University of Minnesota Rochester
2022-23 Undergraduate Courses

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For current information, refer to:

- Program search: z.umn.edu/publicprogramsearch
- Course search: z.umn.edu/publiccoursecatalog
- University policies: policy.umn.edu

University of Minnesota Rochester
111 South Broadway, Suite 300, Rochester, MN 55904
Biochemistry (BIOC)

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

BIOC 3321. Biochemistry. (3 cr. ; A-F or Audit; Every Fall) In this course, students gain an appreciation for the breadth and depth of current knowledge in biochemistry through an active learning, student-centered approach. Students examine the structure of macromolecules essential to life (including proteins, lipids, and carbohydrates). This analysis gives special consideration to the manner in which molecular structure dictates function. Additionally, students examine the enzymatic pathways responsible for synthesis and degradation of macromolecules, the regulation of enzymes that catalyze these reactions, and the energy expended or produced during these processes. Such pathways include carbohydrate metabolism (glycolysis, gluconeogenesis, citric acid cycle), lipid metabolism (beta-oxidation, lipid synthesis), and oxidative phosphorylation. Students apply these concepts to problem solving within the field, while also gaining confidence in his/her communication of biochemical principles through collaborative, team-based activities. prereq: C or better in [BIOC 2111, CHEM 2131, CHEM 2335, MATH 1120]

BIOC 3322. Biochemistry II. (4 cr. ; A-F only; Spring Even Year) This advanced course covers the enzymatic pathways responsible for synthesis and degradation of macromolecules i.e. carbohydrate, lipid and nitrogen metabolism, and the regulation of these processes with an emphasis on metabolic diseases. The course based undergraduate research experience or CURE lab focuses on characterizing novel, unstudied proteins. prereq: C or better in 3321

BIOC 3393. Directed Study in Research in Biochemistry. (1-6 cr. [max 24 cr.]; Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prereq: instr consent, dept consent

BIOC 3721. Special Topics in Biochemistry. (1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring) In-depth study of special topics in Biochemistry. prereq: instr consent; repeated enrollment allowed only if topics are different

Biology (BIOL)

BIOL 1310. Medical Terminology. (2 cr. ; A-F only; Periodic Fall, Spring & Summer) Review of an extensive medical vocabulary through root words, prefixes, suffixes, plurals, and abbreviations. Includes defining, building, and analyzing medical terminology regarding the human body and the healthcare field. Emphasizes effective communication through proper spelling and pronunciation.

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

BIOL 2311. Integrative Biology. (BIOL,TS; 4 cr. ; A-F or Audit; Every Spring) Introductory biology course with lab for health sciences majors. Emphasis on scientific literacy, mastery of core biological concepts, the relationship of biology to health sciences and other major disciplines, lifelong learning and citizenship. Taught utilizing student-centered, active learning, and writing-integrated approaches.

BIOL 2321. Biology of Human Function. (4 cr. ; A-F or Audit; Fall Even Year) Provides students with an understanding of the function of human organ systems including the cardiovascular, respiratory, skeletal, muscular, nervous system and special senses. Diseases of these systems are highlighted to provide direct application to popular culture and everyday life. Varied approaches to learning used including presentations, written assignments and group work in a reduced-lecture format. A hands-on, problem based lab component supplements the didactic instruction.

BIOL 2331. Anatomy and Physiology I. (BIOL; 4 cr. ; A-F or Audit; Fall Odd Year) An introduction to the shape, structure, and function of the human body and its parts including basic anatomy, structure, and function of body systems and special senses. Specific attention is spent differentiating the anatomy and physiological workings of the integument, skeletal, muscular, nervous including the special senses, cardiovascular, respiratory, digestive and urinary systems. Case studies and laboratory activities are used in within a reduced-lecture delivery method to provide a student-centered, active-learning environment. prereq: BIOL 2311

BIOL 3311. Genetics. (BIOL;TS; 3 cr. ; A-F or Audit; Every Fall) Advanced introduction to genetic information, including molecular aspects of inheritance and disease; gene expression and regulation in cells/organisms; population genetics; mutation and molecular evolution; genome organization; gene databases; and pedigree analysis. Incorporates ethical, social and legal perspectives relevant to advances in genetic technology and increasing availability of human genetic information. Taught utilizing student-centered, active learning and writing-integrated approaches. prereq: Biol 2311 and Chem 1333

BIOL 3332. Anatomy and Physiology II. (4 cr. ; A-F or Audit; Every Spring) This course reviews and elaborates on the basic structure and function of body systems covered in BIOL 2331. Attention is given to understanding how those systems and concepts are related to higher order physiological phenomena such as: 1) Our ability to sense stimuli and respond (nervous system, endocrine system, lymphatic system, and immune response); 2) The complex mechanisms/requirements for homeostatic regulation (relationship between nutrition and metabolism and water and ion balance in the human body); 3) Reproduction and fertility. Case studies and laboratory activities incorporate problem solving and applications to health sciences within a student-centered, active learning environment. Strong emphasis on experimental design and execution. Analysis of data using statistical methods. prereq: C- or better in 2331

BIOL 3344. Microbiology. (ENV; 4 cr. ; A-F or Audit; Every Fall & Spring) Microbiology examines the evolution, structure, physiology, metabolism, and genetics of microorganisms with an emphasis on bacteria and viruses, the dynamic impact of microbes on humans and the role of microbes in the environment. This course is taught using student-centered, active learning and writing integrated approaches, and fosters an understanding of problem solving within the field and gaining confidence in communication of microbiology through collaborative, team-based assignments. The accompanying laboratory provides exposure to a variety of current microbiology techniques. prereq: C- or better in [2311, CHEM 1331, MATH 1120]

BIOL 3393. Directed Study or Research in Biology. (1-6 cr. [max 24 cr.]; Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prereq: instr consent, dept consent

BIOL 3511. Bioinformatics. (3 cr. ; A-F only; Fall Odd Year) Introduction to a variety of biological problems and techniques relevant to the field of bioinformatics including the range of ways that scientists can use large genomic data sets to provide insights into complex biological systems. This course assumes no prior expertise in computer programming. Course will include instruction using a variety of software tools in order to manipulate biological data sets, as well as how to communicate/illustrate these results in a clear manner. Topics of particular interest include: DNA/RNA sequence generation and alignment, phylogenetic trees, biological databases, comparative genomics, and the applications of these to human health and disease.

BIOL 3721. Special Topics in the Life Sciences. (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

BIOL 4312. Advanced Topics in Molecular and Cellular Biology and Genetics. (4 cr. ; A-F or Audit; Periodic Fall) Study of the synthesis, function, and regulation of biological molecules (DNA, RNA, and proteins). Examination of the structure of chromosomes and genes and the processes of gene regulation involving DNA replication, transcription, translation, and epigenetic modification. Emphasis placed on the molecular basis of cell function including cellular communication, transport, secretion
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. (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. (0.5-4 cr. [max 24 cr.]; Student Option; Periodic 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; Periodic 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. (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 1000. Academic Inquiry into the Health Sciences. (2 cr. [max 3 cr.]; A-F only; Every Fall) Provides students with a firm foundation for academic success at UMR through collaborative, interdisciplinary, and inquiry-based approaches. Through exploration of a health-related course theme, this course covers the academic skills of reading and listening to perspectives and sources for understanding; evaluating the context and credibility of sources; reflecting on learning processes to strengthen metacognition; and contributing to an academic community of mutual learning and support.

CLI 1196. National Student Exchange: Host Pay. (0-20 cr. [max 40 cr.]; No Grade Associated; Every Fall, Spring & Summer) National Student Exchange enrollment; off-campus study.

CLI 1296. National Student Exchange: Home Pay. (0-20 cr. [max 40 cr.]; No Grade Associated; Every Fall, Spring & Summer) National Student Exchange enrollment; off-campus study.

CLI 1711. University Experience I. (1 cr.; S-N or Audit; Every Fall) Orientes students to UMR's campus environment and resources, providing opportunities to connect with members of the campus community. The course focuses on developing strategies for wellbeing (e.g., academic, community, financial, physical, and social) students can implement as they navigate the university experience. prereq: Admitted to Bachelor of Science in Health Sciences (BShS)
CLI 1712. Personal Development and Career Exploration. (1 cr. ; S-N or Audit; Every Fall & Spring)
This course enables students to develop a deeper understanding of their strengths and personal values, and to make informed decisions regarding career exploration and development. Discussion of a wide variety of careers and career exploration is included. Credit is not given for this course if the student has completed CLI 2713.

CLI 2713. Career Development and Career Skills in the Health Sciences. (1 cr. ; S-N or Audit; Every Fall & Spring)
Builds on foundation of personal development and career exploration. Engage in personal career development through the career decision making process. Utilize and develop career skills including: resume and cover letter writing, interviewing, professionalism, and networking. Reflect on, explore, and engage in meaningful experiences to develop professional competencies. preq: 1712

CLI 3496. Internship: Professional Experience. (1-6 cr. [max 24 cr.] ; S-N only; Every Fall, Spring & Summer)
Matches student's academic/career goals with opportunities in industry, nonprofit organizations, and government agencies. Builds sustainable and meaningful partnerships between the university and the surrounding community. Provides an opportunity for students to build relationships with people of different backgrounds and life experiences, broaden worldviews, critically and creatively examine community concerns, and discover their capacity to affect change in the world around them. preq: instr consent, dept consent, acceptance of internship proposal

CLI 3522. Community Collaboratory. (3 cr. ; A-F only; Every Fall & Spring)
Extends the student learning experience into the local community. Confronts the challenges present in complex human systems and engages in community projects identified by local public, private, and nonprofit organizations. Builds sustainable and meaningful partnerships between the university and the surrounding community. Provides an opportunity for students to build relationships with people of different backgrounds and life experiences, broaden worldviews, critically and creatively examine community concerns, and discover their capacity to affect change in the world around them. preq: junior status or above

CLI 3583. Social Research Design. (3 cr. ; A-F or Audit; Periodic Spring)
This course introduces students to social science research design, methods, and ethics. The first part of the course provides a broad overview of research methods and ethics, and directs students to engage in a literature review to help them conceptualize their question and the theoretical framework they will use for their research. The second part of the course provides more personalized instruction in qualitative, quantitative, and mixed methods studies, including collecting and analyzing data. Students will end the course by writing a research proposal. preq: 1571 or PSY 1511 or PUBH 2561

CLI 3712. Capstone Proposal Writing. (2 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, culminating with a student-submitted proposal with a set of learning experiences connected to a holistic theme. Capstone Proposals are reviewed by the CLI Faculty and must be approved before Capstone experiences can begin.

CLI 3714. Preparing a Competitive Health Professions Application. (1 cr. ; S-N only; Every Spring)
Prepare a compelling and comprehensive application to a health professional program using a centralized application system (e.g., Dental, Med, Optometry, OT, PA, Pharmacy, Podiatry, PT, Vet Med). Create an application plan, write a personal statement and activities statements, navigate the components of the application system, and prepare to interview, all while evaluating preparedness to apply. preq: CLI 2713

CLI 3715. Learning Away Orientation. (1 cr. ; S-N only; Periodic Fall & Spring)
Provides an introduction to the various challenges related to learning away. Students will learn about cultural theories and stumbling blocks to intercultural communication, and acquire new knowledge and attitudes to successfully complete a learning away experience. In addition, the course will provide important information on financial management while away, how to remain healthy and safe, preparing for reentry into the United States and campus community, and how to market an experience away on a resume and cover letter. Online, seven week course. preq: instructor consent

CLI 3716. Living on Purpose. (1 cr. ; S-N only; Periodic Fall)
Living on Purpose allows students to explore the roles personal purpose and intentional living play in our lives (e.g., goal setting and career planning). Students will explore their core values via a combination of discussion and activities that will allow students to further clarify their personal and professional values.

CLI 3721. Special Topics in Learning & Development. (1-4 cr. [max 8 cr.] ; A-F or Audit; Periodic Fall & Spring)
In-depth study of special topics. preq: prerequisites. Repeated enrollment allowed only if topics are different

CHEM 1331. Chemical Structures and Properties. (PHYS; 4 cr. ; A-F or Audit; Every Fall)
This course focuses on the following topics: Organic functional groups and organic structure. Topics include: Atomic composition and mass spectrometry, theory of light, electronic structure and atomic spectroscopy, periodic table, covalent bond and molecular structure, organic functional groups and infrared spectroscopy, conformational analysis and H-NMR, intermolecular forces and phase changes, and chirality and solubility. Spectroscopic techniques are presented from the beginning as tools for evidence and analysis of atomic and molecular structure and composition. preq: high school chemistry or equiv preferred and three years high school math required

CHEM 1332. Chemical Reactivity. (PHYS; 4 cr. ; A-F or Audit; Every Spring)
This course focuses on the following topics: Organic functional groups and organic structure. Topics include: Atomic composition and mass spectrometry, theory of light, electronic structure and atomic spectroscopy, periodic table, covalent bond and molecular structure, organic functional groups and infrared spectroscopy, conformational analysis and H-NMR, intermolecular forces and phase changes, and chirality and solubility. Spectroscopic techniques are presented from the beginning as tools for evidence and analysis of atomic and molecular structure and composition. preq: high school chemistry or equiv preferred and three years high school math required

CHEM 1393. Directed Study in Chemistry. (1-3 cr. ; S-N only; Every Fall & Spring)
Individual study on selected topics or problems. preq: instr consent, dept consent

CHEM 2131. Organic Chemistry II. (3 cr. ; A-F only; Every Fall)
Organic reactions: nucleophilic substitutions, eliminations, carbonyl additions, acyl substitutions, aromatic electrophilic substitution, rearrangements, oxidation and reduction reactions. Use of spectroscopic tools in structure elucidation: nuclear magnetic resonance, mass spectroscopy, infrared and electronic absorption spectroscopy. Reactivity

CHEM 4000. Off-Campus Study. (0-36 cr. [max 72 cr.] ; No Grade Associated; Periodic Fall, Spring & Summer)
Not printed in catalog. A registration mechanism for students pursuing a unique off-campus study experience through either other educational institutions or through private non-credit granting agencies. Limited to students whose study is approved by University of Minnesota Rochester faculty who certify likely departmental credit for successfully completed study as specified by agreement forms signed by both student and faculty. preq: instr consent

CHEM 4394. Off-Campus Directed Research. (1-3 cr. ; S-N only; Periodic Fall, Spring & Summer)
Off-campus research experiences are different from any other type, since they combine elements of directed research with an internship, since typically the research is supervised by a non-faculty member who assigns a grade based on a combination of supervisor feedback and reflective writing. preq: instr consent, dept consent

CHEM 4713. Capstone Reflections. (1 cr. [max 2 cr.] ; S-N only; Every Fall & Spring)
Integrates student life, the curriculum, and career exploration to facilitate student growth and professional development. Course calls for students to participate in, observe, analyze, and interpret their capstone experiences. Requires students to record their observations and analysis throughout the semester and present their capstone portfolio in a public presentation. Typically taken in the final semester. preq: 3712
of biologically important classes of organic compounds such as lipids, carbohydrates, amino acids, peptides, proteins, and nucleic acids. prereq: C- or better in 1333

CHEM 2132. Organic Chemistry II Lab. (1 cr.; A-F only; Every Fall)

Laboratory techniques: synthesis, isolation and purification techniques including extraction, thin-layer and column chromatography. Characterization of organic compounds using spectroscopy such as NMR, mass spect, IR and UV-Vis. prereq or coreq: 2131

CHEM 2335. General Chemistry II. (3 cr.; A-F only; Every Spring)
Complex acid-base chemical equilibria: Acid-base buffers, titration curves, and polyprotic acids. Equilibria of partially soluble substances. Chemical kinetics and nuclear chemistry. Chemical thermodynamics and spontaneity of processes. Electrochemistry and redox reactions: Voltaic and electrolytic cells, applications of electrochemistry to health sciences, and concentration on spontaneity. Coordination chemistry: structure and equilibria. prereq: C- or better in 1333; prereq: C- or better in MATH 1121

CHEM 2336. General Chemistry II Lab. (1 cr.; A-F only; Every Spring)
Experimental laboratory of chemistry: Solution preparation with volumetric material. Standardization of solutions. Titration by indicator and pH-meter. Using UV/Vis spectrophotometry to measure thermodynamic and kinetic parameters. Calorimetry. Qualitative analysis of metals. prereq or coreq: 2335

CHEM 3393. Directed Study or Research in Chemistry. (1-6 cr. [max 24 cr.]; Student Option; Every Fall & Spring)
Individual study or research on selected topics or problems. prereq: instr consent, dept consent

CHEM 3721. Special Topics in Chemistry. (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

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 CHEM 2131. recommend: BIOC 3321

CHEM 4333. Physical Chemistry. (3 cr.; A-F or Audit; Periodic 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: C- or better in [2333, MATH 1171, PHYS 2251]; prereq or coreq: C- or better in MATH 2171

Communication Studies (COMM)

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

COMM 2511. Communication Methods. (3 cr.; A-F only; Every Fall & Spring)
Students learn the role of communication in the public's understanding of health. Students learn theories and practices of verbal, nonverbal, and visual communication and the impact of interpersonal, group, organizational, and scientific contexts on communication in order to analyze and create messages about health related topics. Students develop public speaking skills using presentation software.

COMM 2711. Communication in Professional Contexts. (3 cr.; A-F only; Periodic Fall & Spring)
This course teaches the role of communication skills for professionals in a health care context developing public speaking skills using presentation software. Topics include theories of communication and how to effectively communicate through verbal and nonverbal channels while exploring the role of interpersonal, group, and organizational communication in health care settings.

COMM 3393. Directed Study or Research in Communication. (1-6 cr. [max 24 cr.]; Student Option; Periodic Fall & Spring)
Individual study or research on selected topics or problems. prereq: instr consent, dept consent

COMM 3721. Special Topics in Communication. (1-4 cr. [max 8 cr.]; A-F only; Periodic Fall & Spring)
In-depth study of special topics in communication. prereq: instr consent; repeated enrollment allowed only if topics are different

Echocardiography (ECHO)

ECHO 3011. Foundations of Echocardiography. (TS; 2 cr.; A-F only; Every Fall)
This course provides students with a fundamental understanding of echocardiographic techniques and patient care skills required for cardiac sonographers, and identifies proper imaging techniques to prevent injury. The course includes recognition of cardiac anatomy on an echocardiogram, provides an understanding of machine instrumentation and basic ultrasound physics, identifying proper 2-D, M-mode, and Doppler techniques, and echocardiographic assessment of systolic and diastolic function.

ECHO 3101. Cardiac Anatomy & Physiology. (3 cr.; A-F only; Every Fall)
The course provides the student with an in-depth understanding of gross and cross-sectional cardiac anatomy and an understanding of normal cardiac physiology. The concepts of cardiovascular physiology include circulation blood flow, the cardiac cycle, electrical and mechanical properties of the heart, and blood flow hemodynamics of the arterial and venous system. This course provides the foundation for advanced physiologic concepts and Doppler hemodynamic assessment in subsequent courses.

ECHO 3202. Adult Echocardiography. (6 cr.; A-F only; Every Spring)
This course provides students with the necessary knowledge of cardiomyopathies coronary artery disease, valvular heart disease (stenosis, regurgitation, and prosthetic valves). The course focuses on the echocardiographic assessment of dilated, hypertrophic and restrictive cardiomyopathies by 2-D, M-mode, Doppler and color flow imaging. This course also provides the student an understanding of coronary anatomy and distribution, pathophysiology of coronary heart disease, and the echocardiographic assessment of coronary heart disease. Course content includes echocardiographic appearance of normal valve function and evaluation of valve area, mean gradient, regurgitant volume, and effective regurgitant orifice. This course provides students with the knowledge required to use the continuity equation and PISA formula and proper techniques for evaluating prosthetic valves. The course provides the student with basic knowledge of major cardiac pathophysiology by covering the following: cardiac diseases due to systemic illness; pericardial disease; systemic and pulmonary hypertension; cardiac tumors and masses; and diseases of the great vessels. The course includes complete 2-D, M-mode, and Doppler assessment of the listed cardiovascular disorders. prereq: 3011, 3101, 3301, HP 3021

ECHO 3301. Clinical Practicum I. (8 cr.; A-F only; Every Fall)
This course provides students with an opportunity to perform portions of an echocardiographic exam, review patient positioning, transducer placement, and terminology in the clinical setting. Two-dimensional (2D) and Doppler skills learned in Foundations of Echocardiography are applied in the clinical setting. This course Clinical Practicum I provides the student with the opportunity to observe the clinical environment, understand the clinical application of echocardiography, and interact with clinical staff and patients. This course also includes guided scan labs to develop the student's ability to acquire and optimize images and use proper measuring techniques.

ECHO 3302. Clinical Practicum II. (7 cr.; A-F only; Every Spring)
This course continues to provide the student with the necessary skills and knowledge to integrate academic and clinical learning. Course content includes 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. This course uses hands-on
experience to help develop the skills required to do a hemodynamic assessment in both the clinical and guided scan lab environments. prereq: 3011, 3101, 3301, HP 3021

ECHO 3403. Echocardiographic Application. (3 cr.; A-F only; Every Summer)
This course integrates knowledge from previous courses, focusing on case reviews and the integration of all 2-D and Doppler data. Students are 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. prereq: 3202, 3302

ECHO 3503. Stress Echocardiography. (2 cr.; A-F only; Every Summer)
This course provides the student with the necessary knowledge regarding ECG and basic 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 is identified. Students develop an in-depth understanding of exercise echocardiography and the use of Dobutamine and contrast during a stress echo. The lab sessions for stress echocardiography allow students the opportunity to demonstrate the required skills. prereq: 3202, 3302

ECHO 4111. Ultrasound Physics I. (2 cr.; A-F only; Every Fall)
This course introduces the student to basic physics principles and instrumentation used in diagnostic ultrasound. The course describes basic ultrasound physics principles, formulae and calculations as well as describes 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. prereq: 3403, 3503, 4460, 4303

ECHO 4112. Ultrasound Physics II. (2 cr.; A-F only; Every Spring)
The course is designed to expand on the information learned in Ultrasound Physics I and provide new information regarding theory and operation of diagnostic ultrasound equipment. The course describes 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 introduces 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. prereq: 4111, 4211, 4401

ECHO 4211. Congenital Heart Disease I. (3 cr.; A-F only; Every Fall)
This course provides 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 are discussed as well as postoperative complications. The student is provided necessary information on performing a systematic 2-D, spectral, and color flow Doppler examination on a patient with CHD. prereq: 3403, 3503, 4460, 4303

ECHO 4303. Clinical Practicum III. (6 cr.; A-F only; Every Summer)
Clinical Practicum III primarily focuses on development of student's clinical skills of two-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 begin to integrate the clinical and echo findings and identify final impressions related to the echocardiographic exam. Observational rotations include intraoperative TEE, Outreach echocardiography, TEE and contrast echocardiography. This course includes a few guided scan labs focusing on the more comprehensive exams. prereq: 3202, 3302

ECHO 4401. Clinical Practicum IV. (8 cr.; A-F only; Every Fall)
Clinical Practicum IV continues to develop the student's clinical skills to complete an optimal echocardiographic hemodynamic assessment. The focus of this course is the ability to integrate 2-D and echo data in an accurate patient report. Clinical Practicum IV introduces students to congenital echocardiography, to the field of stress echocardiography, and to echocardiographic research. prereq: 3403, 3503, 4303, 4460

ECHO 4402. Clinical Practicum V. (9 cr.; A-F only; Every Spring)
During Clinical Practicum V, the students apply previous didactic and clinical training to complete a quality echocardiographic examination. Students are responsible for integrating echo data, preparing preliminary echo findings and delivering the report. prereq: 4111, 4211, 4401

ECHO 4460. Special Procedures. (2 cr.; A-F only; Every Summer)
This course builds upon the foundation of the Adult Echocardiography course, with a focus on special procedures performed involving echocardiography. Course content includes anatomy and clinical indications of TTE & TEE, intra-operative & catherization procedures. The course also allows for students to get a basic introductory understanding of multi-modality cardiac imaging and the information these imaging modalities can provide about the heart. Basic and advanced echocardiography imaging and the role of the cardiac sonographer for each procedure and or pathology is the primary focus of the course. prereq: 3202, 3302

ECHO 4501. Research Project and Publication I. (1 cr.; A-F only; Every Fall)
This course provides the student with new and challenging perspectives in the field of echocardiography through an independent project. The independent project consists of a senior research paper based on a clinical case study selected by the student. prereq: 3403, 3503, 4460, 4303

ECHO 4502. Research Project and Publication II. (1 cr.; A-F only; Every Spring)
This course provides the student with new and challenging perspectives in the field of echocardiography through an independent project. The independent project consists of a senior presentation on the same topic selected by the student in Research Project and Publication I. prereq: 4111, 4211, 4401, 4501

English: Literature (ENGL)

ENGL 1393. Directed Study in English. (1-3 cr. [max 6 cr.]; Student Option; Periodic Fall & Spring)
Individual study on selected topics or problems. prereq: inst consent, dept consent

ENGL 1433. Introduction to Literature. (LITR; 3 cr.; A-F or Audit; Every Fall & Spring)
Basic techniques for analyzing/understanding literature and developing critical thinking skills. Readings of novels, short stories, poems, plays.

ENGL 3393. Directed Study or Research in English. (1-6 cr. [max 24 cr.]; Student Option; Every Fall & Spring)
Individual study or research on selected topics or problems

ENGL 3461. Disability Narratives. (3 cr.; A-F or Audit; Periodic Fall & Spring)
Uses a critical disability studies lens to explore disability narratives including literature as well as multimodal texts. Exploration of texts, identities and embodiments, experiences with disability, and the relationship between disability and the health sciences through weekly writing, discussion, and collaboration. Final projects include analyzing additional disability narratives related to students’ area of study and/or reflecting on their own identity and positionality in their area of study/profession.

ENGL 3471. Gender and Sexuality Studies. (DSJ; 3 cr.; A-F or Audit; Every Spring)
This course explores a variety of theories of gender and sexuality; the literary and media representations of gender and sexuality (both contemporary and historical); and the embodiment, performance and construction of gender and sexual identities. The ethical, social, and political dimensions of gender- and heteronormativity and the role of power
in theories and manifestations of gender and sexuality are considered. prereq: 1433 or HIST 1435 or HUM 1437 or PHIL 1441

ENGL 3481. Society, Science, and Science Fiction. (TS; 3 cr.; A-F only; Every Fall) Historical/contemporary analysis of science and technology and their representation in literary, cinematic, and/or multimedia science fiction. Course will explore how science/technology figures create socio-cultural values and truth production, and may include, but is not limited to, the cultural, psychological, historical, and literary perspectives. Course is discussion-based and project-centered. prereq: 1433 or HIST 1435 or HUM 1437 or PHIL 1441

ENGL 3721. Special Topics in English. (; 1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring) In-depth study of special topics in English. prereq: instr consent; repeated enrollment allowed only if topics are different

Health Professions (HP)

HP 3021. Patient Care Techniques. (; 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) Course covers 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 is explored by case study and contemporary readings. The health of individuals and the health of groups is 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. prereq: junior or senior standing, or PUBH 2561

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. prereq: junior or senior status

History (HIST)

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

HIST 1435. Comparative Global History. (GP,HIS; 3 cr.; A-F or Audit; Every Fall & Spring) Examines the cause, course, and consequences of regional, national, and international crises in various parts of the modern world. Exposes students to historical concepts and methodology. Main themes range from genocide, epidemics, ethnic identity, cross-cultural conflict, racism, and humanitarianism.

HIST 3245. Epidemics, Empires, and Environment. (ENV,HIS; 3 cr.; A-F only; Every Fall) Analysis of the impact of epidemic diseases on the social, cultural, and political landscapes from the Black Death to the present. Course themes include: environmental and biological components contributing to infectious disease; development of public health measures; intersection of disease control and imperialism; social reactions of mass hysteria and violence; rise of the germ theory of disease; and the impact of industrialization and globalization on the ecological transmission of disease. prereq: BIOL 2311

HIST 3393. Directed Study or Research in History. (1-6 cr. [max 24 cr.]; Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prereq: instr consent, dept consent

HIST 3721. Special Topics in History. (; 1-4 cr. [max 6 cr.]; A-F or Audit; Periodic Fall & Spring) In-depth study of special topics in History. prereq: instr consent; repeated enrollment allowed only if topics are different

Humanities (HUM)

HUM 1437. History of Medicine in the West. (HIS; 3 cr.; A-F only; Periodic Spring) This course examines the history of medicine in the Western tradition from the Middle Ages into the modern era. It explores a variety of primary and secondary historical documents to assess the evolution and development of medical theory and practice throughout the centuries.

HUM 3401. Contemplation of Mental Health Using Creativity and Qualitative Analysis. (; 3 cr.; A-F only; Periodic Spring) Explore, examine, and experience the parallels between the creative process and healing through 1) participating in and conducting creativity-based sessions offered for patients hospitalized at the Mayo Clinic; 2) examining the theoretical framework of creative thinking, strength perspectives, creative movement, narrative theory, and creative process as a mutual recovery; and 3) assessing and analyzing qualitative data collected from the participants at the creativity-based sessions. By instructor permission only.

HUM 3721. Special Topics in Humanities. (; 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 1120. Precalculus I. (MATH; 3 cr.; A-F or Audit; Every Fall) This course develops skills related to understanding and manipulating equations and connects equations to relations and functions. While studying functions, essential properties to functions are discussed and include function transformations. Attention is given to polynomial and rational functions with an emphasis on linear and quadratic functions. Inverse functions and their applications to exponential and logarithmic functions are also explored. Course concepts are demonstrated in physical contexts using appropriate mathematical and quantitative methods, which includes analytic geometry. Clear and proper communication of the mathematics is stressed. The course utilizes active learning strategies and includes a significant collaboration component. This course includes coverage beyond the usual high school level mathematics. prereq: three years of high school mathematics

MATH 1121. Precalculus II. (MATH; 3 cr.; A-F only; Every Fall & Spring) This course develops quantitative reasoning skills that build upon the understanding of a function as well as the foundation presented in Precalculus I. Trigonometric functions and their properties are explored in depth through unit circle analysis. Additionally, inverse trigonometric functions, right triangle trigonometry, Half and Double Angle theorems, and Laws of Sines and Cosines are discussed. Methods of solving systems of equations, including solving by substitution and elimination by addition, are developed. Arithmetic and geometric sequences and series are discussed. Analysis of conic sections is also explored. Vector analysis may also be completed including the dot product. Throughout the course, modelling physical situations with mathematics using appropriate quantitative methods. Clear and proper communication of the mathematics is stressed. The course utilizes active learning strategies and includes a significant collaboration component. This course includes coverage beyond the usual high school level mathematics courses. prereq: MATH 1120, or placement exam

Courses listed in this catalog are current as of 2022-08-15. For up-to-date information, visit www.catalogs.umn.edu.
MATH 1161. Introduction to Statistics. (MATH; 3 cr.; A-F or Audit; Every Fall) Exploration of statistical analysis in a health sciences context, using technology and active/peer learning. Build statistical inferences from scientific methods. Gather, sort, describe, arrange and construct visual representations of data sets and generate basic predictive models. Introduction to probability and data distributions, leading to inferential statistics. prerequisite: three years of high school math

MATH 1171. Calculus I. (MATH; 4 cr.; A-F or Audit; Every Fall & Spring) The topics in this course are limits of functions and sequences, differential calculus including definition of the derivative via limits and rules of differentiation, applications of differential calculus such as related rates, optimization, and numerical approximation, basic integral calculus, and introductory differential equations. prerequisite: C- or better in 1121 or placement exam

MATH 1393. Directed Study in Mathematics. (1-3 cr.; max 6 cr.; Student Option; Every Fall & Spring) Individual study on selected topics or problems. prerequisite: instructor consent, department consent

MATH 2161. Biostatistics. (MATH; 3 cr.; A-F or Audit; Periodic Fall & Spring) Using real data, this course develops a conceptual understanding of statistical hypothesis testing and critical thinking about sampling techniques and experimental design. Focus on selecting appropriate hypothesis tests for research questions and correctly completing ANOVA tests, non-parametric tests, log/odds ratio tests, logistic regression, and survival analysis. Instruction in using Microsoft Excel and SAS to perform the computational parts of hypothesis testing and produce meaningful graphical representations. Emphasis on discussing statistics in groups, presenting findings, and communicating results. prerequisite: C- or better in 1161

MATH 2171. Calculus II. (MATH; 4 cr.; A-F or Audit; Every Spring) The topics in this course are advanced integral calculus including the substitution rule and integration by parts, applications of integral calculus such as areas between curves, volumes, and average value of a function, convergence of sequences and series, introductory differential calculus of multivariable functions, and an introduction to vectors and matrices for the purposes of solving systems of differential equations. prerequisite: C- or better in 1171

MATH 3393. Directed Study in Mathematics. (1-6 cr.; max 6 cr.; Student Option; Periodic Fall & Spring) Individual study on selected topics or problems. prerequisite: instructor consent, department consent

PHIL 1393. Directed Study in Philosophy. (1-3 cr.; max 6 cr.; Student Option; Periodic Fall & Spring) Individual study on selected topics or problems. prerequisite: instructor consent, department consent

PHIL 1431. Introduction to Philosophy. (AH; 3 cr.; max 6 cr.; A-F or Audit; Every Fall) This course examines historical and contemporary philosophical problems and introduces students to the standards for evaluating philosophical arguments. Some of the problems that may be examined include: the existence of God, the nature of knowledge, the relationship between the mind and the body, the nature of personal identity, and the problem of free will. Course provides an understanding of the nature and historical origin of these problems and how to critically evaluate possible solutions to these problems.

PHIL 1441. Introduction to Ethics. (AH, CIV; 3 cr.; A-F or Audit; Every Fall & Spring) This course introduces students to basic ethical theories and examines several contemporary ethical problems. Some of the problems that may be examined include: income inequality, immigration, the right to die, the right to health care, civil disobedience, just war theory, paternalism, animal rights, and capital punishment. Course provides an understanding of the nature and historical origin of these problems and how to critically evaluate possible solutions to these problems.

PHIL 3393. Directed Study or Research in Philosophy. (1-6 cr.; max 24 cr.; Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prerequisite: instructor consent, department consent

PHIL 3437. History and Philosophy of Science. (HIS; 3 cr.; A-F or Audit; Every Spring) Examination of several historical and contemporary philosophical problems that arise within the context of scientific practice. Problems may include: the nature of scientific explanation, the problem of induction, the problem of demarcation, the role of laws and models in scientific theorizing, the social responsibilities of scientists, and scientific realism. Students gain an understanding of the nature and historical origin of these problems and learn to critically evaluate possible solutions to these problems. prerequisite: sophomore status or above

PHIL 3441. Ethics of Medicine and the Sciences. (AH, CIV; 3 cr.; A-F or Audit; Every Fall) This course examines several contemporary ethical problems that arise within the context of medicine and scientific research. Some of the problems that may be examined include: the social responsibilities of pharmaceutical companies, the role of the family in medical-decision making, cognitive enhancement, the proper payment for research participation, direct-to-consumer advertising of pharmaceutical drugs, empathy and medical professionalism, and the permisibility of religious conscientious objection. Students will gain an understanding of the nature and historical origin of these problems and learn to critically evaluate possible solutions to these problems. prerequisite: 1441

PHYS 1251. Physics I. (PHYS; 4 cr.; A-F or Audit; Every Fall & Spring) An activity-based introductory physics course focused on concepts of motion, force, energy, fluid dynamics, and oscillating systems. The course develops problem solving skills through a systematic decision-making framework and develops knowledge through a formal disciplinary integration and application to biomedical and other real world application. The laboratory component enhances knowledge and promotes good experimental design, techniques, and technical writing. prerequisite: C- or better in MATH 1121

PHYS 1393. Directed Study in Physics. (1-3 cr.; max 6 cr.; Student Option; Periodic Fall & Spring) Individual study on selected topics or problems. prerequisite: instructor consent, department consent

PHYS 2251. Physics II. (PHYS; 4 cr.; A-F or Audit; Every Fall & Spring) A course covering more fundamental concepts building on concepts of motion, force and energy. The course uses an activity-based approach to cover topics including thermodynamics, electricity and magnetism, optics, and atomic and nuclear physics and integrates these concepts with modern medical applications and technology. The course advances problem solving by building on a core systematic decision-making framework. A laboratory component integrates real world applications. prerequisite: C- or better in [251 and MATH 1171]

PHYS 3393. Directed Study or Research in Physics. (1-6 cr.; max 24 cr.; Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prerequisite: instructor consent, department consent

PSY 1393. Directed Study in Psychology. (1-3 cr.; max 6 cr.; Student Option; Every Fall & Spring) Individual study on selected topics or problems. prerequisite: instructor consent, department consent
PSY 1511. Introduction to Psychology. (SOCS; 3 cr. : A-F or Audit; Every Fall & Spring) Scientific study of behavior and mental processes. Examination 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 3393. Directed Study or Research in Psychology. (1-6 cr. [max 24 cr.;] Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prereq: instr consent, dept consent

PSY 3510. Human Development across the Lifespan. (3 cr. : A-F or Audit; Every Spring) This course emphasizes the diverse cultural, social, socioeconomic, and historical contexts of human development throughout the lifespan and explores how these contexts directly influence biosocial, cognitive and psychosocial aspects of human development. The course covers 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: 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. This course focuses on the major concepts and controversies in the field. We consider how abnormality is defined and classified, and how the biological, psychological, and sociocultural paradigms contribute to understanding and treating individuals with mental disorders. The multicausality of mental disorder is understood using a diathesis-stress model. Common types of mental disorders are 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 is 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: 1511

PSY 3721. Special Topics in Psychology. (3 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

PSY 3810. Neuropsychology of Wellbeing and Resilience. (3 cr. : A-F or Audit; Every Spring) This course pulls from current literature in the fields of neuroscience and positive psychology to explore cognition and human behavior from the perspectives of wellbeing, resilience, and coping rather than pathology, damage, and weakness. To explore this topic, the course emphasizes neuroscientific and psychological perspectives to evaluate positive human functioning on multiple levels that range from the cellular and molecular through the sociocultural. The content and activities guide students through an exploration of how positive experiences, positive individual traits, and positive institutions influence and are influenced by neurophysiology and behavior. The course focuses on prevention and competency building instead of merely correcting disorders and weaknesses. prereq: 1511

PSY 4512. Social Psychology. (3 cr.; A-F only; Every Fall) Social Psychology is the scientific study of how people's thoughts, feelings, and actions can influence and/or be influenced by others. This course covers topics that include, but are not limited to: research methods, ethics, and classic and as contemporary research on topics including social influence and social cognition, self and person perception, attitude formation and change, prejudice and stereotypes, aggression and conflict, helping and prosocial behavior. prereq: 1511;

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

PUBH 2561. Introduction to Public Health. (GP; 3 cr.; A-F or Audit; Every Spring) This course teaches an understanding of the major paradigms, research methods, and sequence and processes of public health systems. The course introduces core principles of public health, and provides opportunities to apply new knowledge to address complex population health problems both domestically and globally. Course activities promote critical thinking and integration of public health problems and solutions providing the tools to address population health issues that face individuals, our communities, and the world.

PUBH 3331. Health Equity & Social Determinants of Health. (3 cr.; A-F or Audit; Every Spring) Students investigate the role of social and community factors that contribute to health inequities. Students identify neighborhood characteristics such as poverty or access to care that play a critical role in higher negative health outcomes within at-risk populations. Examination of these complex public health issues using evidence-based approaches, frameworks and models, and research methods. Course activities promote critical thinking skills to discover root causes of health inequities and to examine interventions intended to eliminate disparate health conditions within neighborhoods or specific populations. prereq: 2561

PUBH 3339. Directed Study or Research in Public Health. (1-6 cr. [max 24 cr.;] Student Option; Every Fall & Spring) Individual study or research on selected topics or problems. prereq: instr consent, dept consent

PUBH 3531. Health Policy & Systems. (SOCS,ENV; 3 cr.; A-F or Audit; Every Fall) Students explore health policy as it shapes the lives and health of people and populations locally, nationally, and globally. Students use policy analysis frameworks and evidence-based resources to learn the many dimensions of public health and health policy. Attention is paid to policy at multiple levels, from local policies to national to global policies impacting health outcomes. Students examine the creation, implementation, and impact of health policy through a ?health in all policies? lens. Students address the challenge of meeting the needs of target populations with often different, and conflicting, viewpoints. prereq: 2561

PUBH 3561. Environmental Health and Ecological Justice. (SOCS,ENV; 3 cr.; A-F or Audit; Every Fall) This course examines environmental health issues and the complex challenges that occur within our communities that affect human health. Examination of environmental health at a micro level--investigating problems that occur within the Rochester community--to understand macro concepts. Includes community engagement with learning opportunities to assess current and past environmental conditions throughout the Rochester, MN area. Themes for this course include neighborhood-churning, food, water, air, and waste while investigating corresponding environmental justice issues that contribute to negative health outcomes. Incorporates a variety of hands-on engaged community learning in partnership with community stakeholders with in-class activities and field trip experiences. This "hands-on" learning in our community encourages critical reflection for students to reconcile personal ideals with new knowledge and skills. prereq: 2561

PUBH 3571. EcoliteracySCHOOL: Public Health Immersion Research Experience. (SOCS; 3 cr.; A-F only; Every Fall) Students take a leadership role in the development and implementation of a student led public health projects part of a team field experience. Students explore the environmental impacts on human health from a public health and ecoliteracy perspective. Students engage in active learning experiences working and mentoring with high school students. Public health project topics align with and support the 3-day immersive EcoliteracySCHOOL field experience. These topics include: Teambuilding Emergency Preparedness Director, Water & Hydration Specialist, Marketing & Creative Director, Mentorship Leader, Grant-writing Specialist, and Mindfulness Instructor, to name a few. Course activities promote collaborative work with peers and high-school mentees, project-based applied learning, pursuit of individual interests, use of the evidence-based public health process, and personal and academic leadership and development. Students prepare a project presentation for wider audiences. prereq: instructor permission and 2561

PUBH 3721. Special Topics in Public Health. (1-4 cr. [max 8 cr.;] A-F only; Periodic Fall & Spring)
In-depth study of special topics in public health.

PUBH 4561. Introduction to Epidemiology. (; 3 cr. ; A-F or Audit; Periodic Fall, Spring & Summer)
This course examines epidemiologic concepts to introduce students to the systematic methods of disease discovery, control and prevention. Students look at procedures of the distribution and determinants of health and diseases, morbidity, injuries, disability, and mortality in populations. Application of epidemiologic methods investigate the control of conditions such as infectious and chronic diseases, mental disorders, community and environment health hazards, and unintentional injuries. This course discusses the broader contexts of how epidemiological methods assist in identifying and solving public health issues. prereq: 2561, MATH 1161

PUBH 4571. Ecocitizenship: Public Health Immersion Research Experience. (; 3 cr. ; A-F only; Every Fall)
Students build on the PUBH 3571 experience to design a research study that investigates facets of the Ecocitizenship: Public Health Program, public health concepts and/or curriculum. Students work closely with public health faculty to develop and implement a research agenda that meets individual academic goals. Students are encouraged to present findings at selected conferences. Students build on their exploration of the environmental impacts on human health from a public health and ecocitizenship perspective through a research course. Students engage in active learning experiences working and mentoring with high school students throughout the duration of the course. prereq: instructor permission and 3571

Radiography (RADI)

RADI 3011. Foundations of Radiography. (TS; 2 cr. ; A-F only; Every Summer)
The course introduces students to the imaging and radiologic sciences. Students will explore the radiologic technologist's role within healthcare organizations. The radiologic technologist's ethical responsibility to their profession, institution, and the diverse patient population will be defined in this course. The course examines legal considerations regarding health information management and medical law as it pertains to radiologic technologists.

RADI 3101. Radiographic Procedures I. (; 2 cr. [max 4 cr.]; A-F only; Every Summer)
This procedural course defines radiographic positioning terminology as it relates to patient anatomy. The anatomy and positioning considerations of the respiratory and skeletal systems will be examined. Radiographic image analysis for routine examinations of the chest and skeletal system will be emphasized.

RADI 3102. Radiographic Procedures II. (; 7 cr. ; A-F only; Every Fall)
This procedural course will examine the anatomy and positioning considerations of the skeletal, gastrointestinal, and urinary systems. Radiographic image analysis for routine examinations of these systems will be emphasized. Modifications and adaptations on examinations for the trauma, geriatric and pediatric patient will be explored, along with specialized radiology imaging procedures. Procedural considerations for utilizing contrast in radiographic examinations will be identified. prereq: 3101

RADI 3111. Radiation Physics. (; 2 cr. ; A-F only; Every Fall)
Radiation physics presents the students with a history of people and events which lead to the discovery and use of ionizing radiation in medical imaging, with a review of introductory physics concepts and their application to x-radiation production. Electricity, magnification, transformers, and rectification will be discussed as components of x-ray circuitry and production of x-rays. The student will learn and understand each component of the x-ray tube, including its function and contribution to the production of x-radiation. Theoretical concepts and mathematical formulas needed to adjust exposure techniques in radiography practice will be presented. Students will solve algebraic equations to determine how to make adjustments to exposure factors when changes to mA, time, kVp, or distance are necessary; and explain how these changes affect the emission spectrum. prereq: Physics with lab component

RADI 3201. Introduction to Clinical Radiography. (2 cr. ; A-F only; Every Summer)
This course applies concepts learned in Radiographic Procedures I and Foundations of Radiography to the lab and clinical environments. Students will demonstrate patient care skills and proper positioning for designated radiographic examinations while manipulating x-ray equipment in a simulated environment. Students will also identify pertinent anatomy and evaluate radiographic images.

RADI 3202. Principles of Radiographic Exposure. (; 2 cr. ; A-F only; Every Spring)
In this course students will analyze the relationship of factors controlling and affecting radiographic image exposures. Variable effects on image quality factors will be explored. Through critical thinking, students will learn how to manipulate influencing factors of radiographic quality to produce optimal images. Factors that impact image acquisition, display, archiving, and retrieval will be examined. prereq: 3111

RADI 3301. Clinical Practicum I. (; 5 cr. ; A-F only; Every Fall)
The three main components of this course include: clinical, lab practicum, and professional development. In clinicals, students will assist and perform radiology exams under direct supervision. In an energized lab, students will simulate basic examinations learned in the Radiographic Procedures courses. Students will identify pertinent anatomy and evaluate routine radiographic images. prereq: 3101, 3011

RADI 3302. Clinical Practicum II. (; 9 cr. ; A-F only; Every Spring)
Students will experience the day-to-day operations of a radiology department and perform exams in a variety of clinical rotations. Students will simulate exams in the lab setting, continue to identify pertinent anatomy and critically assess radiographic images. The professional development of a radiologic technologist will also be explored. prereq: 3301, 3102

RADI 4103. Radiographic Procedures III. (2 cr. ; A-F only; Every Spring)
This course explores common diseases presented on radiographic images. The radiographic appearance of diseases and the impact on exposure factor selection will be analyzed. Through an in-depth look of the human body, students will also study the location and relationship of gross anatomical structures to one another. prereq: 3102

RADI 4202. Principles of Radiographic Exposure II. (1 cr. ; A-F only; Every Fall)
This course reviews quality management concepts, measurements, interpretation, connecting actions, and governmental regulations insuring safety are presented. The theoretical concepts and practical application of fluoroscopy, automatic exposure control (AEC) and duplication of radiographs are discussed. prereq: 3202

RADI 4234. Radiation Biology & Protection. (2 cr. ; A-F only; Every Fall)
This course explores the interaction of radiation and its effects on molecules, cells, tissues and the whole body. Factors affecting biological response to radiation will be presented. Students will learn radiation protection principles to ensure the safety of patients, personnel and the public during radiologic examinations, along with federal and state safety requirements. prereq: 3202

RADI 4302. Advanced Modalities. (1 cr. ; A-F only; Every Fall)
This course provides an introduction to additional imaging modalities including: MRI, CT, Cardiac, Interventional Imaging, and Breast Imaging. The history, theory and required equipment are presented, along with discussion of exams performed in each modality and anatomy visualized. prereq: 4101

RADI 4303. Clinical Practicum III. (; 7 cr. ; A-F only; Every Summer)
Students will progress through more diverse and complex rotations, and perform exams under increasingly indirect supervision. In an energized lab, students will simulate more difficult exams. Advanced level critique and evaluation of images will be emphasized. prereq: 3302, 4101

RADI 4403. Clinical Practicum IV. (7 cr. ; A-F only; Every Fall)
Students will assist with the operations of a radiology department and perform exams, transitioning to a competent member of the team. An emphasis will be placed on trauma radiography, adapting to situations, and critical thinking skills. prereq: 4303

RADI 4501. Certification Exam Review. (2 cr. ; A-F only; Every Fall)
In this comprehensive course, students will review topics in all sections outlined on the American Registry of Radiologic Technologists Radiography Examination Content Specifications.

**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. prereq: 3101

**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. Pulmonary 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, pathophysiological 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. prereq: 3201

**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 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. prereq: 3301

**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 for 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. prereq: 3401

**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, 3401

**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. prereq: 3302

**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. prereq: 3202

**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. prereq: 3202

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. prereq: 3202

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. prereq: 3302

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. prereq: 3102

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. prereq: 3302

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. prereq: 4401

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. prereq: 3592

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. prereq: 4501

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.

Sociology (SOC)

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

SOC 1571. Introduction to Sociology. (DSJ,SOCS; 3 cr.; A-F or Audit; Every Fall & Spring)
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.

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. The course teaches decision-making in the context of ethical dilemmas regarding inequality, stratification, research ethics, and biomedical ethics. The course teaches how to use reasoned arguments and evidence to support a position on an ethical issue.

SOC 3393. Directed Study or Research in Sociology. (1-6 cr. [max 24 cr.]; Student Option; Every Fall & Spring)
One course to consider is Reproductive Health, Rights, and Justice (SOC 4571). This course is designed to provide an in-depth study of special topics in sociology. It covers reproductive health, rights, and justice. The course is taught by Loretta Ross and the SisterSong Black Feminist Collective. The goal is to develop a critical understanding of local outcomes resulting from reproductive and sexual health inequities in the community. Students will learn to access reproductive health care through various means, including law, policy, and the criminal justice system. The course emphasizes the role of mass media, enforcement, drug treatment, and the intersectionality of drug use, race, and class. It also covers traditional and non-traditional ways of understanding drug use, patterns, and responses to drug use. The course is offered every spring and requires 1-4 credits, with a maximum of 8 credits. It is graded A-F only, and it is open to all students, including those who have taken previous courses.

Another course to consider is Criminology (SOC 3541). This course is focused on exploring the criminal justice system. It covers the effectiveness or ineffectiveness of our criminal justice system in dealing with crime and the criminal. The course examines the impact of technological developments on population dynamics and how these developments influence crime and corrections. It also explores the impact of societal, institutional, and technological changes on crime and the criminal justice system. The course is offered every fall and requires 3-4 credits. It is graded A-F only, and it is open to all students.

Additionally, SONO 3112: Abdomen II Sonography is a course that introduces students to the practical applications of sonography. It covers the use of duplex ultrasound imaging, Doppler concepts, and the use of computer-aided detection systems. The course is taught by Loretta Ross and the SisterSong Black Feminist Collective. It requires 2-3 credits and is graded A-F only. It is offered every spring. The course provides students with the skills necessary to perform duplex imaging of the abdominal arteries, lower extremity arteries and veins, and nonimaging testing of the peripheral vessels. Students will learn to perform carotid, femoral, and popliteal duplex exams and transcranial Doppler exams, and will be able to identify normal and abnormal anatomy and physiology of the cardiovascular system.
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 sonoanatomic 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 is 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 Summer)
The Fetal Anomalies course prepares students to define fetal pathologies and identify classic sonoanatomic 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 sonoanography 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 sonoanography 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 (SPAN)

SPAN 1393. Directed Study in Spanish. (1-3 cr. [max 6 cr.]; Student Option; Every Fall & Spring)
Individual study on selected topics or problems. prerequisite: instructor consent, department consent.

WRIT 1393. Directed Study in Writing. (1-3 cr. [max 6 cr.]; Student Option; Periodic Fall & Spring)
Individual study on selected topics or problems. prerequisite: instructor consent, department consent.

WRIT 1501. Writing & Research. (4 cr.; A-F only; Every Fall & Spring)
Students research issues in the health sciences through the approaches of critical inquiry, information literacy, and rhetorical awareness. Students analyze the context and credibility of sources and then select, evaluate, synthesize, and cite them in a research project that is accessible to a diversity of audiences. Written and oral feedback on student work is provided by instructors and peers to foster a supportive and collaborative learning community as students work through a recursive revision process. To strengthen metacognitive and communicative skills, students regularly reflect on their rhetorical choices.

WRIT 3393. Directed Study or Research in Writing. (3 cr. [max 24 cr.]; Student Option; Every Fall & Spring)
Individual study or research on selected topics or problems. prerequisite: instructor consent, department consent.

WRIT 3721. Special Topics in Writing. (1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring)
In-depth study of special topics in writing. prerequisite: instructor consent, repeated enrollment allowed only if topics are different.

Writing Studies (WRIT)

WRIT 1393. Directed Study in Writing. (1-3 cr. [max 6 cr.]; Student Option; Periodic Fall & Spring)
Individual study on selected topics or problems. prerequisite: instructor consent, department consent.

WRIT 1501. Writing & Research. (4 cr.; A-F only; Every Fall & Spring)
Students research issues in the health sciences through the approaches of critical inquiry, information literacy, and rhetorical awareness. Students analyze the context and credibility of sources and then select, evaluate, synthesize, and cite them in a research project that is accessible to a diversity of audiences. Written and oral feedback on student work is provided by instructors and peers to foster a supportive and collaborative learning community as students work through a recursive revision process. To strengthen metacognitive and communicative skills, students regularly reflect on their rhetorical choices.

WRIT 3393. Directed Study or Research in Writing. (3 cr. [max 24 cr.]; Student Option; Every Fall & Spring)
Individual study or research on selected topics or problems. prerequisite: instructor consent, department consent.

WRIT 3721. Special Topics in Writing. (1-4 cr. [max 8 cr.]; A-F or Audit; Periodic Fall & Spring)
In-depth study of special topics in writing. prerequisite: instructor consent, repeated enrollment allowed only if topics are different.