# Supportive Courses

The following courses are offered by departments in liberal arts and sciences to graduate students and qualified undergraduates. Graduate students who intend to use them as an integral part of their degree program should consult both their graduate advisor and the chair of the department concerned.

## Geological Sciences (Earth Science)

**GES 505 Field Observation in Natural History**
**4 hrs.**
For non-majors: field oriented investigation of diverse topographic forms, mountain structures, and materials composing the earth. Develops understanding of rapidly deteriorating environment through observation of geophysical, astronomical, and biological variations. One week of classes; three week bus trip to marine station, and return. Not open to undergraduate geological sciences majors.

**GES 546 Groundwater Hydrology and Hydraulics**
**3 hrs.**
Groundwater in the hydrological cycle, fundamentals of groundwater flow; flow net analysis; steady-state and transient well testing techniques for parameter estimation; multiple well systems; leaky aquifers; sea water intrusion; groundwater investigation; artificial recharge of aquifers, design of wells; subsidence and lateral movement of land surface due to groundwater pumping. Design and computer applications. Cross listed as CE 546. Prerequisites: CE 202, 304, or consent of instructor.

**GES 691 Directed Study in Geological Sciences**
**1-4 hrs.**
Projects designed to supplement departmental offerings in geological sciences. Prerequisite: consent of instructor.

## History

**HIS 505, 506 Seminar in Directed Reading**
**1-3 hrs. each**
Program of directed readings; analysis, synthesis, and interpretation of materials. Prerequisites: senior or graduate standing; 15 hrs. of college-level history with at least a B average; consent of department chair.

**HIS 507, 508 Area Study in Directed Reading**
**1-3 hrs. each**
Projects and readings in area studies; e.g. Asia, Russia, Africa, or South America. Prerequisites: 15 hours of college-level history with at least a B average; consent of department chair.

## Mathematics

**MTH 501 Topics in Applied Mathematics I**
**3 hrs.**
Theory, applications, and algorithms for basic problems of modern applied mathematics. Symmetric linear systems, minimum principles, equilibrium equations, calculus of variations, orthogonal expansions, and complex variables. Prerequisite: MTH 224 or 345.

**MTH 502 Topics in Applied Mathematics II**
**3 hrs.**
Continuation of MTH 501. Selected numerical algorithms: Fast Fourier transform, initial value problems, stability, z-transforms, and linear programming. Prerequisite: MTH 501 or consent of instructor.

**MTH 503 Complex Variables II**
**3 hrs.**
Continuation of MTH 403. Advanced topics in complex analysis. Prerequisite: MTH 403 or consent of instructor.

**MTH 510 Numerical Methods I**
**3 hrs.**
Introduction to numerical and computational aspects of various mathematical topics: finite precision, solutions of non-linear equations, interpolation, approximation, linear systems of equations, and integration. Cross listed as CS 510. Prerequisites: CS 104 or 106; MTH 207 and 223.

**MTH 511 Numerical Methods II**
**3 hrs.**
Continuation of CS/MTH 510: further techniques of integration, ordinary differential equations, numerical linear algebra, nonlinear systems of equations, boundary value problems, and optimization. Cross listed as CS 511. Prerequisites: MTH 224 or 345; CS/MTH 510.

**MTH 514 Partial Differential Equations**
**3 hrs.**
Fourier series and applications to solutions of partial differential equations. Separation of variables, eigenfunction expansions, Bessel functions, Green's functions, Fourier and Laplace transforms. Prerequisite: MTH 224 or 345.

**MTH 515 Finite Element Analysis**
**3 hrs.**
Mathematics of finite elements, variational and residual methods, error analysis, element analysis, ordinary and partial differential equations, various boundary conditions, and selected applications. Prerequisite: MTH 224 or 345.

**MTH 590 Special Topics**
**3 hrs.**
Topics of special interest which may vary each time course is offered. Topic stated in current Schedule of Classes. Prerequisite: consent of instructor.

# Philosophy

**PHL 551, 552 Readings in Philosophy**
**1-3 hrs. each**
Directed individual study. Prerequisites: 6 hours in philosophy; senior or graduate standing; consent of department chair.

# Physics

**PHY 501 Quantum Mechanics I**
**3 hrs.**
Inadequacies of classical physics when applied to problems in atomic and nuclear physics. Development of mathematical formalism used in basic quantum theory. Applications to simple models of physical systems. Prerequisites: PHY 202, 301, 306; consent of instructor. MTH 207 recommended.

**PHY 502 Quantum Mechanics II**
**3 hrs.**
Mathematical formalism of quantum mechanics. Applications to problems of electron spin and many-particle systems. Development of approximation techniques with applications to complex physical systems. Prerequisite: PHY 501.

**PHY 539 Topics in Theoretical Physics**
**3 hrs.**
Topics of special interest which may vary each time course is offered. Topic stated in current Schedule of Classes. Prerequisites: PHY 301, 305, 501; or consent of instructor.

**PHY 541 Physics Basics**
**2 hrs.**
Numerical and graphical analysis of data; basic mechanics including Newton's laws and gas laws; hydrostatics and hydrodynamics; energy conservation principles; thermal physics; electricity and magnetism; and solubility and transport processes. Only students in the Nurse Administered Anesthesia Program may register.

**PHY 545 Biophysics**
**3 hrs.**
Applications of physics principles and methods to investigation of biological systems. Emphasis on physical environmental effects on biological systems. Cross listed as BIO 545. Prerequisites: PHY 108 or 201; senior standing; or consent of instructor. PHY 345 recommended.

**PHY 555 Independent Readings**
**1-3 hrs.**
Individually assigned reading assignments of relevant topics in physics or astronomy. Prerequisites: senior or graduate student standing; background appropriate to the study; consent of instructor.

**PHY 563 Special Problems in Physics**
**1-3 hrs.**
Qualified students work on an individually assigned problem and prepare oral and written reports on the problem solution. Approved for off-campus programs when required. May be repeated for a maximum of 6 hours credit. Prerequisites: physics preparation sufficient for the problem; consent of instructor and Department Chair.

**PHY 568 Condensed Matter Physics**
**3 hrs.**
Introduction to the physics of the solid state and other condensed matter especially for students of physics, materials science, and engineering; structure of crystals; molecular binding in solids, thermal properties, introduction to energy band structure and its relation to charge transport in solids; semiconductors; superconductivity. Prerequisites: PHY 202 or 303; MTH 224; consent of instructor.

**PHY 699 Thesis**
**1-6 hrs.**
Research and thesis preparation. Open to students in the MNS program only. Repeatable for up to 6 hours credit. A student can receive no more than a total of 6 hours credit in BIO 699 or CHM 699 or PHY 699. Prerequisite: consent of program coordinator.

# Political Science

**PLS 583, 584 Reading in Political Science**
**1-3 hrs. each**
Individual in-depth work on a subject approved and supervised by a PLS faculty member. For highly qualified students. Prerequisites: senior standing; political science major; consent of instructor.

# Psychology

**PSY 681, 682 Readings I, II**
**1-3 hrs. each**
Readings in area selected by student. Prerequisites: graduate standing and prearrangement with instructor.

**PSY 691, 692 Research I, II**
**1-3 hrs. each**
Research in area selected by student. Prerequisites: graduate standing and prearrangement with instructor.

# Sociology

Undergraduate registration in any 500-numbered course requires the permission of the chair of the sociology department.

**SOC 571 Field Studies**
**1-3 hrs.**
Individual research. Prerequisite: senior or graduate standing and consent of department chair.