isotope laboratories support research in biogeochemical cycling, paleoclimatology and paleontology. Paleontology also employs molecular techniques. Ecological studies are supported by a motion analysis system, a biotelemetry laboratory, and the departmental membership in the Cooperative Institute of Fisheries Oceanography, a joint venture of NOAA's National Marine Fisheries Service and a number of universities within the state. Advancements in air-sea interactions come through the Satellite Oceanography and Image Analysis Laboratory; the Physical Oceanographic Research Laboratory with its complement of equipment to monitor the ocean's motion and composition; the Planetary Boundary-Layer Laboratory with its instrumentation for monitoring physical processes at the land-air and sea-air interfaces; and the center for Marine Sciences and Technology at the coast in Morehead City, NC.

Curricula

The department offers several curricula in each of the areas of marine, earth and atmospheric sciences. Each prepares students for employment at graduation or for further professional training. There are three Bachelor of Science (B.S.) curricula in atmospheric sciences: Meteorology, Marine Meteorology, and Environmental Sciences, Air Quality. Most students in meteorology are employed with private companies and public agencies. Air quality graduates are employed by consulting firms, private industry and public agencies. In the marine sciences, students can pursue a B.S. in marine science with one of five concentrations: Biological Oceanography, Chemistry, Geology, Meteorology, and Physics. Earth sciences house three curricula: B.A. (Bachelor of Arts) and B.S. in Geology, and B.S. in Environmental Sciences, Geology concentration. The B.A. and B.S. degree programs require similar core courses, but the B.A. contains more social sciences and humanities, and the B.S. more mathematics and other physical sciences. An environmental sciences degree combines core knowledge in the science with economics, politics, and policy. Geologists are employed in both the private and public sector. The B.S. in natural resources, with a concentration in marine and coastal resources, combines marine sciences with economics, politics, policy, and management, to prepare scientists who can interface with policy-makers and regulators.

Specific curriculum requirements are available online: www.ncsu.edu/registrar/curricula

Minor in Geology

The Department of Marine, Earth, and Atmospheric Sciences offers a Minor in Geology to majors in any field except geology. This program provides a means of recognition for students in any field who have a curiosity about the materials, structures, and processes of the solid earth. Admission to the program requires a grade of C or better in MEA 101 and MEA 110. Successful completion of the program requires a C- or better in at least 15 hours of geology or geophysical course work which must include MEA 101, MEA 110 and two additional laboratory courses.

Program Administrator and Contact

Dr. Ronald Fodor
 Department of Marine, Earth and Atmospheric Sciences
 2144 Jordan Hall, Box 8208
 phone: (919) 515-7177

Minor in Meteorology

The Department of Marine, Earth, and Atmospheric Sciences offers a Minor in Meteorology to majors in any field except meteorology. Admission to the program requires a grade of C or better in MA 141, 241, and 242, and in PY 205 and 208. Successful completion of the program requires a grade of C- or better in the following courses: MEA 213, 214, 311, 312, 313, 314, and 421. MEA 130 may substitute for MEA 213.

Program Administrator and Contact

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DEPARTMENT OF MATHEMATICS

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- A. G. Helminck, Department Head
- H. T. Tran, Associate Head
- J. S. Scroggs, Director of Undergraduate Programs
- S. L. Campbell, Director of Graduate Programs
- E. L. Stitzinger, Administrator of Graduate Programs
- J. R. Griggs, Coordinator of Classroom Instruction
- H. J. Charlton, Scheduling Officer and Director of Summer School

Professors: H.T. Banks, S.L. Campbell, M.T. Chu, J.D. Cohen, A. Fauntleroy, J.E. Franke, R.O. Fulp, P.A. Gremaud, A.G. Helminck, H. Hong, I. Ipsen, K. Ito, N. Jing, E.L. Kaltofen, C.T. Kelley, A. Kheyfets, T. Lada, Z. Li, X.B. Lin, S. Lubkin, R. H. Martin, N. Medhin, C.D. Meyer, K.C. Misra, M.S. Putcha, S. Schecter, J.F. Selgrade, F.H.M. Semazzi, M. Shearer, J.W. Silverstein, M. Singer, R. Smith, E.L. Stitzinger, H.T. Tran, R.E. White; Adjunct Professors: E.M. Peck, P. Schlosser; Professor Emeriti: J.W. Bishir, E.E. Burniston, R.E. Chandler, E.N. Chukwu, L.O. Chung, J. Danby, J.C. Dunn, W. Harrington, R.E. Hartwig, K. Koh, John Kolb, J. Luh, J. Marlin, L.B. Martin, P. Nickel, C.V. Pao, E.L. Peterson, N.J. Rose, C.E. Siewert, Raimond Struble; Associate Professors: A. Chertock, M.A. Haider, M. Kang, A. Lloyd, L.K. Norris, M.S. Olufsen, T. Pang, S.O. Paur, J. Rodriguez, J.S. Scroggs, A. Szanto, S. Tsynkov, D. Zenkov; Associate Professor Emeritus: G.D. Faulkner, D.E. Garoutte, L.B. Page, R.T. Ramsay, R. Savage, R. Silber, D. Ullrich, W.M. Waters, Jr.; Assistant Professors: B. Bakalov, R. Buche, H.J. Charlton, I. Kogan, D. Labate, N. Reading, S. Sullivan, D. Zenkov; Assistant Professor Emeritus: D.J. Hansen; Teaching Assistant Professor: A. Duca, M. Fenn, J.R. Griggs; Lecturers: B. Burns-Williams, E. Dempster, L. Kurtz.

The undergraduate majors in mathematics and applied mathematics provide a core of basic mathematics courses along with flexible choices of electives, which permit both a well-rounded education and preparation for math-related careers. Students may focus their studies in financial mathematics, mathematical biology, mathematical physics, mathematical statistics, or computational mathematics. Employment objectives can be focused on quantitative careers in business or government, teaching at the secondary level, or graduate study in mathematics and/or related areas.

Specific curriculum requirements are available online: www.ncsu.edu/registrar/curricula



Academic Enrichments

Many undergraduates in the Mathematics Department participate in research programs with members of our faculty, presenting their results in both regional and national meetings. Other enrichment activities include off-campus programs, such as the NSF sponsored Research Experience for Undergraduates, the Budapest Semester in Mathematics, and the Society for Undergraduate Mathematics, a club for all students interested in mathematics, and is a Student Chapter of the Mathematical Association of America.

Talented students are encouraged to consider a 5-year Accelerated Bachelors/Masters Program (ABM). A key feature of the program is counting up to 12 hours of graduate courses to both the BS and MS degrees. Students can choose between the MS in Mathematics, Applied Mathematics, or Financial Mathematics.

Undergraduate math students have the opportunity to take courses that are part of our Financial Mathematics (FM) Professional Science Masters (PSM), and to focus their studies in the area of Actuarial Science. Faculty affiliated with FM has research interests and teaching specialties related to finance. A career that involves modeling energy futures or pricing mortgage-backed securities requires advanced training, such as the FM PSM, but the math background and problem-solving skills learned as an undergraduate provide a solid foundation for further studies in this field.

Honors Program

Students that demonstrate high aptitude in mathematics are invited to participate in the Mathematics Honors Program. The program provides intensive mentoring and preparation for graduate studies. Students are invited to join the program if they are recommended by a teacher in an upper-level math course and have a GPA of 3.5 in math. To complete the program, students must take MA 426, at least three graduate level math courses, and do a research project. Math Honors students often study abroad at programs such as the Budapest Semesters in Mathematics or Math in Moscow and participate in funded summer research at other universities.

Awards

The department recognizes its superior students with the following annual awards: the Hubert V. and Mary Alice Park Scholarship, for an outstanding rising junior or senior in mathematics; the John W. Cell Scholarship, for an outstanding rising junior or senior in mathematics; Carey Mumford Scholarship, for an outstanding sophomore, junior, or senior in mathematics; Levine-Anderson Award, for the student who has the best performance in the William Lowell Putnam Examination (not restricted to math majors); Charles N. Anderson Scholarship, for an outstanding sophomore in mathematics; Charles F. Lewis Scholarship, for an outstanding senior who is a double major in mathematics/mathematics education; Mrs. Roberts C. Bullock Scholarship, for an outstanding mathematics major with a demonstrated interest in the English language; the Dr. Rebecca R. Bullock Memorial Scholarship Endowment, for an outstanding mathematics major with a demonstrated interest in the English language; the Howard A. Petrea Scholarship, for an outstanding junior or senior in mathematics; H. Thomas and Sue Banks, outstanding undergraduate pursuing degrees in one of the departments of the college; Marvin and Mary Chaney and Fulton and Ruby H. Starling.

The department also has a chapter of the National Mathematical Honorary Fraternity Pi Mu Epsilon. Membership is open to those students with superior performance in mathematics courses.

Minor in Mathematics

The minor program consists of the successful completion with a grade of C- or better of any 15 hours selected from the Department of Mathematics' list of approved courses. The list includes MA 225 Foundations of Advanced Mathematics as well as any MA courses at the 300, 400, and 500 levels.

DEPARTMENT OF PHYSICS

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M. A. Paesler, Head
K. Warren, Assistant Head
J.M. Blondin, Director of Undergraduate Programs
H.W. Ade, Director of Graduate Programs

Named Professors: D.E. Aspnes, J. Bernholc, G. Lucovsky; Alumni Distinguished Graduate Professors: G.E. Mitchell; Alumni Distinguished Undergraduate Professors: R.J. Beichner, C.R. Gould, D.G. Haase, S.P. Reynolds; Professors: H. Ade, D.E. Aspnes, R.J. Beichner, J. Bernholc, J.M. Blondin, J.D. Brown, R. Chabay, S.R. Cotanch, D.C. Ellison, R.E. Fornes, C.R. Gould, D.G. Haase, H. Hallen, P.R. Huffman, C.R. Ji, J. Krim, G. Lucovsky, L. Mitas, G.E. Mitchell, J.R. Mowat, M.A. Paesler, S.P. Reynolds, J.S. Risley, C.M. Roland, T. Schaefer, A.R. Young; Professors Emeriti: J.W. Cook, K.T. Chung, W.R. Davis, W.O. Doggett, G.L. Hall, A.W. Jenkins, K.L. Johnston, G.H. Katzin, F. Lado, Jr., J.D. Memory, J.Y. Park, R.R. Patty, J.F. Schetzina, L.W. Seagondollar, P.J. Stiles, D.R. Tilley; Associate Professors: M. Buongiorno-Nardelli, D.J. Lee, G. McLaughlin, M.C. Sagui; Associate Professor Emeritus: C.G. Cobb, D.H. Martin, G.W. Parker; Assistant Professors: L.I. Clarke, K.E. Daniels, D. Dougherty, K. Gundogdu, D. Lazzati, T.P. Pearl, R. Riehn, K. Weninger.

Physics is the fundamental science of observation, measurement and description of the natural world. Physicists seek to establish a mathematical description of all physical phenomena, ranging from the interactions of quarks in nuclei to the collisions of galaxies in the universe. Together with scientists in engineering and other physical, biological, and mathematical sciences, physicists collaborate to develop new materials and new insights in all areas of modern science and technology.

Curricula

The Physics undergraduate curricula provide a strong background in the fundamentals, and offers course options for deeper studies in areas of interest. Undergraduates have the opportunity to work in research laboratories with faculty in: astrophysics, atomic physics, biological physics, physics education, nuclear and particle physics, synchrotron radiation, near-field optics, and materials physics, solid-state and condensed-matter physics. Undergraduates are frequently co-authors on scientific papers. Physics majors are part of a close-knit community- a small highly motivated group of people who have wide-ranging interests and a passion for solving problems.

Specific curriculum requirements are available online: www.ncsu.edu/registrar/curricula

Bachelor of Science in Physics

This degree equips students with a broad technical background, providing a solid basis for graduate study in physics or related sciences, enrollment in professional schools such as law or medicine, and employment in government or industrial laboratories.

Bachelor of Arts in Physics

This degree offers a flexible course of studies for students who may not plan to become professional physicists but who desire an interdisciplinary program with a strong emphasis on physics. The proper choice of electives will help to prepare the graduate for professional careers in education, law, business, journalism, or graduate school in an allied science. It is especially suitable as part of a double major or as preparation for high-school teaching. Since the first four semesters are essentially identical to those of the B.S. program, students may enter the B.A. program either directly from high school or at some later point after entering the university.

Honors Programs

The Department of Physics Honors Program offers students the opportunity to develop their academic potential by increased involvement and participation in physics study and research. A minimum GPA of 3.5 in physics courses and overall GPA of 3.0 is required for admission. Students must complete three (3) hours of PY 499, Independent Research, and submit a written scientific report based on their research. Students must also complete an additional nine (9) hours of upper-level physics courses drawn from the following two categories: 300- and 400- level physics courses taken with the honors option, and 500-level physics courses.

Minor in Physics

The Department of Physics offers a minor in physics to majors in any field except physics. To complete the minor, 17 hours of specified physics courses are required, consisting of PY 205, 208, 407 (or 201, 202, 203) and two of PY 328, 341, 401, 402, 411, 412, 413, 414, 415.

DEPARTMENT OF STATISTICS

Patterson Hall, Room 201
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S. G. Pantula, Head
L. A. Stefanski, Assistant Head
J.M. Hughes-Oliver, Co-Director of Graduate Programs for Statistics
P. J. Arroway, Co-Director of Graduate Programs for Statistics
A. Lloyd, Director of Biomathematics Graduate Program
Z. Zeng, Director of Bioinformatics Research Center
R.D. Woodard, Director of Undergraduate Programs in Statistics

William Neal Reynolds Professor: M. Davidian, Z. Zeng; Drexel Professor of Statistics: A.A. Tsiatis
Alumni Distinguished Graduate Professors: M. Davidian; Alumni Distinguished Undergraduate Professors: J.M. Hughes-Oliver; Alumni Distinguished Research Professor: A.A. Tsiatis; Professors: P. Bloomfield, D.D. Boos, M. Davidian, D.A. Dickey, T.M. Gerig, S.K. Ghosh, M.L. Gumpertz, J. Hughes-Oliver, J.F. Monahan, S.G. Pantula, K.H. Pollock, D.L. Solomon, L.A. Stefanski, A.A. Tsiatis, Z. Zeng; Research Professor: N. Sedransk; Adjunct Professors: J.C. Brocklebank, J.R. Chromy, R.B. Conolly, J.H. Goodnight, P.D. Haaland, J.M. Hoenig, N.L. Kaplan, P.H. Morgan, D.W. Nychka, R.D. Wolfinger, S.S. Young; Professors Emeriti: B. Bhattacharyya, C. Brownie, F.G. Giesbrecht, H.J. Gold, A.H.E. Grandage, T. Johnson, L.A. Nelson, C.H. Proctor, C.P. Quesenberry, J.O. Rawlings, D.L. Ridgeway, R.G.D. Steel, W. Swallow, J.L. Wasik, O. Wesler; Associate Professors: M. Fuentes, S. Ghosal, D. Martin, S.V. Muse, J.A. Osburne, T.W. Reiland, C.E. Smith, D. Zhang; Teaching Associate Professor: P.J. Arroway; Adjunct Associate Professors: H.X. Barnhart, A.S. Kosinski; Associate Professor Emeritus: A.C. Linnerud; Assistant Professors: H.D. Bondell, K. Gross, L. Li, W. Lu, E.A. Stone, A. Motsinger, J. Tzeng, H. Wang, H. Zhang; Research Assistant Professor: C. Arellano, D.M. Nielsen; Teaching Assistant Professors: J.R. Thompson, K.S. Weems, R. Woodard; Adjunct Assistant Professors: G. Bobashev, S.R. Browning, M.G. Ehm, J.S. Kimbell, M.W. Lutz, E.R. Martin; Assistant Professor Emeritus: B.J. Stines; Visiting Lecturer: W.F. Hunt; Senior Statistician: S.B. Donaghy

Statistics is the body of scientific methodology that deals with the logic of experiment and survey design, the efficient collection and presentation of quantitative information, and the formulation of valid and reliable inferences from sample data. The Department of Statistics provides instruction, consultation, and computational services on research projects for other departments of all colleges at North Carolina State University including the Agricultural Research Service. Department staff are engaged in research in statistical theory and methodology. This range of activities furnishes a professional environment for training students in the use of statistical procedures in the physical, biological and social sciences and in industrial research and development. The Department of Statistics is part of the Institute of Statistics, which includes Department of Biostatistics and Statistics at Chapel Hill.

Opportunities

The importance of sound statistical thinking in the design and analysis of quantitative studies is reflected in the abundance of job opportunities for statisticians. Industry relies on statistical methods to control the quality of goods in the process of manufacturing and to determine the acceptability of goods produced. Statistical procedures based on scientific sampling have become basic tools in such diverse fields as weather forecasting, environmental monitoring, opinion polling, crop and livestock estimation, market research, and business trends prediction. The development and testing of new drugs and therapies requires statistical expertise, and

College of Physical and Mathematical Sciences

advances in genomic science provide tremendous opportunities for statistical work. Because one can improve the efficiency and use of increasingly complex and expensive experiment and survey data, the statistician is in demand wherever quantitative studies are conducted.

Scholarships and Awards

The Department of Statistics recognizes the importance of superior academic performance through the awarding of scholarships and certificates of merit. Scholarships are available for the freshman year for the purpose of attracting academically superior students. There are four named departmental scholarships: John L. Wasik Freshman Scholarship, Francis E. McVay Scholarships, Dr. Jackson A. and Viola H. Rigney Scholarship and SAS Institute Scholarships. The department's NSF Computation for Undergraduate Statistics Program (CUSP) and NSF-VIGRE traineeships provides advanced training and support for outstanding juniors and seniors. The North Carolina State University chapter of Mu Sigma Rho, the national statistics honorary fraternity, accepts as members students who have had superior performance in statistics courses. Also, outstanding senior statistics students are recognized through the awarding of engraved plaques.

Honors Program

The Department of Statistics allows exceptional undergraduate students to design a program of study that typically includes advanced courses not ordinarily taken by statistics majors and one or two semesters of independent study or research. Students in the program complete a minimum of 9 credit hours in courses drawn from at least two of the following three categories: MA 425, MA 426, or other courses designated as appropriate by the honors adviser, 500-level courses in statistics or mathematics, and 400- or 500-level courses in independent study. Interested students should contact the Honors Adviser in the statistics department for additional information.

Curricula

The undergraduate curriculum provides basic training for a career in statistics or for graduate study and leads to the Bachelor of Science in Statistics. In addition to statistics, the curriculum includes study in mathematics, computer science, and the biological/physical sciences. While fulfilling their major elective requirements, students can either elect a minor or distribute their study across disciplines exploring the application of statistics in other fields such as agriculture and life sciences, computer science, economics and business, industrial engineering, and the social sciences. A cooperative work-study option is also available.

The Department of Statistics also advises students in the Environmental Sciences, Statistics Concentration major. The environmental sciences, whether concerned with basic research or monitoring the status of environmental health, are heavily involved in experimental and/or sampling design, collection of data, data analysis and interpretation. Statistics is the science of designing efficient studies for the collection of data to address specific research questions, and the analysis of these data to provide understanding of the nature of the process or population under study. It is important that environmental scientists be aware of the role of statistics in research and be familiar with basic statistical methods in order to properly plan and execute these studies. The Statistics Concentration will prepare students to become a full member of an interdisciplinary research team attacking an environmental problem. Successful completion of the B.S. in Environmental Sciences, Statistics Concentration will prepare students to perform at the junior statistician level or for graduate study.

Specific curriculum requirements are available online: www.ncsu.edu/registrar/curricula.

Minor in Statistics

The Department of Statistics offers a minor in statistics to majors in any field except statistics. The importance of statistical reasoning to solve real world problems has been recognized by the business, government, and scientific communities. This minor program will provide students with an opportunity to become competent in the use of statistical methods to summarize information and/or provide answers to policy/research questions. Students completing this program of study will also be provided with experience in statistical computing. The typical minor program consists of the successful completion of ST 301-302, ST 371-372 or ST 421-422, and one other approved Department of Statistics course with a grade of C or better in each course. Other sets of five courses may be acceptable; see the Director of Undergraduate Programs.