

# Course Numbers and Abbreviations

Check the University Catalogs website at [www.catalogs.umn.edu](http://www.catalogs.umn.edu) for the most current course information. The courses in this catalog are not offered every semester. To find out whether a course is offered during a particular semester, consult the online *Class Schedule* at [onestop.umn.edu/registrar/registration/courses.html](http://onestop.umn.edu/registrar/registration/courses.html).

## Course Designators

In conjunction with course numbers, departments and programs are identified by a 2-, 3-, or 4-letter designator prefix (e.g., CE for Civil Engineering, POL for Political Science, ECON for Economics). When no designator precedes the number of a course listed as a prerequisite, that prerequisite course is in the same department as the course being described.

## Course Numbers

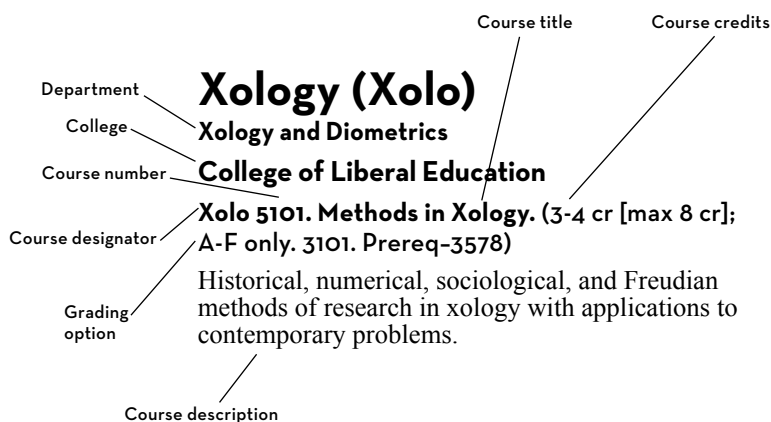
- 0xxx** ..... Courses that do not carry credit toward any University degree.
- 1xxx** ..... Courses primarily for undergraduate students in their first year of study.
- 2xxx** ..... Courses primarily for undergraduate students in their second year of study.
- 3xxx** ..... Courses primarily for undergraduate students in their third year of study.
- 4xxx** ..... Courses primarily for undergraduate students in their fourth year of study; graduate students may enroll in such courses for degree credit. 4xxx courses can be counted for a Graduate School degree if the course is taught by a member of the graduate faculty or an individual appointed to Limited Teaching Status (LTS).
- 5xxx** ..... Courses primarily for graduate students; undergraduate students in their third or fourth year may enroll in such courses.

## Abbreviations

The following abbreviations are used throughout the course prerequisites of most University catalogs to denote common and recurring items of information.

- Prereq** ..... Course prerequisites.
- cr** ..... Credit.
- div** ..... Division.
- DUS** ..... Director of undergraduate studies.
- equiv** ..... Equivalent.
- fr, soph, jr, sr** ..... Freshman, sophomore, junior, senior.
- H** ..... Honors. Courses with an H following the course number satisfy honors requirements.
- V** ..... Honors and Writing Intensive. Courses with a V following the course number satisfy both honors and liberal education writing intensive requirements.
- W** ..... Writing Intensive. Courses with a W following the course number satisfy the writing intensive requirement for liberal education.
- A-F only** ..... A-F grade basis only; course may not be audited or take pass/fail
- A-F or Aud** ..... A-F grade basis, or course may be audited for no grade
- S-N only** ..... S-N grade basis only (pass/fail), course may not be audited or taken A-F
- S-N or Aud** ..... S-N grade basis (pass/fail), or course may be audited for no grade
- No Grade** ..... No grade will be given for the course; typically used for laboratory components of courses
- OPT No Aud** ..... Student selects the grading option; course may not be audited
- Stdnt Opt** ..... Student selects the grading option; course may be audited

## Course Listing Sample



**Biochemistry (BIOC)**

**BIOC 3321. Biochemistry.** (3 cr. ; A-F or Audit; Every Fall & Spring)  
Structure and function of biomolecules: carbohydrates, lipids, nucleic acids and proteins. Protein function and enzyme catalysis. Bioenergetics: Glycolysis, gluconeogenesis and pentose phosphate pathway. Principles of metabolic regulation. The citric acid cycle. Catabolism of lipids and amino acids. Oxidative phosphorylation. Biosynthesis of lipids and carbohydrates. Introduction to hormonal regulation and integration of metabolism. prereq: BIOL 2311, CHEM 2231, CHEM 2333 or instr consent

**Biology (BIOL)**

**BIOL 2311. Integrative Biology.** (BIOL,TS; 5 cr. ; A-F or Audit; Every Spring)  
Introduction to core biological concepts, from biomolecules to complex systems. How principles from biochemistry, cellular/molecular biology, genetics/diversity, and evolution contribute to understanding of complex systems. Problem solving, applications to health sciences. Lab. prereq: [Grade of at least C- in [[MATH 1161 or equiv], [CHEM 1231 or equiv]]] or placement test

**BIOL 2331. Anatomy and Physiology I.** (BIOL; 4 cr. ; A-F or Audit; Every Fall) Shape, structure, and function of human body and its parts. Basic anatomy, structure, and function of body systems and special senses. Concepts/principles of body organization, histology, and hematology. Case studies, lab. prereq: Grade of at least C- in 2311 or placement test

**BIOL 2332. Anatomy and Physiology II.** (4 cr. ; A-F or Audit; Every Spring)  
Shape, structure, and function of human body and its parts. Basic anatomy, structure, and function of body systems and special senses. Concepts/principles of body organization, histology, and hematology. Case studies, lab. prereq: Grade of at least C- in 2331 or placement test

**BIOL 3311. Molecular Genetics.** (BIOL,TS; 3 cr. ; A-F or Audit; Every Fall)  
Advanced introduction to genetic information, molecular aspects of inheritance and disease; gene expression and regulation in cells/organisms; population genetics; mutation and molecular evolution; genome analysis; and pedigree construction. Emphasizes human genetics. Incorporates ethical, social and legal perspectives relevant to advances in genetic technology and increasing availability of human genetic information. prereq: 2311, CHEM 1231, CHEM 2331

**BIOL 3344. Microbiology.** (ENV; 4 cr. ; A-F or Audit; Every Fall & Spring)  
Microbiology examines the anatomy, biochemistry, genetics, immunology, and pathogenesis of microorganisms with an emphasis on bacteria and viruses. Students examine the dynamic impact of microbes

on humans and the role of microbes in the environment. prereq: [Grade of at least C- in [[2311 or equiv], [CHEM 1231 or equiv], [MATH 1110 or equiv]]]

**BIOL 4312. Advanced Topics in Molecular and Cellular Biology and Genetics.** (4 cr. ; A-F or Audit; Periodic Fall)  
Molecular biology of prokaryotic and eukaryotic cells. Structure of genes and chromosomes. Mechanisms of DNA replication, transcription, translation. Regulation of gene expression. Processes fundamental to cells. Assembly/function of membranes/organelles. Cell division, cell form/movement, intercellular communication, transport, secretion pathways. Emphasis on molecular basis of cell functions. Lab. prereq: 3311, concurrent registration is required (or allowed) in BIOC 3321

**BIOL 4342. Neuroscience.** (3 cr. ; A-F or Audit; Every Fall)  
Investigation into principles of brain function from neurons to behaviors within the context of current technological advances in studies of the brain and nervous system. prereq: 2331; [2332 or 3311 or BIOC 3321]; or instr consent

**BIOL 4364. Immunology.** (3 cr. ; A-F or Audit; Every Spring)  
The general properties of the human immunology system including: the participating tissues and cells, the general mechanism of the innate and adaptive immune systems, the development and deployment of "self" vs "non-self" and practical applications of immunology. prereq: 2332; [[3341 and 3345] or BIOC 3321]; or instr consent

**BIOL 4721. Special Topics in the Life Sciences.** (TOPICS; 1-4 cr. [max 8 cr.] ; A-F or Audit; Periodic Fall & Spring)  
In-depth study of special topics in the life sciences. prereq: instr consent; repeated enrollment allowed only if topics are different

**Biomed Inform & Comput Biology (BICB)**

**BICB 5620. Topics in Biomedical Informatics and Computational Biology.** (TOPICS; 0.5-4 cr. [max 24 cr.] ; Student Option; Every Fall, Spring & Summer)  
Each section corresponds to a Mayo 5XXX and 6XXX course. prereq: BICB grad student, permission of DGS

**BICB 8333. FTE: Master's.** (1 cr. ; No Grade Associated; Every Fall, Spring & Summer)  
TBD prereq: Master's student, adviser consent, DGS consent

**BICB 8401. Ethics in Bioinformatics and Computational Biology.** (1 cr. ; Student Option; Every Fall)  
Ethics of scientific investigation. Ethical conduct related to the scientific enterprise. Discussions on ethical topics related to bioinformatics data.

**BICB 8444. FTE: Doctoral.** (1 cr. ; No Grade Associated; Every Fall, Spring & Summer)

TBD prereq: Master's student, adviser consent, DGS consent

**BICB 8510. Computation and Biology.** (2 cr. [max 4 cr.] ; A-F only; Every Fall & Spring)  
Course taught in modular form. Overview of topics in, for instance, molecular biology and genetics; mathematics, statistics and biostatistics; programming in FORTRAN and C/C++; programming in Perl; data management; data mining. prereq: BICB grad student or instr consent

**BICB 8620. Topics in Biomedical Informatics and Computational Biology.** (TOPICS; 0.5-4 cr. [max 24 cr.] ; Student Option; Every Fall, Spring & Summer)  
Each section corresponds to a Mayo 8XXX course. prereq: BICB grad student, permission of DGS

**BICB 8666. Doctoral Pre-Thesis Credits.** (1-6 cr. [max 12 cr.] ; No Grade Associated; Every Fall, Spring & Summer)  
Doctoral Pre-Thesis Credits prereq: Doctoral student who has not passed prelim oral; no required consent for 1st/2nd registrations, up to 12 combined cr; dept consent for 3rd/4th registrations, up to 24 combined cr; doctoral student admitted before summer 2007 may register up to four times, up to 60 combined cr

**BICB 8670. Topics in Management of Technology.** (TOPICS; 0.5-4 cr. [max 24 cr.] ; Student Option; Every Fall, Spring & Summer)  
Each section of this course corresponds to one of the MOT courses. prereq: BICB grad student, DGS consent

**BICB 8777. Thesis Credits: Master's.** (1-18 cr. [max 50 cr.] ; No Grade Associated; Every Fall, Spring & Summer)  
TBD

**BICB 8888. Thesis Credit: Doctoral.** (1-24 cr. [max 100 cr.] ; No Grade Associated; Every Fall, Spring & Summer)  
TBD

**BICB 8920. BICB Colloquium.** (1 cr. [max 2 cr.] ; S-N only; Every Fall & Spring)  
Weekly colloquium. Features research talks. prereq: BICB grad student

**BICB 8930. BICB Journal Club.** (1 cr. [max 4 cr.] ; S-N only; Every Fall & Spring) Weekly seminar. Journal articles presented by participants. prereq: BICB grad student or instr consent

**BICB 8932. Proposal Writing Seminar.** (1 cr. ; S-N only; Every Spring)  
Process of developing/writing research proposal that serves as basis for preliminary written exam in BICB graduate program. prereq: BICB PhD student or instr consent

**BICB 8940. Education and Pedagogy Seminar.** (1 cr. [max 4 cr.] ; S-N only; Every Fall & Spring)  
Offered jointly with Center for Learning Innovation (under development at UMR). Pedagogical approaches based on cognitive science research. Current/past literature on how our understanding of learning has shaped

classroom teaching. prereq: BICB grad student or instr consent

**BICB 8960. Internship.** (1-6 cr. [max 12 cr.] ; S-N only; Every Fall & Spring)  
tbd prereq: BICB Ph.D. student

**BICB 8970. Entrepreneurship and Leadership Seminar.** (1 cr. ; S-N only; Every Spring)

Students will be introduced to aspects of entrepreneurship and leadership primarily in the context of clinical and translational research, such as data confidentiality, policies, challenges to bring research to the market, or federal funding trends. The seminar includes guest speakers. prereq: BICB graduate student or instructor permission

**BICB 8990. Seminar on Current Topics.** (TOPICS, ONLINE, 12; 1 cr. [max 4 cr.] ; Student Option; Periodic Fall, Spring & Summer)  
Current topics in biomedical informatics and computational biology. prereq: BICB grad student or instr consent

**BICB 8991. Independent Study.** (1-2 cr. [max 4 cr.] ; S-N only; Every Fall, Spring & Summer)  
Individual reading on specialized topics. prereq: BICB grad major

**BICB 8994. Directed Research.** (1-3 cr. [max 6 cr.] ; S-N only; Every Fall, Spring & Summer)  
Course used to develop a research project prior to enrolling in thesis credits. Project may lead to thesis research. prereq: BICB grad student or instr consent

## Center for Learning Innovation (CLI)

**CLI 1196. National Student Exchange: Plan A.** (0 cr. ; S-N only; Every Fall, Spring & Summer)  
National Student Exchange enrollment; off-campus study.

**CLI 1296. National Student Exchange: Plan B.** (0 cr. ; S-N only; Every Fall, Spring & Summer)  
National Student Exchange enrollment; off-campus study.

**CLI 1393. Directed Study.** (1-3 cr. [max 6 cr.] ; Student Option; Every Fall, Spring & Summer)  
Individual study on selected topics or problems. prereq: instr consent, dept consent

**CLI 1711. University Experience I.** (1 cr. ; S-N or Audit; Every Fall)  
Orientation to University environment and skills required to be successful in the transition to college. Students will explore themes of personal responsibility, diversity, and self-awareness. Students will develop skills in time management; financial management; academic strategies; physical, mental, and sexual health; and conflict resolution. prereq: Admitted to Bachelor of Science in Health Sciences (BSHS)

**CLI 1712. University Experience II.** (1 cr. ; S-N or Audit; Every Spring)

Exploration of strengths and values in understanding self. Students will take a strengths-based approach to academics, teams and relationships, and an introduction to a wide array of health careers. Students will also explore themes of self-awareness in relation to diversity and difference, beliefs, and making meaning of the college experience. prereq: 1711 or instr consent

**CLI 2522. Community Collaboratory.** (3 cr. ; A-F only; Every Fall & Spring)

The academic goal of this course is to extend the student learning experience into the local community. Responding to needs identified by local public, private, and nonprofit organizations, students will confront the challenges present in complex human systems and contribute to projects aimed at improving the quality of life in Southeastern Minnesota. In doing so, students participate in sustainable and meaningful partnerships between the University of Minnesota Rochester and the surrounding community. Students will also have the opportunity to build relationships with people of different backgrounds and life experiences, to broaden their worldview, to critically and creatively examine community concerns, and to discover their own capacity to affect change in the world around them.

**CLI 2713. Career Exploration in the Health Sciences.** (1 cr. ; S-N or Audit; Every Fall & Spring)

Through this course students will explore diverse career fields through exposure to health professionals and health professional settings. Students will develop the skills to write effective resumes and cover letters, as well as networking and interviewing skills. Continuing education options and capstone information will also be shared throughout the course. prereq: 1712 or instr consent

**CLI 3393. Directed Study.** (1-3 cr. [max 6 cr.] ; Student Option; Every Fall, Spring & Summer)  
Individual study on selected topics or problems. Emphasizes selected readings, use of scientific literature. prereq: instr consent, dept consent

**CLI 3394. Directed Research.** (1-6 cr. ; Student Option; Every Fall, Spring & Summer)  
Individual research on selected topics or problems. prereq: instr consent, dept consent

**CLI 3496. Internship: Professional Experience.** (1-6 cr. [max 12 cr.] ; S-N or Audit; Every Fall, Spring & Summer)  
Matches student's academic/career goals with opportunities in industry, nonprofit organizations, and government agencies. prereq: instr consent, dept consent, acceptance of internship proposal

**CLI 3711. Career Preparation.** (TOPICS; 1 cr. [max 4 cr.] ; S-N or Audit; Every Fall & Spring)  
Diverse fields of life/health sciences. Integration across disciplines. Career planning. Student development. Communication. Effective leadership. Preparation for diverse careers in life/health sciences and health care sector. prereq: CLI 2712 or instr consent

**CLI 3712. Capstone Proposal Writing.** (1 cr. ; S-N or Audit; Every Fall & Spring)

This course focuses on all aspects of writing and submitting the Capstone Proposal for the BSHS degree. Students will propose a set of learning experiences which connect to a holistic theme. Proposals must include a minimum of 6 and maximum of 30 upper-division academic credits and may also include non-credit based opportunities. Capstone Proposals are reviewed by the CLI Faculty and must be approved before Capstone experiences can begin. prereq: 2713 or instr consent

**CLI 3950. Special Topics.** (TOPICS; 1-3 cr. [max 6 cr.] ; Student Option; Every Fall, Spring & Summer)

In-depth study of special topic related to health sciences.

**CLI 4393. Capstone Directed Study.** (1-3 cr. [max 6 cr.] ; S-N only; Every Fall & Spring)

Individual study on selected topics or problems. Emphasizes selected readings and/or use of scientific literature. Must be part of an approved capstone. prereq: instr consent, dept consent

**CLI 4496. Capstone Internship.** (1-12 cr. [max 36 cr.] ; S-N only; Every Fall, Spring & Summer)

Experience in industry, nonprofit organization, or non-government agency. prereq: [concurrent registration is required (or allowed) in 4711 or 4712], acceptance of capstone proposal

**CLI 4696. Capstone Research Experience.** (1-12 cr. [max 24 cr.] ; S-N or Audit; Every Fall, Spring & Summer)

Research experience in academic or clinical setting. prereq: [concurrent registration is required (or allowed) in 4712 or 4712], acceptance of capstone proposal

**CLI 4711. Capstone Reflections I.** (ONLINE; 1 cr. ; S-N only; Every Fall, Spring & Summer)

This course represents the seventh part in a series of professional development courses that intentionally integrates student life, the curriculum, and career exploration to facilitate student growth and professional development. The purpose of this course is to participate in, observe, analyze and interpret your capstone experience. To illustrate your growth, you will record your observations and analysis throughout the semester. prereq: 3712 or instr consent

**CLI 4712. Capstone Reflections II.** (ONLINE; 1 cr. ; S-N only; Every Fall, Spring & Summer)

This course represents the eighth part in a series of professional development courses that intentionally integrates student life, the curriculum, and career exploration to facilitate student growth and professional development. The purpose of this course is to participate in, observe, analyze and interpret your capstone experience. To illustrate your growth, you will present your capstone portfolio in a research paper or public presentation. prereq: 4711 or instr consent

**CLI 4713. Capstone Reflections I and II.** (2 cr. ; S-N only; Every Fall, Spring & Summer)

This course represents a combined version of the seventh and eighth parts of a series of professional development courses that intentionally integrates student life, the curriculum, and career exploration to facilitate student growth and professional development. The purpose of this course is to participate in, observe, analyze and interpret your capstone experience. To illustrate your growth, you will record your observations and analysis throughout the semester and present your capstone portfolio in a research paper public presentation. This course is accelerated and requires special permission; it may only be taken if your capstones activities do not span two semesters.

**CLI 4896. Capstone Certificate in Health Professions.** (1-15 cr. [max 30 cr.]; Student Option; Every Fall, Spring & Summer) Enrollment in certificate program courses in a health profession. prereq: [concurrent registration is required (or allowed) in 4711 or concurrent registration is required (or allowed) in 4712], acceptance of capstone proposal, full-time enrollment in certificate program

**CLI 4950. Special Topics.** (TOPICS; 1-3 cr. [max 6 cr.]; A-F or Audit; Every Fall, Spring & Summer) In-depth study of special topic related to BSHS program. prereq: instr consent, dept consent

## Chemistry (CHEM)

**CHEM 1231. Organic Chemistry I.** (PHYS; 4 cr. ; A-F or Audit; Every Fall) Introduction to organic chemistry. Atomic theory of matter. Reaction stoichiometry, bonding, hybridization, functional groups, IR spectroscopy, thermochemistry, organic acids/bases, stereochemistry. Conformational analysis of cycloalkanes. Chemical kinetics. Classification of organic reactions. Aliphatic nucleophilic substitution reactions. Biological examples. Lab. prereq: concurrent registration is required (or allowed) in MATH 1161, [high school chemistry or equiv preferred and three years high school math required]

**CHEM 2231. Organic Chemistry II.** (4 cr. ; A-F or Audit; Every Spring) Study of organic reactions (addition/elimination reactions, chemistry of carbonyl compounds, aromatic electrophilic substitution, rearrangements, oxidations and reductions); Biological examples. Introduction to the use of spectroscopic tools in structure elucidation (nuclear magnetic resonance, mass spectroscopy, Infrared and electronic absorption spectroscopy); Organic polymers and biologically important classes of organic compounds such as lipids, carbohydrates, amino acids, peptides, proteins, and nucleic acids; Lab. prereq: Grade of at least C- in 1231, concurrent registration is required (or allowed) in BIOL 2311

**CHEM 2331. General Chemistry I.** (4 cr. ; A-F or Audit; Every Fall) SI units, factor conversion and essential physical magnitudes. Structure, properties and behavior of gases, liquids and solids.

Ideal gases. Thermochemistry. Nature of light and quantum atomic theory. Periodic table and periodic trends. Chemical bond and molecular structure. Intermolecular interactions and phase change. Solution chemistry and stoichiometry. Chemical equilibrium. Acid-base reactions. Chemical applications to Health Sciences. Lab. prereq: Precalculus or equivalent; grade of at least C- in MATH 1161; BIOL 2311; 1231

**CHEM 2333. General Chemistry II.** (4 cr. ; A-F or Audit; Every Spring) Chemical kinetics and nuclear chemistry. Chemical thermodynamics and spontaneity of processes. Electrochemistry and redox reactions. Complex acid-base chemical equilibria: Acid-base buffers, titration curves and polyprotic acids. Equilibria of partially soluble substances. Coordination chemistry: structure and equilibria. Crystal field theory of coordination compounds. Experimental laboratory of General Chemistry. prereq: 2231; 2331; MATH 1171

**CHEM 4331. Chemical Biology/Bioorganic Chemistry.** (3 cr. ; A-F or Audit; Every Spring) Topics include: Chemical control of signal transduction; Polyketide biosynthesis; Non-natural amino acid insertion into proteins (in vivo nonsense suppression); Non-ribosomal peptides; Organic chemistry of polymerase chain reaction; Protein backbone modification - secondary structure stabilization; Chemical biology of fluorescent proteins. DNA binding antibiotics; DNA backbone modification; RNAi; Cell surface engineering through oligosaccharide biosynthesis. prereq: C- or better in 2231; Recommended BIOC 3321

**CHEM 4333. Physical Chemistry.** (3 cr. ; A-F or Audit; Every Spring) Statistical mechanics to understand macroscopic description of chemical phenomena: molecular energy levels, Boltzmann factor and partition functions. Chemical thermodynamics, phase equilibria, liquid-liquid solutions and chemical equilibria. Introduction to molecular spectroscopy. Principles of nuclear magnetic resonance spectroscopy. prereq: concurrent registration is required (or allowed) in MATH 2171, [Grade of at least C- in [2333], [PHYS 2251], [MATH 1171]];

**CHEM 4721. Special Topics in Chemistry.** (TOPICS; 1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring) In-depth study of special topics in chemistry. prereq: instr consent; repeated enrollment allowed only if topics are different

## Echocardiography (ECHO)

**ECHO 3011. Foundations of Echocardiography.** (TS; 4 cr. ; A-F only; Every Fall) The intent of this course is to provide the student with a basic knowledge of performing an echocardiographic exam including two-dimensional imaging, Doppler, Color Flow imaging, patient care, transducer placement, imaging skills, assessment of systolic and

diastolic function by echocardiography, basic instrumentation of ultrasound physics and echocardiographic terminology. Students will participate in scanning labs in preparation for their clinical experience. Two-dimensional (2-D) and Doppler skills and competency testing will be completed during scanning labs. Students will apply 2-D and Doppler echocardiography skills learned in the classroom to echocardiographic exams performed in scanning lab demonstrating an understanding of the clinical application of echocardiography.

**ECHO 3202. Adult Echocardiography.** (6 cr. ; A-F only; Every Spring) The intent of this course is to provide the student with the necessary knowledge of cardiomyopathies, coronary artery disease, and cardiac diseases due to systemic illness, pericardial diseases, systemic and pulmonary hypertension, cardiac tumors and masses, diseases of the great vessels and echocardiographic assessment of valvular heart disease by utilizing 2-D, M-mode, and Doppler techniques.

**ECHO 3301. Clinical Practicum I.** (9 cr. ; A-F only; Every Fall) The intent of this course is to provide the student with an opportunity to perform portions of an echo exam, review position, transducer placement, and terminology in the clinical setting. Two-dimensional (2-D) and Doppler skills learned in Foundations of Echocardiography will be applied in the clinical setting. Clinical Practicum I will provide the student with the opportunity to observe the clinical environment, understand the clinical application of echocardiography, and interact with clinical staff.

**ECHO 3302. Clinical Practicum II.** (7 cr. ; A-F only; Every Spring) The intent of this course is to continue to provide the student with the necessary skills and knowledge to integrate academic and clinical learning. Course content will include review of how to perform a routine two-dimensional, Color Flow, and Doppler echocardiography examination and the development of skills necessary to do a complete hemodynamic and Doppler assessment. Course will use hands-on experience to help develop the skills required to do a hemodynamic assessment.

**ECHO 3403. Echocardiographic Application.** (3 cr. ; A-F only; Every Summer) The intent of this course is to integrate knowledge from previous courses. This course will focus on case reviews and the integration of all 2-D and Doppler data. Students will be able to demonstrate application of echocardiographic data and recognize discrepancies in data, ability to identify key findings, ability to create a preliminary report, and effectively communicate the echo findings to the reviewer.

**ECHO 3503. Stress Echocardiography.** (2 cr. ; A-F only; Every Summer) This course will provide the student with the necessary knowledge regarding common lab

values, ECG, and basis cardiac pharmacology along with a thorough understanding of the different types of stress tests performed in an echocardiographic laboratory and the technical aspects of the digitizing equipment. The role of the sonographer for each procedure will be identified. Students will develop an in-depth understanding of exercise echocardiography and the use of Dobutamine and contrast during a stress echo.

**ECHO 4111. Ultrasound Physics I.** (2 cr. ; A-F only; Every Fall)

This course is designed to introduce the student to basic physics principles and instrumentation used in diagnostic ultrasound. The course will describe basis ultrasound physics principles, formulae and calculations as well as describe ultrasound itself. Key areas to be covered include: the properties of sound waves, principles of reflection, transmission, scattering and refraction; principles of attenuation and components of sound energy loss; transducer construction and function; sound beam anatomy; spatial resolution; transducer array technology; sound beam steering, and focusing. The course goal is to help the student understand the process by which an image is created, and ultimately identify ways to produce an optimal echo image.

**ECHO 4112. Ultrasound Physics II.**

(2 cr. ; A-F only; Every Spring) The course is designed to expand the information learned in Ultrasound Physics I and provide new information regarding theory and operation of diagnostic ultrasound equipment. The course will describe 2-dimensional imaging principles and instrumentation, image storage and display, the Doppler effect, pulsed and continuous wave Doppler generation, spectral analysis and display, color flow imaging, image features and artifacts, quality assurance, bioeffects and safety, and will introduce students to newer technologies including contrast and tissue harmonics, Doppler tissue imaging, and power Doppler. The course goal is to help the student understand the process by which an image is created, Doppler information is generated and displayed, and identify ways to produce high quality, diagnostic echocardiographic information.

**ECHO 4211. Congenital Heart Disease I.** (2 cr. ; A-F only; Every Summer)

The intent of this course is to provide the student with advanced knowledge of anatomy of congenital cardiac abnormalities, adult congenital heart disease (CHD), and follow-up of these patients. Surgical repair and interventional catheterization or methods will be discussed as well as postoperative complications. The student will also be provided necessary information on performing a systematic 2-D, spectral, and Color Flow Doppler examination on a patient with CHD.

**ECHO 4212. Congenital Heart Disease II.** (2 cr. ; A-F only; Every Fall)

The intent of this course is to provide the student with advanced knowledge of acquired congenital cardiac pathologies, adult congenital heart disease (CHD), and follow-up of these

patients. Surgical repair and interventional catheterization or methods will be discussed as well as postoperative complications. The student will also be provided necessary information on performing a systematic 2-D, spectral, and color flow Doppler examination on a patient with CHD.

**ECHO 4303. Clinical Practicum III.** (6 cr. ; A-F only; Every Summer)

Clinical Practicum III will primarily focus on development of students clinical skills for 2-Dimensional and Doppler echocardiography. Clinical Practicum III is devoted to clinical training, allowing students an opportunity to apply didactic classroom instruction and develop their clinical skills. Students will begin to integrate the clinical and echo findings and identify final impressions related to the echo exam. Observational rotations will include intraoperative TEE, Outreach echocardiography, Stress echocardiography, TEE and contrast echocardiography. 3D and strain rate echocardiography and the role of the sonographer for each procedure will also be included in this course. Lab sessions will allow students the opportunity to demonstrate the required skills for 3D and strain rate imaging.

**ECHO 4401. Clinical Practicum IV.** (9 cr. ; A-F only; Every Fall)

Clinical Practicum IV will continue to develop the student's clinical skills to complete an optimal echocardiographic hemodynamic assessment. The focus of the term will be the ability to integrate 2-D and echo data in an accurate patient report. Clinical Practicum IV will introduce students to congenital echocardiography, to the field of stress echocardiography, and to echocardiographic research.

**ECHO 4402. Clinical Practicum V.**

(10 cr. ; A-F only; Every Spring) During Clinical Practicum V, the students will apply previous didactic and clinical training to complete a quality echocardiographic examination. Students will be responsible for integrating echo data, preparing preliminary echo findings and delivering the report.

**ECHO 4501. Research Project and**

**Publication I.** (1 cr. ; A-F only; Every Spring) Students will be responsible for devising, developing and undertaking a research project which would be suitable for submission either to a scientific meeting or for publication. This will include developing a research question, devising and submitting a research protocol, reviewing related literature, and reporting the findings in abstract, paper, and/or a short oral presentation. Research mentors will be assigned to allow guided independent study.

**English: Literature (ENGL)**

**ENGL 1433. Introduction to Literature.**

(LITR; 3 cr. [max 6 cr.] ; A-F or Audit; Every Fall & Spring) Introduces literary genre and critical thinking. Focuses on the relationship between language and meaning in social and historical contexts.

Emphasizes integration with sciences and relationship to health sciences.

**ENGL 3471. Literatures of Diversity.** (DSJ; 3 cr. ; A-F only; Every Spring)

Historical/contemporary analysis of the development of selfhood and identity in and across literatures of diverse populations and cultures. The course could address concerns that may include, but are not limited to race, gender, sexuality, ethnicity, religion, and issues of power/privilege. prereq: [1431 or 1433 or 1435] or instr consent

**ENGL 3481. Technology and Society.** (TS; 3 cr. ; A-F only; Fall Even Year)

Historical/contemporary analysis of technology. The course explores ways in which technology influences, and is influenced by, cultures and their values and how technology figures in modes of truth production. The course could explore perspectives that may include, but are not limited to, the cultural, the philosophical, the historical and the literary. prereq: [1431 or 1433 or 1435] or instr consent

**Health Professions (HP)**

**HP 3021. Patient Care Techniques.**

(ONLINE: 1 cr. ; A-F only; Every Fall & Summer)

This multidisciplinary course uses a blended format to introduce students to the fundamental practice, attitudes, and competencies needed by all health care providers. Professionalism, communication skills, infection control, vital signs, ergonomics, patient safety, medical emergencies, medication, and managing tubes are reviewed. Students will practice general patient care procedures and skills and demonstrate competent performance.

**HP 4802. Health Economics and Finance.**

(DSJ; 3 cr. [max 6 cr.] ; A-F only; Every Spring)

Students will learn micro- and macro-economic theory applied within the healthcare sector. A flow of funds approach explores finances in healthcare transactions and incentives. Historical development of third party reimbursement, healthcare financial structures and mechanisms, individual health and public health factors affecting the delivery system, payment system, and supply/demand system is followed by a wider macroeconomic review to explore factors of change within the healthcare system. National health spending and the role of government and regulators in public and private health will be applied by case study and contemporary readings. The health of individuals and the health of groups will be studied in terms of cost, economic, ethical and socioeconomic disparities, and in non-Western countries. The course aims to make the language of healthcare finance and economics understandable and relevant for students in healthcare professions.

**HP 4902. Management and Leadership in Healthcare.** (GP; 2 cr. [max 4 cr.] ; A-F only; Every Spring)

Students acquire background and skills of business/administrative aspects of healthcare. Applications of business theory are applied to medical settings. Functions of management

organization models, budget and other planning, information systems, human resource functions including staff scheduling, employee evaluation, productivity management, personal accountability, group leadership, external factors including accreditation and non-Western views will be explored. Alternative theories including Systems Thinking will be explored and contrasted with traditional management.

## History (HIST)

### HIST 1435. Introduction to History.

(GP, TOPICS, HIS; 3 cr. ; A-F or Audit; Every Fall & Spring)

How historical knowledge is produced from artifacts (primary sources). Value/limitations of such sources. Approaches to the past. Thinking critically about assumptions/assertions.

## Humanities (HUM)

### HUM 4721. Special Topics in Humanities.

(TOPICS; 3 cr. [max 6 cr.]; A-F or Audit; Periodic Fall & Spring)

In-depth study of special topics in the humanities. prereq: instr consent; repeated enrollment allowed only if topics are different

## Mathematics (MATH)

### MATH 1110. College Algebra with Physical Concepts.

(MATH; 3 cr. ; A-F or Audit; Every Spring)  
The goal of this course is to develop quantitative reasoning skills relevant to number sense, elementary physical concepts, basics of polynomial functions, rational functions, exponential/logarithmic functions, trigonometric functions, graph transformations and introduction to functions of several variables motivated by the exploration of physical sciences concepts. Students learn to model real world situations, simplify expressions and solve equations using mathematical and logical symbols and quantitative techniques and communicate results clearly. This course goes beyond the usual coverage in three-year high school mathematics curriculum. prereq: Three yrs high school math or placement exam;

### MATH 1111. Precalculus with Physical Concepts.

(MATH; 3 cr. ; A-F or Audit; Every Fall & Spring)  
The goal of this course is to make students proficient in quantitative reasoning skills relevant to fundamental algebra concepts, in depth treatment of functions and graphs, polynomial functions, rational functions, exponential/logarithmic functions, trigonometric functions, vectors, matrices and systems of equations with a focus on the use of physical sciences contexts. Students learn to model real world situations, graph, simplify expressions and solve equations using mathematical and logical symbols and quantitative techniques and communicate results clearly. This course goes beyond the usual coverage in three-year high school mathematics curriculum. prereq: Grade of at least C- in [MATH 1110 or equiv] or placement exam;

### MATH 1161. Statistics and Discrete

**Mathematics.** (MATH; 3 cr. ; A-F or Audit; Every Fall)

Data representation/visualization/exploration. Descriptive statistics, hypothesis testing, regression, predictions, clinical studies, counting, elementary probability theory, distributions, graphs, networks. Emphasizes statistical concepts, analysis of authentic data sets, simulations, and model building. prereq: Three yrs high school math or placement exam

### MATH 1171. Calculus, Modeling, and Data

**I.** (MATH; 4 cr. ; A-F or Audit; Every Fall & Spring)

Differential/integral calculus of a single variable. Optimization. Differential/difference equations. Related rates. Applications emphasize biology, health sciences, and integration of data and mathematical models. prereq: Grade of at least C- in 1111 or placement exam or instr consent

### MATH 2161. Bioinformatics and

**Biostatistics.** (MATH; 3 cr. ; A-F or Audit; Every Fall)

Retrieval of gene and protein sequence information from media (online databases, published articles, and other media); Gene and protein structure and function; Sequence recognition; Genome analysis; Sequence alignment; Phylogenetic analysis; Clinical trial and/or experiment design; Nonparametric analysis of clinical trial data; Analysis of variance (ANOVA); Logistic regression of clinical trial data; Survival analysis of clinical trial data. prereq: Grade of at least C- in [1161, BIOL 2311]

### MATH 2171. Calculus, Modeling, and Data II.

(MATH; 4 cr. ; A-F or Audit; Every Spring)

Differential/integral calculus of a single variable. Differential calculus of multiple variables. Systems of differential/difference equations. Matrices. Deterministic/stochastic modeling. Applications emphasize biology, health sciences, and integration of data and mathematical models. prereq: Grade of at least C- in 1171 or placement exam

### MATH 4721. Special Topics in the Mathematical Sciences.

(TOPICS; 1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring)

In-depth study of special topics in the mathematical sciences. prereq: instr consent; repeated enrollment allowed only if topics are different

## Philosophy (PHIL)

### PHIL 1431. Introduction to Philosophy.

(AH; 3 cr. [max 6 cr.]; A-F or Audit; Every Fall)  
Introduction to methods of philosophical analysis. Examines a range of problems relevant to the sciences and to diverse global, cultural, scientific and religious traditions in historical and cultural contexts. Emphasis on critical thinking, communication and relevance to health sciences.

### PHIL 1441. Introduction to Ethics.

(CIV; 3 cr. ; A-F or Audit; Every Spring)

Introduction to the philosophical analysis of ethical problems. Introduces ethical cases and explores methods of analysis and application of these methods to issues affecting people in everyday life. Ethical problems may be drawn from biomedicine, environment, globalization, business and sport. Emphasis on critical thinking and relevance to health sciences. prereq: 1431 or instr consent

### PHIL 3437. History and Philosophy of Science.

(HIS; 3 cr. ; A-F or Audit; Every Spring)  
This course will examine several historical and contemporary philosophical problems that arise within the context of scientific practice. Students will gain an understanding of the nature and historical origin of these problems and learn to critically evaluate possible solutions to these problems. Some of the problems that we will consider include: the nature of scientific explanation, the problem of induction, the problem of theory underdetermination, the social responsibilities of scientists, and scientific realism. prereq: 1431 or 1433 or 1435 or 1441 or instr consent

### PHIL 3441. Ethics of Medicine and the Sciences.

(AH, CIV; 3 cr. ; A-F or Audit; Every Fall)  
This course enables students to engage in far more detailed and rigorous analysis of ethical problems relevant to the health sciences than is possible in introductory level courses. We will analyze problems drawn from law, medicine, healthcare, emerging technologies, and the sciences, using relevant ethical theory and the tools of philosophical argument. prereq: 1441 or instr consent

## Physics (PHYS)

### PHYS 1251. Physics I.

(PHYS; 4 cr. ; A-F or Audit; Every Fall & Spring)  
Fundamental principles of physics. Description of motion, forces, conservation principles. Applications to fluids, oscillations and waves. Ray optics and the eye. Information coding, including sound detection and visual perception. Focuses on biological and medical applications. Lab. prereq: Grade of at least C- in [MATH 1111 or equiv] or [concurrent registration is required (or allowed) in MATH 1171 or equivalent] or MATH 2161

### PHYS 2251. Physics II.

(PHYS; 4 cr. ; A-F or Audit; Every Fall & Spring)  
Fundamental principles of physics. Motion, forces and conservation principles. Applications to thermodynamics/kinetics, mass and heat transport, including osmosis, and diffusion. Electricity/magnetism. Application of electromagnetic radiation to biological systems, including photosynthesis, phototransduction, and x-ray imaging. Quantum mechanics, its application to biological systems. Feedback systems. Focuses on biological and medical applications. Lab. prereq: Grade of at least C- in [1251 or equiv], Grade of at least C- in [MATH 1171 or equiv];

### PHYS 4721. Special Topics in the Physical Sciences.

(TOPICS; 1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring)

In-depth study of special topics in the physical sciences. prereq: instr consent; repeated enrollment allowed only if topics are different

## Psychology (PSY)

**PSY 1511. Psychology.** (SOCS; 3 cr. ; A-F or Audit; Every Fall & Spring)

Scientific study of behavior and mental processes. Analysis of historical and contemporary paradigms in psychology, research methods, sequence and processes of human development, and the joint contribution of biological and environmental influences on behavior..

**PSY 3511. Human Development across the Lifespan.** (3 cr. ; A-F or Audit; Every Spring)

This course will emphasize the diverse cultural, social, socioeconomic, and historical contexts of human development throughout the lifespan and explore how these contexts directly influence biosocial, cognitive and psychosocial aspects human development. The course will cover the basic principles of human development including: major paradigms, research methods, the sequences and processes of development, and the joint contributions of biological and environmental influences. prereq: PSY 1511

**PSY 3512. Principles of Abnormal Psychology.** (3 cr. ; A-F or Audit; Every Fall)

Abnormal psychology is the study of the classification, explanation and treatment of abnormal phenomena and mental disorder. In this course we will focus on the major concepts and controversies in the field. We will consider how abnormality is defined and classified, and how the biological, psychological, and sociocultural paradigms contribute to understanding and treating individuals with mental disorder. The multicausality of mental disorders will be understood using a diathesis-stress model. Common types of mental disorders will be covered with an emphasis on the phenomenology of the disorder (i.e., what it is like to have the disorder), the biopsychosocial causes of the disorder, and the major treatment approaches. Attention will be given to appreciating the impact of abnormal mental phenomena on the sufferer and their loved ones, and examining the values and ethics that apply to working with people with mental disorder. prereq: (PSY 1511 or equiv) or instr consent

**PSY 4721. Special Topics in Psychology.** (TOPICS; 3 cr. [max 6 cr.]; A-F or Audit; Periodic Fall & Spring)

In-depth study of special topics in psychology. prereq: Repeated enrollment allowed only if topics are different

## Public Health (PUBH)

**PUBH 2561. Public Health: A Global Perspective.** (GP; 3 cr. ; A-F or Audit; Every Spring)

Introductory overview of public health; history and contemporary principles, core disciplines, systems, problems/challenges, applications,

career opportunities, etc. Discussion of the complementary roles of public health and healthcare systems in developed and developing countries. Application of public health principles to case studies from around the globe.

**PUBH 3331. Social Determinants of Health: How Inequality Makes Us Sick.** (3 cr. ; A-F or Audit; Fall Odd Year)

The goal of this course is to promote student exploration of how and why various social factors shape disparities in health outcomes. Through an in-depth exploration of the literature we will examine the ways by which social inequalities shape differences in overall health statuses, access to health care, cancer outcomes, and other diseases. The course will focus on health disparities as historically marginalized groups including communities of color, recent immigrants, and low-income populations in the United States experience them. prereq: 2561 or instr consent

**PUBH 3531. Health Policy in a Global Context.** (GP,SOCS; 3 cr. ; A-F or Audit; Fall Even Year)

In this course, students will begin to explore the ways in which policy shapes: the lives and health of individuals, and population health. By comparing the varying health issues faced by populations around the world, as well as the ways different countries seek to meet the health needs of their citizens, students will begin to place health policy in the United States within a global context. Specific topics may include: environmental and social determinants of health; globalization and its impact on health outcomes; health care providers, health care payers, and health care reform; and the effect of public policy on population health, as well as individuals' mental and physical health.

**PUBH 3561. Environmental Health and Environmental Justice.** (ENV,SOCS; 3 cr. ; A-F or Audit; Every Fall)

This course explores how environments -- both natural and built -- can negatively impact human health outcomes. We will examine major environmental health issues; exposures/causes as well as possible approaches or interventions for reducing associated disease burdens in developing and developed countries. The course also provides an introduction to the concept of environmental justice or notion that all communities, regardless of socioeconomic status, should bear an equal burden of environmental hazards. prereq: 2561 or instr consent

**PUBH 4561. Introduction to Epidemiology: Research and Data Exploration.** (3 cr. ; A-F or Audit; Every Spring)

Introductory overview of epidemiology, the "basic science of public health." Topics covered to include history of the discipline, common epidemiologic measures, epidemiologic research designs, and basic statistics. The course also covers sources of public health data, public health surveillance, and outbreak investigation. Case studies and examples will explore epidemiologic topics/investigations in both developing and

developed countries. prereq: (2561, MATH 1161) or instr consent

## Radiography (RADI)

**RADI 3011. Foundations of Radiography.** (TS; 2 cr. ; A-F only; Every Fall)

This course introduces students to the profession and provides a foundation for understanding the radiographer's role in a radiology department. The radiographer's ethical responsibility to their profession, institution and the diverse patient population is clarified through the introduction of the Radiographer's Code of Ethics and the Patient's Bill of Rights. The course will introduce radiographic positioning terminology as it relates to patient anatomy, exposure factors and corresponding technique chart use, interaction with patients, and methods to ensure radiation protection for patients and healthcare workers.

**RADI 3101. Radiographic Procedures I.** (4 cr. ; A-F only; Every Fall)

This course provides a review of the anatomy of the skeletal systems of the upper and lower limbs, the respiratory system and abdomen. Routine radiographic anatomy as well as pathology and traumatic changes demonstrated on radiographic images will be included. Methods to modify standard positioning for trauma, pathology and pediatric patients are presented. Positioning considerations and evaluating radiographs will be emphasized.

**RADI 3102. Radiographic Procedures II.**

(7 cr. ; A-F only; Every Spring) This course provides a review of the anatomy of the axial skeletal system and skull, the gastrointestinal system and the urinary system. Radiographic positioning instruction utilized to demonstrate the anatomy of the systems listed above is proved in this course. Routine radiographic anatomy as well as pathology and traumatic changes demonstrated on radiographic images will be included. Methods to modify standard positioning for trauma, pathology and pediatric patients are presented. Positioning considerations and evaluating radiographs will be emphasized.

**RADI 3111. Radiation Physics.** (2 cr. ; A-F only; Every Fall)

This course provides the student with an analysis of physics concepts in velocity, acceleration, force, weight, momentum, work, power, heat, magnetism, energy and anatomic structure, and their application for problem solving as they relate to x-ray production. The course provides an explanation of the function that electricity, magnification, transformers, and rectification play as components of x-ray circuitry. The components of the x-ray tube, their function, relations to one another and contribution to the production of x-rays are discussed and explained.

**RADI 3202. Principles of Radiographic Exposure.** (2 cr. ; A-F only; Every Spring)

This course begins with x ray production. The emission spectrum from tungsten and

molybdenum targets is described. Interactions of radiation with matter, dose and the radiologic image are presented. The effect of scattered and secondary radiation on image quality and methods of control are included. Image receptors (film/screen) are discussed in terms of structure, function, types, and uses. The role of the primary variables (kVp, time mA, and SIRD) in radiography is presented. Their effects on density, contrast, and visibility of detail are defined. Methods of exposure calculation for changes in the primary variables are reviewed. Systems for building workable technique charts are presented.

#### **RADI 3301. Clinical Practicum I.**

(5 cr. ; A-F only; Every Fall)

The course consists of two components; a lab practicum and a 16-week clinical rotation in the following clinical areas on the Mayo Clinic campus: Gonda 14 Orthopedics, Gonda 15 Cast room/hand clinic, Mayo Chests, Mayo EXU, Mayo GI, Mayo Pediatrics, SMH General, SMH Surgery, RMH General, RMH Surgery, Baldwin General. Lab practicum encompasses the nursing skills covered in the Patient Care course as well as anatomy, positioning and film critique of the projections covered in the Radiographic Procedures I course.

#### **RADI 3302. Clinical Practicum II.**

(5 cr. ; A-F only; Every Spring) The course consists of two components;

a lab practicum and an 16-week clinical rotation in the following clinical areas on the Mayo Clinic campus: Gonda 14 Orthopedics, Gonda 15 Cast room/hand clinic, Mayo EXU, Mayo GI, Mayo GI Nursing, Mayo Pediatrics, Computerized Tomography, Magnetic Resonance Imaging, Neuro-cardiovascular Imaging, SMH General, SMH Surgery, SMH Non-regular hours, SMH GI, RMH General, RMH Surgery, and Baldwin General. Lab practicum focuses on routine positioning and techniques of the spine and skull.

#### **RADI 3503. Radiographic Factor Analysis: Removed starting Summer 2016.**

(1 cr. ; A-F only; Every Summer) Theoretical concepts and mathematical formulas needed to adjust exposure techniques in radiography practice will be presented in this course.

Students will solve algebraic equations to determine how to make adjustments to exposure factors when changes to mA, time, kVp, screens, grids or distance are necessary. The concepts discussed are used by practicing radiographers every day in order to determine and adjust technical factors while producing images.

#### **RADI 3603. Applied Radiography Topics.**

(1 cr. ; A-F only; Every Summer) The Applied Radiography Course requires the student to perform a literature review of a radiologic topic of their choice and write a paper exploring the topic. The topic of the paper must directly pertain to the imaging field. The paper will include the purpose, method and scope of the literature search. The student will draw on the information and opinions of others who have written on the topic and offer their own significant opinions on the issues discussed. The paper requirements dictate

that it must include 4-6 pages of text in the body of the paper and be written according to the American Psychological Association, 6th Edition (APA) writing style. A minimum of 5 references, 2 of which must be peer-reviewed journal articles, are required.

#### **RADI 4101. Radiographic Procedures III.**

(3 cr. ; A-F only; Every Fall) This course provides an introduction to MRI, CT, Mammography and Neuro-cardiovascular imaging. The history, theory and required equipment for the imaging modality is presented, along with an discussion on of exams performed in each area. Emphasis is placed on anatomy visualized by each modality.

#### **RADI 4241. Radiation Protection Advanced Imaging.**

(3 cr. ; A-F only; Every Fall) This course reviews the types and sources of radiation and their interactions with matter. Effects of high doses on biologic systems are described, and effects of low doses on populations are presented. Elements of radiation protection are included. Quality management concepts, measurements, interpretation, and correcting actions, and governmental regulations insuring compliance are presented. The theoretical concepts and practical application of fluoroscopy, tomography, automatic exposure control, and duplication of radiographs are discussed.

#### **RADI 4303. Clinical Practicum III: Changed to 7.0 credits starting Summer 2016.**

(6 cr. ; A-F only; Every Summer) The course consists of two components; a lab practicum and a 16-week clinical rotation in the following clinical areas on the Mayo Clinic campus: Gonda 14 Orthopedics, Gonda 15 Cast room/hand clinic, Mayo EXU, Mayo GI, Mayo Pediatrics, SMH General, SMH Surgery, SMH trauma/portables, SMH Non-regular hours, SMH GI, RMH General, RMH Surgery, and Baldwin General. Lab practicum focuses on the anatomy, positioning and film critique of the projections covered in the Radiographic Procedures I and II courses and exposure factors learned in the Principles of Radiographic Exposure course.

#### **RADI 4401. Clinical Practicum IV.**

(7 cr. ; A-F only; Every Fall) The course consists of two components; a lab practicum and a 16-week clinical rotation in the following clinical areas on the Mayo Clinic campus: Gonda 14 Orthopedics, Gonda 15 Cast room/hand clinic, Mayo EXU, Mayo GI, Mayo Pediatrics, SMH General, SMH Surgery, SMH trauma/portables, SMH Non-regular hours, SMH GI, RMH General, RMH Surgery, and Baldwin General. Lab practicum focuses on the anatomy, positioning and film critique of the projections covered in the Radiographic Procedures I and II courses and exposure factors learned in the Principles of Radiographic Exposure course.

#### **RADI 4402. Clinical Practicum V.**

(8 cr. ; A-F only; Every Spring) The course consists of two components; a lab practicum and a 16-week clinical rotation

in the following clinical areas on the Mayo Clinic campus: Gonda 14 Orthopedics, Gonda 15 Cast room/hand clinic, Mayo Pediatrics, Computerized Tomography, Magnetic Resonance Imaging, Neuro-cardiovascular Imaging, SMH General, SMH Surgery, SMH Non-regular hours, SMH GI/QA, RMH General, RMH Surgery, Baldwin General and optional rotations to Mammography and Lake City Medical Center.

### **Respiratory Care (Rochester) (RESP)**

#### **RESP 3011. Foundations of Respiratory Care.**

(TS; 2 cr. ; A-F only; Every Fall) This course reviews the clinical roles/responsibilities and career options within the fields of respiratory care. In addition, this course provides students with a solid foundation in professional attributes, cardiopulmonary science, chemical and physics relationships, and mathematical skills to promote success as they begin the clinical-based curriculum. Students explore respiratory care subspecialties and role differences in various clinical settings. Class includes laboratory sessions, discussion, simulation and role-playing.

#### **RESP 3101. Respiratory Care Modalities and Equipment I.**

(4 cr. ; A-F only; Every Fall) Students will become proficient in performing non-invasive monitoring and therapeutic procedures, including medical gas therapy, humidity and aerosol therapy, bronchial drainage and volume expansion therapy. Commonly prescribed aerosol medications will also be reviewed. Learners will practice skills using simulation-based education and in a laboratory setting. Procedures will be discussed in the context of national practice guidelines as to the scientific rationale, limitations, hazards and complications, issues of asepsis and modification to adapt to patient needs.

#### **RESP 3102. Respiratory Care Modalities and Equipment II.**

(4 cr. ; A-F only; Every Spring) Students will become competent in the implementation and operation of a range of invasive monitoring devices and life support technology used in care of the critically ill patient. Learners will practice skills using simulation-based medical education and in a laboratory setting. This will include airway management, electrocardiogram hemodynamic and respiratory monitoring, and mechanical ventilation for perinatal, pediatric and adult patients.

#### **RESP 3201. Cardiopulmonary Patient Assessment.**

(4 cr. ; A-F only; Every Fall) Patient assessment skills are developed to allow students to both gather and interpret a wide range of patient data. This would include the medical record, patient interview, physical examination, medical laboratory tests, pulmonary function reports (including blood gas analysis), hemodynamic record



and radiographic imaging. Cardiopulmonary diseases are introduced with emphasis on pathophysiological manifestations that can be assessed. The laboratory provides a setting for role playing, mock exams and practice of assessment skills. A weekly bedside teaching case review is designed to integrate coursework, examination skills as well as the human aspect of patient care. The Mayo Multidisciplinary Simulation Center allows practice and debriefing of assessment skills in a safe environment.

**RESP 3202. Advanced Cardiopulmonary Physiology and Pathophysiology.**

(3 cr. ; A-F only; Every Spring) The first half of the course will provide students with a detailed review of the physiology of cardiovascular and pulmonary systems. The second section involves a review of adult, pediatric and perinatal cardiopulmonary disorders. Emphasis will be placed on integrating assessment, laboratory evaluation, major pathology, pathophysiologic manifestations and treatment options with focus on respiratory care. A bi-weekly bedside patient case review allows interaction with patients and application of coursework on cardiopulmonary disorders. The Mayo Multidisciplinary Simulation Center allows students to apply skills, knowledge and develop as reflective practitioners using simulated patients in a safe environment.

**RESP 3301. Clinical Practicum I.** (3 cr. ; S-N only; Every Fall)

Students begin a series of rotations including 18 different clinical areas at the Mayo Medical Center. Each rotation requires completion of specific competencies. Those areas include 9 intensive care units, the operating room, emergency room, general floor care areas, pulmonary function labs, sleep disorders center, smoking cessation clinic, pulmonary rehabilitation program, home care and outpatient clinic. Learners will practice and master skills using simulation-based medical education. Students will perform respiratory care procedures and diagnostic testing with the supervision of a clinical instructor.

**RESP 3302. Clinical Practicum II.** (3 cr. ; S-N only; Every Spring)

Students continue a series of rotations including 18 different clinical areas at the Mayo Medical Center. Those areas include 9 intensive care units, the operating room, emergency room, general floor care areas, pulmonary function labs, sleep disorders center, smoking cessation clinic, pulmonary rehabilitation program, home care and an outpatient clinic. Learners will practice and master skills using simulation-based medical education. Students will expand their competencies in adult as well as perinatal & pediatric critical respiratory care.

**RESP 3401. Seminar in Respiratory Care I.** (1 cr. ; A-F only; Every Fall)

Students will attend weekly conferences and seminars in which issues and cases of clinical importance in respiratory care will be discussed. Students will, with faculty guidance, prepare a presentation on a topic and lead

class discussion on the topic presented. The emphasis will be on a critical review of the medical literature. Effective presentation skills will be covered. (1 hour-either Pulmonary & Critical Care Medicine Case Conference or Combined Critical Care Conference) and 1 hour seminar weekly).

**RESP 3402. Seminar in Respiratory Care II.**

(1 cr. ; A-F only; Every Spring) Students will attend weekly conferences and seminars in which cases and issues of clinical importance in respiratory care will be discussed. Students will prepare and present a case presentation and lead discussion on the case and issues raised by the case. The relevant medical literature will be critically reviewed. In the second part of the course students will gain familiarity with the common forms of medical literature and be introduced to the critical appraisal of published articles in a seminar format.

**RESP 3502. Clinical Research: Literature, Methodology, and Application.** (3 cr. ; A-F only; Every Spring)

Students will become readers and writers of research literature, especially that literature which pertains to health care. Students will learn the methodologies of scientific investigation. Students will learn to become constructive critics of scientific investigation. The course provides study content in scientific writing, statistics, research study design including problem statement development and protocol development, research questions or hypothesis development, feasibility analysis, sampling methods and instruments, data management, data analysis and interpretation, and dissemination of research. prereq: Statistics course

**RESP 4300. Clinical Practicum Summer - Adult Critical Care.** (2 cr. ; A-F only; Every Summer)

Students will focus on topics relevant to providing respiratory care to critically ill adults. There will be an emphasis on reviewing case examples of cardiopulmonary problems and therapeutic procedures. However, a multi-organ system-wide patient approach will be maintained. Advanced competencies in ventilator management and critical care monitoring, diagnostics and therapeutic procedures will be assured by laboratory experiences.

**RESP 4311. Advanced Perinatal and Pediatric Respiratory Care.** (3 cr. ; A-F only; Every Fall)

The didactic course combined with its clinical counterpart will allow students to assume the role of the perinatal/pediatrics specialist as defined by the National Board for Respiratory Care (NBRC). A thorough review of the literature on mechanical ventilation, monitoring applied with emphasis on an evidence-based care, will be provided. Current strategies for extended mechanical ventilation or other forms of long-term support will be reviewed using case study examples.

**RESP 4321. Advanced Cardiopulmonary Diagnostics.** (2 cr. ; A-F only; Every Fall)

Students will review the rationale and methods used in cardiopulmonary diagnostics. This course along with its clinical counterpart will allow students to assume the role of the advanced pulmonary function technologist and complete the NBRC's CPFT specialty board exams. Procedures in which participants would become competent include inert gas and body plethysmographic measurement of lung capacity, diffusion studies, bronchial provocation, and heart & lung function during maximal exercise. Interpretation of results and quality control in the laboratory will be facilitated by case reviews and laboratory experiences.

**RESP 4331. Cardiopulmonary Rehabilitation, Disease Prevention and Case Management.** (1 cr. ; A-F only; Every Fall)

Students will review the delivery of care to chronically ill patients with lung and heart disorders with emphasis on respiratory care. The rehabilitation process will be applied to hospital-based program, extended care facilities and in the home. Topics include clinical testing, exercise prescriptions, and practice guidelines for management. Patient care reviews as part of the laboratory will underscore the multidisciplinary approach to case management and responsibilities unique to the respiratory therapist. This course along with its clinical counterpart will allow students to perform the responsibilities attributed to this subspecialty in respiratory care. Students will become certified asthma educators.

**RESP 4341. Clinical Practicum III: Advanced Respiratory Care.** (3 cr. ; S-N only; Every Fall)

Students will complete competencies focused in the areas of advanced-level respiratory care including clinical subspecialties and related areas important to the respiratory care practitioner desiring greater scope of practice. Learners will practice and master skills using simulation-based medical education. Advanced Perinatal and Pediatric Respiratory Care: Clinical experiences in high-risk delivery, perinatal & pediatric intensive, inter-hospital transport and chronic care. Advanced Cardiopulmonary Diagnostics: Clinical experiences in pulmonary function testing including lung volume measurement, diffusion studies, exercise testing, sleep diagnostics, ventilation control, indirect calorimetry, provocation testing, oxygen titration and laboratory quality control. Cardiopulmonary Rehabilitation, disease prevention and case management: Clinical experiences in cardiopulmonary rehabilitation including cardiopulmonary disease assessment, disease prevention, patient family education, evaluation of impairment/disability, exercise training and social and psychological considerations.

**RESP 4342. Clinical Practicum V: Advanced Respiratory Care.** (3 cr. ; S-N only; Every Spring)

Students will complete competencies focused in the areas of advanced-level respiratory care including clinical subspecialties and related areas important to the respiratory care

practitioner desiring greater scope of practice. Learners will practice and master skills using simulation-based medical education. Advanced Perinatal and Pediatric Respiratory Care: Clinical experiences in high-risk delivery, perinatal & pediatric intensive, inter-hospital transport and chronic care. Advanced Cardiopulmonary Diagnostics: Clinical experiences in pulmonary function testing including lung volume measurement, diffusion studies, exercise testing, sleep diagnostics, ventilation control, indirect calorimetry, provocation testing, oxygen titration and laboratory quality control. Cardiopulmonary Rehabilitation, disease prevention and case management: Clinical experiences in cardiopulmonary rehabilitation including cardiopulmonary disease assessment, disease prevention, patient family education, evaluation of impairment/disability, exercise training and social and psychological considerations.

**RESP 4400. Advanced Adult Respiratory Critical Care Techniques I.** (2 cr. ; A-F only; Every Summer)

Students will focus on topics relevant to providing respiratory care to critically ill adults. There will be an emphasis on reviewing case examples of cardiopulmonary problems and therapeutic procedures. However, a multi-organ system-wide patient approach will be maintained. Advanced competencies in ventilator management and critical care monitoring procedures including hemodynamic monitoring will be assured by laboratory experiences.

**RESP 4401. Clinical Practicum IV: Advanced Adult Respiratory Critical Care.** (1 cr. ; A-F only; Every Fall) Clinical experiences in intensive care of patients including post-operative general-surgical, neurology/neurologic surgery ICU, trauma care, medical ICU, thoracic surgical ICU, inter-hospital transport and hemodynamic monitoring.

**RESP 4402. Clinical Practicum VI: Advanced Adult Respiratory Critical Care.** (2 cr. ; A-F only; Every Spring)

Clinical experiences in intensive care of patients including post-operative general-surgical, neurology/neurologic surgery ICU, trauma care, medical ICU, thoracic surgical ICU, inter-hospital transport and hemodynamic monitoring.

**RESP 4500. Advanced Adult Respiratory Critical Care Techniques II.** (1 cr. ; A-F only; Every Fall)

Students will focus on advanced topics relevant to providing respiratory care to critically ill adults. There will be an emphasis on reviewing complex case examples of cardiopulmonary problems and therapeutic procedures. However, a multi-organ system-wide patient approach will be maintained. Advanced competencies in ventilator management and critical care monitoring, diagnostics and therapeutic procedures will be assured by laboratory experiences. prereq: 4400

**RESP 4501. Research Project I.** (1 cr. ; A-F only; Every Fall)

Students in small groups will be responsible for devising, developing and undertaking a research project which would be suitable for submission either to a scientific meeting or for publication. This will include developing a research question, devising and submitting a research protocol, carrying out the research and reporting the findings in abstract and a short oral presentation. Research mentors will be assigned to allow guided independent study.

**RESP 4502. Research Project II.**

(1 cr. ; A-F only; Every Spring) Students in small groups will continue work on their chosen research project from RESP 4501. This project will be suitable for submission to either a scientific meeting or for publication. This will include developing a research question, devising and submitting a research protocol, carrying out the research and reporting the findings in abstract and a short oral presentation. Research mentors will be assigned to allow guided independent study.

**RESP 4602. Grand Rounds.** (2 cr. ; A-F only; Every Spring)

This capstone course reviews allied health clinical and professional issues over a broad spectrum and also allows reflection on caregiver roles. Presentations cover a wide range of topics that impact allied health practitioners and include global views of national health policy, economics, multiculturalism/diversity, ethical and legal problems, and challenging clinical cases. Group discussion sessions provide a forum for multidisciplinary review of cases in order to bring larger issues down to individual patient and family experiences. A key element of the course will be the opportunity to both experience and apply course topics through service learning activities.

**RESP 4802. Health Care Delivery Systems and Finance.** (3 cr. ; A-F only; Every Spring)

Students explore health care delivery systems including a review of health economics, third party and public reimbursement, and contemporary trends in health care organization, management and administration. Regulations, standards, quality assurance, accreditation and ethical issues are considered in the context of contemporary medical practice. Future implications for health care providers and professionals, patients and families, communities, and international health are included. This course will also provide an understanding of finance in the health care industry through a discussion of how the health care industry's financial information is interpreted and used. The course aims to make the language of health care finance understandable and relevant for students in health care professions.

**RESP 4902. Leadership and Management in Health Professions.** (2 cr. ; A-F only; Every Spring)

Students acquire background and skills in the business and administrative aspects of health care. Applications of business theory are applied to medical settings including organization models, reimbursement

methodologies, information systems, staff scheduling, employee evaluation, accreditation agencies, productivity management, budget planning and group leadership.

## Sociology (SOC)

**SOC 1571. Introduction to Sociology.**

(DSJ,SOCS; 3 cr. ; A-F or Audit; Every Fall) Introduction to foundational ideas and research techniques in sociology. Includes a critical engagement with core concepts, including the sociological imagination, socialization, culture, the interplay between individuals and institutions, and social stratification. prereq: concurrent registration is required (or allowed) in MATH 1161

**SOC 1641. Social Justice and Ethical Decision Making.** (CIV; 3 cr. ; A-F or Audit; Every Spring)

Utilizes foundational sociological concepts to systematically explore the role of policies, regulations, values, norms, and social structures in reinforcing or undermining inequality. Students will exercise decision-making in the context of ethical dilemmas regarding inequality, stratification, research ethics, and biomedical ethics.

**SOC 3531. Health Policy in a Global Context.**

(GP,SOCS; 3 cr. ; A-F or Audit; Fall Even Year) In this course, students will begin to explore the ways in which policy shapes the lives and health of individuals, and population health. By comparing the varying health issues faced by populations around the world, as well as the ways different countries seek to meet the health needs of their citizens, students will begin to place health policy in the United States within a global context. Specific topics may include: environmental and social determinants of health; globalization and its impact on health outcomes; health care providers, health care payers, and health care reform; and the effect of public policy on population health, as well as individuals' mental and physical health.

**SOC 3571. Drugs and Society.** (DSJ,SOCS; 3 cr. ; A-F or Audit; Spring Odd Year)

This course will investigate a variety of causal factors for drug use, including environmental and biological, and situate these within their social, historical, and cultural contexts. Topics include drug use across cultures; social responses to drug use; drug use and race/class conflict; drug policy, legislation, and enforcement; drug treatment; mass media images of drug use and related activities. prereq: [1571 or 1641] or instr consent

**SOC 3581. Medical Sociology and Technology.** (SOCS,TS; 3 cr. ; A-F or Audit; Spring Even Year)

This course will explore the complicated interplay among health, illness, disease, health care systems, technology, biomedical science, and society. This course utilizes the sociological perspective to investigate the personal, social, cultural, and organizational, and technological issues that influence the health of people in the United States

and globally. Topics include the role that society plays in the development of medical technologies, as well as the impact of those technological developments on population health, individual health, and the field of medicine. prereq: [1571 or 1641] or instr consent

**SOC 4721. Special Topics in Sociology.** (TOPICS; 1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring)  
In-depth study of special topics in sociology.

## Sonography (SONO)

**SONO 3011. Foundations of Sonography.** (TS; 3 cr. ; A-F only; Every Fall)  
This introductory course will provide the skills and knowledge necessary to begin a clinical rotation in an ultrasound department. Students will receive lectures and participate in lab exercises to help them understand basic anatomy, physics, instrumentation, ultrasound terminology, scanning techniques, image orientation, film labeling, and scanner controls.

**SONO 3111. Abdomen I Sonography.** (2 cr. ; A-F only; Every Fall)  
This course will present the anatomy, physiology, laboratory values, pathology, and sonographic appearances of the prevertebral vessels, kidneys, and spleen. There will be a review of scanning protocols and scanning practice in a controlled environment which will integrate course material with clinical applications.

**SONO 3112. Abdomen II Sonography.** (3 cr. ; A-F only; Every Spring) This course will use lectures and scanning labs to help students learn the anatomy, physiology, laboratory values, pathology, and sonographic appearances and scanning techniques for the liver, biliary tree and pancreas.

**SONO 3113. Abdomen III Sonography.** (2 cr. ; A-F only; Every Summer) This predominantly Blackboard course will present the anatomy, pathophysiology, laboratory values, and sonographic appearances of the GI tract, retroperitoneum, peritoneum, chest cavity, abdominal wall, as well as emergency sonography, transplant sonography and interventional applications. Emphasis and practical application will be placed on topics most commonly encountered in a typical sonography department such as appendix, FAST Scan, hypertrophic pyloric stenosis, renal-pancreas, and liver transplant and ultrasound guided sterile procedures.

**SONO 3121. Cross-Sectional Abdominal Anatomy.** (1 cr. ; A-F only; Every Fall)  
This predominantly online course will assist students in identifying abdominal and pelvic anatomical structures in cross-sectional imaging studies. After reviewing anatomical structures using standard anatomy illustrations, the corresponding Ultrasound, CT and MRI planar images will be demonstrated with a focus on location and spatial relationships to each other.

**SONO 3201. Gynecologic Sonography.** (2 cr. ; A-F only; Every Fall) GYN Sonography is the first course of the obstetrics and gynecology (OB/GYN) curriculum. This course covers gynecologic anatomy, pathophysiology, and GYN ultrasound information. The curriculum includes the following topics: female pelvic anatomy and physiology, uterine, ovarian, and tubal pathology, infertility, and pelvic sonographic scanning techniques.

**SONO 3301. Clinical Practicum I.** (3 cr. ; A-F only; Every Fall)  
This course is a 13-week clinical rotation in the following ultrasound areas: General, Vascular, and Obstetrics. Students will learn through observation, scanning, and application of knowledge obtained during didactic coursework and scanning labs. Students will be directly supervised.

**SONO 3302. Clinical Practicum II.** (5 cr. ; A-F only; Every Spring) This course is a 16-week clinical rotation in the following ultrasound areas: General, Vascular, and Obstetrics. Students will learn through observation, scanning, and application of knowledge obtained during didactic coursework and scanning labs. Students will be directly supervised.

**SONO 3311. Vascular Technology.** (2 cr. ; A-F only; Every Fall) Vascular I is the first course of the Vascular curriculum. This course provides the student with basic knowledge of the physics of duplex ultrasound imaging. Doppler concepts and machine instrumentation to prepare the student to perform carotid duplex exams and transcranial Doppler exams and identify normal and abnormal anatomy and physiology of the carotid system.

**SONO 3312. Vascular Technology II.** (3 cr. ; A-F only; Every Spring) This course provides the student with the basic knowledge and skills necessary to perform duplex imaging of the abdominal arteries, lower extremity arteries and veins, and nonimaging testing of the peripheral vessels. Lectures and scanning labs include anatomy, pathophysiology, treatment, and testing techniques (including nonimaging vascular testing) for upper and lower extremity veins and arteries.

**SONO 3313. Vascular Technology III.** (1 cr. ; A-F only; Every Summer) This course covers anatomy, pathology, treatment, indications, and scanning techniques necessary to perform duplex imaging exams of upper extremity arteries and veins, dialysis grafts and mapping, lower extremity venous insufficiency and perforator veins, and upper and lower extremity venous mapping. Test validation and QA statistics will also be explored.

**SONO 3401. OB Sonography.** (2 cr. ; A-F only; Every Spring)  
This course provides the student with the necessary information to perform and aid in interpreting normal and abnormal

obstetrical sonograms. The following topics will be presented: embryology, first trimester sonography, normal fetal anatomy, amniotic fluid, invasive procedures, assessment of fetal age and growth restriction, placenta, cord, membranes, high-risk pregnancy, indications and safety.

**SONO 3403. Concepts Review and Case Studies.** (2 cr. ; S-N only; Every Summer)  
This course provides the student opportunities to review concepts taught throughout the curriculum by completing computerized review exams and case studies.

**SONO 3503. Superficial Sonography.** (2 cr. ; A-F only; Every Summer) This course will present anatomy, physiology, laboratory values, pathology and sonographic appearance of the breast, neck, prostate and scrotum. Musculoskeletal ultrasound will also be introduced. There will be review of scanning protocols and practices.

**SONO 4111. Ultrasound Physics I.** (2 cr. ; A-F only; Every Fall)  
This course provides the student with a general overview of diagnostic pulse-echo ultrasound imaging devices, basic mathematical concepts, and knowledge of the basic physics of ultrasound and its interaction with tissue.

**SONO 4112. Ultrasound Physics II.** (2 cr. ; A-F only; Every Spring)  
This course provides the student with a detailed description of the physics and technology of diagnostic pulse-echo B-mode ultrasound imaging devices.

**SONO 4201. Pediatric Sonography.** (1 cr. ; A-F only; Every Fall)  
This course provides the student with necessary information about the anatomy of the neonatal brain and pathologies of intracranial hemorrhage. Other pediatric pathophysiology are also presented including: pediatric renal/urinary tract disease, pediatric abdominal masses and neonatal hips and spines.

**SONO 4301. Fetal Anomalies.** (2 cr. ; A-F only; Every Fall)  
The Fetal Anomalies course prepares students to define fetal pathologies and identify classic sonographic findings associated with cranial, thoracic, neck, GI, GU, skeletal, cardiac, and chromosomal fetal anomalies.

**SONO 4303. Clinical Practicum III.** (6 cr. ; A-F only; Every Summer) This course is a 14-week clinical rotation in the following ultrasound areas: General, Vascular, Obstetrics, Vascular Testing Lab, and affiliate rotations. Students will learn through observation, scanning, and application of knowledge obtained during didactic coursework and scanning labs. Students will be indirectly supervised at the discretion of the Clinical Instructor.

**SONO 4401. Clinical Practicum IV.** (7 cr. ; A-F only; Every Fall)  
This course is a 16-week clinical rotation in the following clinical areas: General,

Vascular, Obstetrics, Vascular Testing Lab, Neurovascular Lab, and Breast Imaging. Students will learn through observation, scanning, and application of knowledge obtained during didactic coursework and scanning labs. Students will be indirectly supervised at the discretion of the Clinical Instructor.

**SONO 4402. Clinical Practicum V.**

(8 cr. ; A-F only; Every Spring) This course is a 17-week clinical rotation in the following clinical sites: General, Vascular, Obstetrics, Vascular Testing Lab, and selected specialty areas. Students will learn through observation scanning, and application of knowledge obtained during didactic coursework and scanning labs. Students will be indirectly supervised at the discretion of the Clinical Instructor.

**SONO 4501. Research Project & Publication.**

(1 cr. ; A-F only; Every Fall) This course provides the student with the opportunity to explore emerging technologies and advanced concepts in sonography through the completion of a research paper.

**SONO 4502. Research Project and**

**Publication II.** (1 cr. ; A-F only; Every Spring) This course provides the student with the opportunity to explore emerging technologies and advanced concepts in sonography through the completion of a poster to be submitted for competition at the Minnesota Society of Diagnostic Ultrasound (MSDU) Annual Spring Seminar, or the national SDMS meeting.

**SONO 4602. Professional Growth and**

**Development.** (1 cr. ; A-F only; Every Spring) This course provides the student with the opportunity to explore the many aspects of professionalism including: professional interactions, professional responsibilities, sonographer scope of practice, clinical practice standards, ARDMS credentialing requirements, legal issues, sonography lab expenses, interviewing and resume skills, and current sonographer issues.

**SONO 4802. Mock Exams.** (1 cr. ; S-N only; Every Spring)

Through a series of course reviews, mock registry examinations and information sessions, students are able to prepare for ARDMS examinations. Information on credentialing examinations, effective test-taking strategies, and ARDMS examination content are also provided. Students will be required to apply for and take the ARDMS Physics and Instrumentation board examination during the last part of Semester 5.

**Spanish.** (1 cr. ; A-F or Audit; Every Fall & Spring)  
Catalog Description: (1.0 cr; Prereq-Grade of at least C- in 1521 or placement test, [Previous high school or college-level Spanish coursework or equiv], %; A-F, fall, every year).

Students who score above the threshold at the Entrance Placement Test have the option to enroll in a short course to review the materials covered in SPAN 1521. The course is taught utilizing many online and electronic resources, including digital video projects, online workbooks, Spanish-language news media, online radio, and social media use in Spanish. prereq: Previous high school or college-level Spanish coursework or equiv; Students must score above the threshold at the Entrance Placement Test

**SPAN 1521. Spanish I.** (3 cr. ; A-F or Audit; Every Fall & Spring)

A communicative approach to grammar and vocabulary within the context of the health sciences. Development of listening, speaking, reading and writing skills.

**SPAN 1522. Spanish II.** (3 cr. ; A-F or Audit; Every Fall & Spring)

A communicative approach to grammar and vocabulary within the context of the health sciences. Development of listening, speaking, reading and writing skills. prereq: Grade of at least C- in 1521 or 1520 or placement test

**SPAN 1524. Conversational Spanish.** (1 cr. ; A-F only; Every Fall & Spring)

Conversation class that puts into practice vocabulary and grammatical concepts present in 1522 course. prereq: concurrent registration is required (or allowed) in 1522

**SPAN 2521. Spanish III.** (3 cr. ; A-F or Audit; Every Fall & Spring)

Intensive review of grammar and vocabulary within the context of the health sciences. Practice in oral and written communication. prereq: Grade of at least C- in 1522 or equiv or placement test

**SPAN 2524. Spanish IV.** (3 cr. ; A-F or Audit; Every Fall & Spring)

Intensive review of grammar and vocabulary within the context of the health sciences. Practice in oral and written communication. prereq: Grade of at least C- in 2521 or equiv or placement test

**SPAN 4721. Special Topics in Spanish.**

(TOPICS; 1-4 cr. [max 8 cr.] ; A-F or Audit; Periodic Fall & Spring)  
In-depth study of special topics in Spanish. prereq: instr consent; repeated enrollment allowed only if topics are different

## Writing Studies (WRIT)

**WRIT 1511. Writing Studio I.** (1 cr. ; A-F or Audit; )

Introduction to and practice of writing. Integrated into freshman academic coursework. Formal/informal writing assignments. Critical reading skills. Principles of audience, purpose, and argumentative strategies. prereq: Only Rochester-admitted students will be able to enroll in this course.

**WRIT 1512. Writing Studio II.** (1 cr. ; A-F or Audit; Every Spring)

Drafting, revising, editing. Integrated into freshman academic coursework. Formal/

informal writing assignments. Critical reading skills. Principles of audience, purpose, and argumentative strategies. Library. Annotated bibliography. prereq: Writ 1511 or instr consent

**WRIT 3511. Communication Methods.** (3 cr. ; A-F only; Every Fall & Spring)

Theories/practices of interpersonal, small group, organizational, scientific, and technical communication. Theory and analysis of public presentation of information. Oral presentation skills. Visual communication. Small group work. prereq: Writ 1512 or instr consent

**WRIT 4721. Special Topics in Writing.**

(TOPICS; 3 cr. [max 6 cr.] ; A-F or Audit; Periodic Fall & Spring)  
In-depth study of special topics in writing.