

# EPIDEMIOLOGY AND PUBLIC HEALTH (EPH)

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**EPH 600. Introduction to the Science & Practice of Public Health. 3 Credit Hours.**

This introductory course will provide students with the opportunity to explore and analyse contemporary public health issues and provide a history and a context that will allow students to better understand the field of public health, its core disciplines and their role as future public health professionals. Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP, CLIMUN.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 601. Medical Biostatistics I. 4 Credit Hours.**

This is an introductory level biostatistics course designed for public health, biomedical sciences, and healthcare professionals. The course covers topics such as explanatory data analysis, data description and presentation techniques, probability and probability distributions, sampling distributions, statistical inferences from small and large samples, analysis of categorical data, analysis of variance, and correlation. Upon completion of the course, students will achieve a basic understanding of the concepts and techniques of data description and statistical inferences. Students will also acquire a working knowledge of commonly used statistical software such as SAS. Students will be able to understand, interpret, and critique the statistical analyses performed in research articles published in the biomedical and public health journals.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP, CLIMUN.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 602. Biostatistics II. 3 Credit Hours.**

Continuation and elaboration of EPH601. Topics include design of factorial experiments, analysis of variance and variance components, multiple linear regression, and life tables.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 603. Medical Biostatistics. 3 Credit Hours.**

This course is a hands-on introduction to biomedical research with a focus on collecting and analyzing patient data. Topics covered include: data security, visualization and analysis. Statistical topics include: probability, frequentist and Bayesian thinking, and both parametric and non-parametric statistical methods. Methods covered include: regression, contingency tables, and survival analysis techniques.

Prerequisite: MD/MPH Four Year/Regional Med Camp.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 604. Clinical Trials. 3 Credit Hours.**

The Clinical Trials course is directed specifically at providing an overview of the broad area of clinical trials. Specifically, this course presents principles that underlie the design and conduct of clinical trials, statistical methods used in clinical trials, and ethical considerations in clinical trials and research. The course uses lectures, case studies, board discussions, written assignments, and applied exercises. The course is designed to focus on practical aspects of designing and conducting randomized clinical trials in a real-world public health settings.

Prerequisite: EPH 601.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Summer.

**EPH 607. Interdisciplinary Health Communication. 3 Credit Hours.**

Health communication is a critical tool for protecting and improving the health of people and their communities and is most effective when developed collaboratively using expertise from many disciplines. The focus of this course is the development of written, oral, and multimedia communication skills that will enable you to effectively communicate concepts and evidence-based scientific findings to diverse communities and professionals in health and other fields. Class time will largely be devoted to the development of these skills in the context of working effectively in interprofessional teams of approximately 5-6 students. Working collaboratively, students will develop teamwork skills and an awareness for the diversity of expertise that underpins effective interprofessional communication teams.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 608. Professional Development. 2 Credit Hours.**

This 2-credit seminar will be dedicated to providing students with opportunities to gain experiences with professional skills such as job interviewing, public speaking, preparing budgets, grant proposal writing, and working with community organizations. The course will be interactive, where I will talk about skills that are important in the public health workforce and students will then practice the skills in pairs or groups. There will be no exams or quizzes; rather, students will be graded on public speaking, performance in a mock job interview, ability to write a mock grant application, developing a grant proposal budget, preparation of a CV/resume, and disseminating research findings to community stakeholders. Class will meet every Tuesday from 1 to 3:30 in CRB 989. Students should come ready to participate and to give constructive feedback to their peers. Each topic will be covered across 2 (and sometimes 3) class sessions, so that everyone has sufficient time to practice their skills and receive feedback.

**Components:** LEC.

**Grading:** SUS.

**Typically Offered:** Offered by Announcement Only.

**EPH 611. Mindfulness in Public Health and Medicine. 3 Credit Hours.**

The stress of modern life can adversely impact physical and mental health functioning which may be ameliorated by the practice of mindfulness. Mindfulness is a mental state achieved by focusing one's awareness on the present moment, while calmly acknowledging and accepting one's feelings, thoughts, and bodily sensations. This practice is derived from Buddhist traditions more than 2,500 years old. In recent decades these practices have been adopted for use in United States and elsewhere and evidence is growing that these practices can reduce psychological symptomatology (e.g., symptoms of depression and anxiety), enhance resiliency in response to stressors, enhanced pain coping ability, and enhanced attentional regulation, among other benefits. The first half of this course will be devoted to the completion of an 8-week Mindfulness-Based Stress Reduction Course (MBSR) that will involve in-class activities and daily at-home mindfulness practice assignments. Students will maintain a journal documenting their "first-person" encounter with the practice of mindfulness. The second half of the course will be organized around a lecture format with weekly brief quizzes. Anonymous questionnaire data will be collected before, during and after completion of the MBSR course. These data will be used by student teams to evaluate the impact of MBSR on multiple outcomes. Groups will prepare a written report and present their findings to the class at the end of the semester.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 612. Global Health. 3 Credit Hours.**

This seminar examines current global public health issues, governance and decision-making challenges for the 21st Century across developing, transitioning, and developed countries. Topics of discussion include new actors for world health in the era of globalization; linking human development, poverty and health inequities; social, cultural and ethical considerations for health planning; role of industry, trade and public health; evidence based research for improved global health initiatives; foreign policy and health security challenges associated with emergence and re-emergence of infectious diseases and public and private partnerships in global health. Open only to EPH majors.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 613. Emerging Challenges in Global Health Systems. 2-3 Credit Hours.**

Health systems around the world must respond to an evolving landscape of health risk and disease burden that is increasingly dominated by complex, chronic illness. Contrary to what is often espoused, chronic and non-communicable diseases affect both poor and rich. Yet, access to health services is highly inequitable creating immense divides and equity imperatives that have largely been ignored in global health. This course examines how global and national health systems - particularly in low and middle-income countries – can better face the changing burden of disease with a focus on equity and universal coverage.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 614. Global Outbreak. 3 Credit Hours.**

This seminar examines current global public health issues and provides an overview of global outbreak investigations and disease surveillance. Participating in epidemiological/outbreak investigations in international settings provides unique opportunities to learn about health challenges in different ecologic, cultural and resource limited settings. This seminar will also allow students to gather insight into public health surveillance and understand the utility of the ongoing systematic collection, analysis and interpretation of data for use in planning and evaluation of public health intervention programs.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Summer.

**EPH 616. Global Health and Global Justice. 3 Credit Hours.**

Global health has emerged as a field distinct from older visions of international health, by focusing on macro-level problems caused by globalization whose origin and solution must transcend national boundaries. Yet global health has also challenged ethics to develop new accounts of justice in this changing world. This course will analyze global health from the lens of ethics. The course will introduce core theories of public health ethics (e.g. utilitarianism, statism and cosmopolitanism) to make sense of the rise of global justice as a distinct field of ethical inquiry. Armed with this conceptual foundation, we will then examine some of the central problems of global health, as well as proposed solutions to those problems. Such skills in argumentation will be increasingly critical for future public health leaders, yet too few public health students are exposed to ethical analysis. By applying ethical frameworks to analyze global health problems, students will gain critical skills in how to integrate distinct forms of knowledge, how to develop cogent normative arguments, and how to articulate and defend an account of fair decision-making and just policies in global health.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 617. Disease Prevention and Health Promotion. 3 Credit Hours.**

This course will introduce students to the science of prevention and health promotion. More specifically, through didactic presentations, group discussions, article readings and critiques, and a term project, this course will focus on providing students with an overview of: the top preventable causes of disease in the U.S., the etiology of disease (with a focus on the top preventable causes of disease in the U.S.) across the lifespan, the role of prevention theories in the development of preventive interventions, and the role of methodology in prevention science. The course will also provide an overview of efficacious/effective preventive interventions, including (but not limited to): family community, and school level interventions. Examples from the fields of obesity, drug use, smoking, and HIV will be used to illustrate the course learning objectives detailed below.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP, CLIMUN.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 618. Violence as a Public Health Issue. 3 Credit Hours.**

Violence is a leading cause of death, disability and health care use in the United States as well as worldwide. Although significant progress has been made in the last few decades, there remains a great need to further reduce the frequency of violence and its sequelae. The consequences of community-level, state-level, individual and interpersonal violence are also felt through medical and public health systems often irreparably altering the quality of life and well-being of individuals, families, and communities. In this course students will learn about various aspects of violence as a public health issue and its impact on healthcare systems, communities and individuals. Violence is a complex public health, medical and public policy problem and can only be understood and reduced through a multidisciplinary approach. The course will cover the epidemiology of violence; roots of violence including biological, psychological, and social causes (e.g., economic deprivation, religious factors); specific types of violence; media and the arts portrayal of violence; the business/economic impact of violence; physical and mental consequence; and ways to control and prevent violence in our communities, including criminal justice and public health approaches.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 620. Health Education and Behavior. 3 Credit Hours.**

Educational processes with special emphasis on the social and cultural determinants of health behavior, health education as a process of social change, and community based health education organizations. Open only to EPH majors.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 621. Fundamentals of Epidemiology. 3 Credit Hours.**

Principles and methods of epidemiology. Descriptive epidemiology, environmental and other risk factors, detection of outbreaks, basic demography, and etiologic studies.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP, CLIMUN.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 622. Obesity and Public Health. 3 Credit Hours.**

Nearly two thirds of the United States is now considered overweight or obese and the associated medical costs are placing an unsustainable burden on our health care system. However, the issue of overweight/obesity extends beyond behavioral choices and medical costs. This course will take a deeper look at the complex interactions between our environment, behaviors, and policies, and how they jointly contribute to the obesity epidemic. This course will provide an interdisciplinary perspective of the biological, psychosocial, ecological, and economic determinants that contribute to obesity and the resulting pathways to chronic disease and disability. Finally, current evidence-based public health programs currently will be discussed to stimulate critical thinking necessary to implement effective obesity prevention and control programs.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 623. Determinants of Health and Health Disparities Across the Life Course. 3 Credit Hours.**

This course builds on the concepts and methods examined in Introduction to Disease Prevention and Health Promotion and Health Education and Behavior by delving further into risk and protective processes related to health outcomes and inequities across the life course, from the prenatal period to older adulthood. Class readings and discussions will cover examples of common and unique risk pathways contributing to various diseases and disorders, including pathways hypothesized to be related to health inequities, such as: economic, social and educational disadvantage, stress, sedentary behavior, poor behavioral regulation, social isolation, among others. Common protective factors that promote health will also be reviewed, such as: positive parenting and family relations, healthy behaviors, physical activity, and social support. Students will address national and global issues, as well as the connections among ecosystem, human, and animal health. The course uses ecological and life course models to continue to build the foundation for subsequent courses in the Prevention Science Track.

Prerequisite: EPH 617 or EPH 620.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Summer.

**EPH 624. Applied Epidemiology: Theory and Practice. 3 Credit Hours.**

This course will demonstrate how to apply traditional epidemiological methods for determining disease etiology to real life problems in public health and health services research. It will introduce students to the field of applied epidemiology, the division of epidemiology that involves the detection, response, control, and prevention of public health issues in the population. It will focus on the practice of epidemiology in government agencies and community settings, providing a contrast to epidemiologic work conducted in research settings and academic institutions. Upon completion of this course, students will understand the role and methodologies of applied epidemiologists and learn skills that will prepare them for future work as public health practitioners.

Prerequisite: EPH 621.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Summer.

**EPH 625. Ethics in Public Health. 3 Credit Hours.**

This course will survey leading and contemporary ethical issues and challenges in public health and its sciences. It will include a foundation in the responsible conduct of research (RCR) to meet NIH standards for graduate students. Ethical issues to be addressed include those arising in epidemiology practice and research, surveillance, vaccines and quarantines, public health informatics, prevention and noncommunicable diseases, education and intervention, and hospital epidemiology. The course will be conducted as a seminar for engaged adult learners in which all students are expected to participate.

Prerequisite: EPH 600.

**Components:** LEC.

**Grading:** SUS.

**Typically Offered:** Spring.

**EPH 631. Public Health Administration. 3 Credit Hours.**

An overview of the historical background, philosophy, and purpose of public health. Relationship between government, law, and public health. Organization, management, and intergovernmental relationships of public health agencies in the United States at the federal, state, and local level. Basic principles of management, decision making, and prioritizing in public health are discussed. Overview of programs and services provided by public health organizations with emphasis on current public health issues and problems are also included. Open only to EPH majors.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 632. U.S. Health Systems. 3 Credit Hours.**

This course provides an introduction to the multiple systems that define, describe, and shape the delivery of health care in the United States. Using case studies and presentations of major issues, this course will give the learner an appreciation of the dilemma confronting policy makers, providers, and patients: how to balance cost, quality, and access.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 633. Policy & Management of the Health Effects of Climate. 3 Credit Hours.**

Using a health-centered approach, the course will provide critical review of the existing policies aimed at managing the health effects of climate/weather, identify potential gaps in the policies needed to improve and protect health effects of short- and long-term trends of climate and weather and extreme weather. Students will be exposed to real-world preparation and adaptation strategies to manage health effects of climate, and develop understanding of and skills in the cost-benefit analysis of evidence-based policies. As a part of the course, students will develop and evaluate (evidence-based) policies to manage a selected health outcome with respect to a selected (in)direct climate/weather related condition(s).

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 639. Ecology and Control of Vector-Borne Diseases. 3 Credit Hours.**

The course will provide students with an overview of the epidemiology of major vector-borne diseases in the U.S. (e.g., Lyme Disease, West Nile Virus) and globally (e.g., malaria, dengue, filariasis, leishmaniasis, and other arboviruses), field and lab-based methodologies for vector studies to incriminate vector species and assess transmission dynamics, vector and disease surveillance, and "cutting-edge" vector control technology. A major focus will be on the ecology of vectors in their local environments and how transmission dynamics are affected by changes in land use, urbanization, and climate. Students will learn about new WHO-approved strategies for integrated Vector Management (IVM) and how they are applicable for the prevention and control of all vector-borne diseases.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 640. Urban Environment and Public Health. 3 Credit Hours.**

Where we live, where we work, where we go, and how we get there may all impact our behaviors and ultimately our health and well-being. This course examines the urban environment - in particular, those aspects of urban/suburban/semi-rural environments created by humans. This includes how homes, neighborhoods, cities and regions impact public health challenges such as obesity, chronic disease, mental health, infectious disease, and injuries. This course will teach students to translate scientific findings to design healthy communities, and develop interventions to promote urban health. Students will learn how to map neighborhood characteristics such as food outlets, parks and walkability, and to develop recommendations for policymakers.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 641. Environmental Health. 3 Credit Hours.**

Interdisciplinary scope of environmental health problems. Development of a practical, dynamic model for integrating fundamental concepts from a variety of environmental disciplines. Open only to EPH majors.

Requisite: Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP, CLIMUN.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 643. Introduction to Occupational Health. 3 Credit Hours.**

This course offers a general introduction to major concepts and issues in occupational health and safety from local to global, addressing fundamental topics and current controversies. The course covers core topics that prepare students to more fully understand and address occupational health issues: toxicology, exposure assessment, occupational epidemiology, risk assessment/risk management, prevention of workplace injury and disease, health promotion of adults and protection of worker populations from environmental hazards.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 644. Fundamentals of Program Evaluation. 3 Credit Hours.**

Fundamentals of Program Evaluation was developed as a survey course directed specifically at providing an overview of the broad area of program evaluation. At its base, program evaluation is the investigator of a program's characteristics and merits. In context of health care, the purpose of program evaluation is to provide information in the effectiveness of programs or interventions so as to optimize the outcomes, efficiency and quality of health care. Evaluation of a program is an essential part of the successful implementation and conduct of any health care project or intervention, and should ideally be designed along with the project itself. Program evaluation activities can use a wide range of methodologies (e.g., qualitative, quantitative), analyze different aspects of a program (e.g., structure, activities, organization), and have a large number of intended outcomes (e.g., achievement or program's goals objectives, extent of program impact, program cost).

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 646. Climate and Health. 3 Credit Hours.**

There is an intricate relationship between climate and health. Climate changes directly affect health and well-being but also mediate the effects of socio-physical and biochemical changes in the environment on health and well-being. This course will help students unravel this intricate relationship between climate and health. A range of topics will be covered including: a) the etiology of disease with respect to climate change, b) shifting burden of disease and disability with respect to changing climate and climate-mediated changes in the environment, and c) application areas of climate-health linkages: unintentional injuries and climate change, vector-borne disease and climate change, heat-related mortality, disease of metabolic syndrome and climate change, cardiopulmonary, allergy and immunology disease due to bioaerosols and air pollution.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 647. Community Based Participatory Research and Social Network Analysis. 3 Credit Hours.**

Community-based participatory research (CBPR) is a collaborative approach to research in which the research process is driven by an equitable partnership that is formed between community members, organizational representatives, and academic researchers. This course is designed to provide students with a robust and comprehensive theoretical and practical foundation in CBPR including principles of CBPR practice, methodological CBPR considerations in building community partnerships, community participatory assessment, research planning, data gathering, and data sharing. Students will also learn how to incorporate social network analysis in every phase of CBPR. Social networks can be used to reveal and understand the social dynamics between nodes (e.g., individuals or organizations) in a community. Social network structures and dynamics can be used to understand the driving force behind risky behaviors. Social network analysis can also enhance CBPR projects by revealing the interaction between network components, structures and roles (e.g., influencers who are nodes with high centrality).

Prerequisite: EPH 621 and EPH 617 or EPH 620. And Requisite: Must be in a Plan of BSTS or EPID or PREV or MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 648. Climate, Cool Cities, Healthy Communities. 3 Credit Hours.**

In the current era of climate change and rapid urbanization, an understanding of the impacts of urban design, planning and policies on climate and human health in urban and suburban areas is critical. Drawing on diverse disciplinary perspectives, including public health, architecture, planning, and public policy and government and non-profit sectors, the course provides students with the ability to comprehend, synthesize, communicate, and apply evidence-based urban design principles in relation to current and future challenges of climate and health. Additionally, in accordance with the adage, "Think globally, act locally," students will have the opportunity to interact with local experts who will share their knowledge of national and international policies and programs in the area of urban design, climate and health – while applying their learning to measure current challenges and inform policies of climate and health in the urban/suburban localities of the South Florida region.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 650. Health Economics for Evaluation and Policy. 3 Credit Hours.**

This course centers on a discussion of the criteria used to evaluate the allocation of resources and analyze the behavior of two of the principal actors—consumers and firms. The principles of microeconomics are presented in the context of health care systems and markets. Numerous real-world issues and case studies are used to demonstrate economic decision-making techniques, especially for health care organizations and consumers.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 651. Research Methods. 3 Credit Hours.**

Purpose of the course is to provide students with a sound understanding of the fundamental concepts and methods for conducting public health research. After a brief introduction to the philosophy of science, the major emphasis in the early portion of the course is on research conceptualization, design and measurement, with a particular focus on the logic of minimizing rival alternative explanations of finding for experimental and quasi-experimental studies.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 652. Health Policy. 3 Credit Hours.**

Part I will examine seven models encompassing different perspectives on public health: philosophy, political theory and politics, law, economic, science and information culture and religion, and organization and management, including how they relate and their relevance in formulating, implementing, and evaluating public policy. Part II will examine the policy making process including how issues reach the government agenda, how laws are formulated, and how the process affects substance. Part III describes the core elements of policy analysis including: problem definition; background; political, economic, and social landscape; development of policy options; and recommendation. It will also include discussions of how to find and analyze documents and data as well as discuss the financing of health care.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Summer.

**EPH 653. Leading Change in Population Health—Moving From Talk to Action. 3 Credit Hours.**

Addressing the public health challenges of the 21st century will require public health leaders to be facile in leading change efforts (on the individual, organizational and system levels) and multi-stakeholder collaborations for measurable results. This transition course at the end of the MD/MPH second year will prepare MD/MPH students for their more advanced experiences in community and public health in the third and fourth years. The objective of this course is to provide students with an opportunity to develop essential skills in leading change in public health while linking their academic work in epidemiology and public health for real world application in public health practice. Students will receive didactic presentations on topics such as leading change, mobilizing multi-stakeholder leaders for aligned action, interest-based negotiation, leading from the middle, leveraging conflict to advance adaptive challenges, communicating /framing your message(s), systems change, as well as lectures on health disparities and the social determinants of health. These lectures will be integrated with interactive discussions and hands-on small group exercises to explore how practitioners can translate public health and community knowledge into sustainable solutions. Leading Change in Population Health— Moving From Talk to Action will provide students with 21st-century leadership skills that prepare them to tackle public health issues in our society from the most simple to very complex. Participants will be challenged to think differently on many levels (systems thinking, interplay between relationships and results, etc.) and prepare them to be agents of change for future generations.

Requisite: Academic Plan: BSTS, EPID, EPID1, PREV, MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 655. Health Economics and Financing. 3 Credit Hours.**

Health economics studies economic principles, methods of decision making, and the allocation of resources within health care systems and markets. This course will provide students with an understanding of the flow of funds and services throughout the U.S. health care system and how the structure and financing of health care impacts population health status. We will use numerous real-world issues and case studies to demonstrate economic decision-making techniques, especially for health care organizations and consumers (patients, providers). Students are not expected to have familiarity with economic concepts and principles prior to taking this course. In addition, students are not expected to use calculus in this course. However, students are expected to have an understanding of basic algebra, and graphical analysis will be used often throughout the class.

Prerequisite: MD/MPH Four Year/Regional Med Camp.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 656. Qualitative Research Methods. 3 Credit Hours.**

The purpose of this course is to introduce students to the philosophical underpinnings of qualitative research and its practical application to the field of public health. Students will 1) develop an understanding of the significance and use of qualitative research methods in public health; 2) differentiate between numerous qualitative research approaches, including phenomenology, grounded theory, and ethnography; 3) describe different methods for collecting qualitative data, including interviews and focus groups; 4) develop skills in the collection, analysis and reporting of qualitative data; and 5) develop a basic understanding of how qualitative and quantitative research may be combined in mixed methodological approaches. The course will include a combination of lectures, presentations of applied qualitative research studies by guest experts, student presentations, and assignments designed to foster students' skills in formulating appropriate qualitative research questions, designing qualitative studies, collecting and analyzing qualitative data, and summarizing findings for publication. More specific details on the topics to be covered in this course are provided below.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 657. Toxicology: Climate and Health. 3 Credit Hours.**

The course will train students in developing an understanding of and skills in assessing the mechanism of the effects of climate, weather and climate and weather mediated effects of environment on biophysiological responses. For example, changes in levels of bronchoconstriction due to change in temperature is a direct effect of weather, and increase in allergies and asthma due to increase in bioaerosols in response to increase in precipitation and temperature is an indirect effect. Students will be exposed to general principles of toxicology and toxicological experimental design, including in-vitro and in-vivo experiments, designs needed to understand and investigate the health effects of climate, weather and climate mediated environmental conditions. The course objectives are to (1) understand general principles of toxicology, (2) understand biophysiological responses to climate, weather and weather anomalies, (3) develop an understanding of and skills in in-vitro and in-vivo experimental designs to assess toxicity of climate, and (4) characterize and quantify biophysiological responses in response to the trends and anomalies of weather and climate.

Prerequisite: BIL 150 or BMB 401 or CHM 111 or CHM 112 or CHM 201 or CHM 202.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 659. Public Health Seminar I. 1 Credit Hour.**

The EPH 659-02 Public Health Seminar Series is designed to explore contemporary issues, problems, and controversies in public health through an interdisciplinary perspective. This course is designed to help you develop and sharpen the skills which are the primary building blocks of a successful career in consulting (as well as many other areas of business), namely (1) analysis, (2) presentation, and (3) teamwork. This class will help you to develop rigorous skills in each of these areas through (i) discussion of the principles underlying best practices and (ii) application and feedback in a series of exercises and cases.

Prerequisite: MD/MPH Four Year/Regional Med Camp.

**Components:** SEM.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 660. Public Health Seminar II. 2 Credit Hours.**

The Public Health Seminar is designed to explore contemporary issues, problems, and controversies in public health through an interdisciplinary perspective. Upon the completion of the course students will be able to: 1) understand key public health problems, their distribution, and prevention strategies, 2) examine the complex tapestry of social, economic, political, and environmental factors that affect public health outcomes, 3) understand the complexities inherent in improving health locally and on a global scale, 4) examine the major determinants of, and responses to, poverty and health, 5) analyze public health disparities through a social justice perspective, 6) understand and analyze the roles and agendas of major stakeholders in local, state, national, and global public health, 7) understand the link between global and local health issues, 8) discuss selected interdisciplinary, cross-cutting issues in public health, 9) explain the interrelationships among the five core areas of public health. This course is only open to MD/MPH students.

Requisite: MD/MPH Four Year/Regional Med Camp and EPH 659.

**Components:** SEM.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 661. Public Health Nutrition. 3 Credit Hours.**

This course provides a dynamic, interactive approach to public health designed to prepare students in basic policy, epidemiology, and health education related to nutrition. Recognizing the multiple social, cultural, environmental, and physiological factors leading to nutritional disease. The course includes experts from a variety of disciplines. Public health nutrition addresses issues germane to the public's health by elucidating their extent, determinants and consequences, and the policies and programs to address them. Open only to EPH majors.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 662. Child Policy. 3 Credit Hours.**

This course will focus on U.S. federal child policy. This course has been designed to provide a comprehensive, multi-disciplinary (e.g., public health, public policy and social work), and cross-sector perspective (e.g., government, private and philanthropic sectors) on child and family policies. Sessions will cover varying approaches and include presentations from a wide range of experts.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 663. Hospital Health Care Services and Access: An Interdisciplinary Inquiry. 3 Credit Hours.**

Hospitals play a vital role in the health of the communities they serve. Yet, their accessibility and availability to those communities is often unequal, and significant racial and ethnic disparities exist in the utilization of hospital services, quality of care provided, health outcomes and patient experiences. Attention has been increasingly focused on creating sustainable solutions to attenuating these disparities. Initial steps include the examination of community and hospital data to identify inequalities in disease distribution, as well as utilization of care. Such data provides evidence to define critical areas of concern and provides a starting point for engagement with the community. The real work begins when hospitals work with community partners to engage in authentic and collaborative partnerships to address the needs and the health of the local citizens. This process, known as Community-Based Participatory Research (CBPR), can harness resources and build capacity to address health issues relevant to the community. This course will discuss the change that hospitals can achieve when they facilitate community-academic partnerships that bring together knowledge, expertise and interest of community partners with the research and training of clinicians and academic researchers.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 671. Maternal and Child Health. 3 Credit Hours.**

Preventative and therapeutic concepts pertinent to the reduction of morbidity and mortality among mothers and their children.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.



**EPH 678. CAPSTONE PRACTICUM EXPERIENCE AND PROJECT PREPARATION. 1 Credit Hour.**

This course is available only for MD/MPH students. This is the first of two courses required to complete the MPH capstone project. Students will spend the summer between their first and second year of medical school identifying a community health issue of interest and developing a proposal using evidence-based methodology to address the issue. They will obtain practical field experience in a public health setting related to their capstone project area of interest. They will also identify relevant stakeholders who would benefit from the capstone project and can serve as mentors in completion of the project.

Requisite: Plan Code MDRP\_MD.

**Components:** PRA.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 679. Learning Collaboratory. 3 Credit Hours.**

This course is the first semester of a 4-semester program titled the "Public Health Learning Collaboratory". The mission of this Department of Public Health Sciences (DPHS) program is to transform the learning experience of master of public health students by providing opportunities to develop core skills necessary for effective public health practice, while completing their capstone or thesis in the community. Organized in small groups around 4 thematic areas, students learn about substantive areas (e.g., prevention with children and families, access to health care, urban health, health in Latin America), while building competencies to successfully develop and implement projects in collaboration with community health organizations (e.g., community engagement, needs and capacity assessments, researching evidence based practices, teamwork and problem-solving skills, project planning, development and implementation skills).

**Components:** LEC.

**Grading:** SUS.

**Typically Offered:** Fall.

**EPH 680. Practical Field Experience. 3 Credit Hours.**

Practical field experience requirement for MPH students. Students are placed in health-related settings (local, national, and international) to work on projects of mutual interest to both the field organization and the student.

**Components:** FLD.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 681. Capstone Experience Project. 3 Credit Hours.**

The capstone project is intended to build upon EPH 680 field work and will provide students with an opportunity to apply public health academic theory and acquired skills to community health problems.

**Components:** LEC.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 682. Generalist Capstone Project. 2 Credit Hours.**

The Capstone Experience Project Special is intended to build upon EPH 680 field-work (or equivalent course) and will provide students with an opportunity to apply public health academic theory and acquired skills to community health problems. As part of the project, the student will generate a 10-15 page written report using evidence-based practice (EBP) that clearly addresses a public health problem. Capstone Projects may be:

- Continued collaborations with the same community partner as the field experience addressing public health needs identified at the site; or
- Collaborations with a different community partner but with similar population or public health topic from the field experience; or
- Collaborations with a different community partner and with different population and/or public health topic from the field experience.

**Components:** FLD.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 684. Special Topics. 1-3 Credit Hours.**

This course is designed to allow the listing of special topics within the Department of Epidemiology and Public Health and cross-list topics with other departments' offerings.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 698. Masters Thesis Proposal. 3 Credit Hours.**

This is an independent study course required for the Public Health Sciences Master's degrees. Students in the DPHS Master's programs must follow the DPHS Master of Science Thesis Handbook instructions to complete this course. Registration for this course requires approval from the student's faculty advisor and completion of a departmental online form. The purpose of this course is to form a Thesis Committee per Graduate School guidelines and DPHS Thesis Handbook, develop the proposal for the culminating Master's Thesis (EPH 699) and obtain proposal approval from the thesis committee members. This course is required for the master's degree noted below and must be completed prior to start of data collection and analysis for the thesis. a. Master of Science in Public Health (MSPH) b. Master of Science in Prevention Science and Community Health (MS PSCH) c. Master of Science in Climate and Health (MS CH)

**Components:** THE.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 699. Masters Thesis. 3 Credit Hours.**

This is an independent study course required for the Public Health Sciences Master's degrees. Students in the Master's programs must follow the DPHS Master of Science Thesis Handbook instructions to complete this course. Registration for this course requires approval from the student's faculty advisor. The purpose of this course is to complete the culminating Master's Thesis per guidelines requirements and timeline of the UM Graduate School Electronic Thesis and Dissertation (ETD). The thesis includes data collection, analysis, thesis writing and oral presentation. All requirements and deadlines are listed in the DPHS Thesis Handbook and in the Graduate School ETD website. This course is required for students enrolled in one of the following Master's program: a. Master of Science in Public Health (MSPH) b. Master of Science in Prevention Science and Community Health (MS PSCH) c. Master of Science in Climate and Health (MS CH)

**Components:** LEC.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 700. Professional Development Seminar. 1 Credit Hour.**

This course covers fundamental topic areas in professional development for PhD students in the public health sciences. Topic areas include: presenting research at conferences, writing manuscripts for publication, preparing the dissertation, the PhD comprehensive exams, effective teaching and mentoring, and getting a job in academia. Through interactive workshops, in-class exercises, brief presentations and assignments, students will have an opportunity to practice and strengthen necessary skills, including effective communication (oral and written), conflict resolution, and developing collaborations.

Requisite: Academic Program Plan:BSTS, EPID, PREV.

**Components:** LEC.

**Grading:** SUS.

**Typically Offered:** Fall & Spring.

**EPH 701. Innovations in Prevention Science Methodology. 1 Credit Hour.**

This course is a part of series "Innovations in Prevention Science Methodology" which covers specialized topics in prevention science that have been identified as moving the field forward.

Prerequisite: PSY 633 with a B or Higher. and Requisite: Plan BSTS or EPID or EPID1 or PREV or MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EPH 703. Advanced Statistical Methods I. 4 Credit Hours.**

This is the first course in a two-semester sequence in statistical modeling techniques. The course will provide students with an in-depth and focused study of advanced statistical models for continuous outcomes for cross-sectional studies and will provide brief introduction for longitudinal studies with continuous outcomes. It is designed to cover many aspects of general linear/non-linear models and their applications to public health, epidemiology, bio-behavioral research, medicine, and biomedical sciences. The types of research designs for which of these models are most appropriate will be discussed along with estimation and interpretation of model parameters. Through examples, analytic issues that arise in the analysis of real data, including assessing for violations of model assumptions will be discussed. In addition to theory, students will also acquire a working knowledge of commonly used statistical software such as SAS (if time permits introduction to R). Students will be able to understand, to interpret, and to critique the statistical analyses performed in research articles published in the biomedical and public health journals on related modeling techniques covered in the class. The students will be able to reproduce statistical analysis independently and to develop novel analyses and to able to write about the results.

Prerequisite: EPH 601 and Must be in either Program Plan, BSTS, EPID, EPID1, PREV, MDRP.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 705. Advanced Statistical Methods II. 3 Credit Hours.**

Continuation and elaboration of EPH 703. Advanced statistical methods used in analyzing data from epidemiologic investigations. Topics include Kappa statistics, life tables, survival analyses, logistic regression, Poisson regression, log linear models, clusters, meta-analysis, and other special topics.

Prerequisite: EPH 703.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 711. Cancer Epidemiology. 3 Credit Hours.**

This course covers the basic epidemiology of cancer. Major sites and exposures are stressed, highlighting descriptive, etiologic and preventive aspects. A major course project and one final exam are included.

**Components:** LEC.

**Grading:** GRD.

**EPH 717. Integrating Behavior Health Theories and Models. 3 Credit Hours.**

This course is designed to provide an opportunity for synthesis and integration of knowledge regarding the phenomenon of health behavior. The focus is on critical examination of theoretical and empirical work in the area of health behavior from a public health perspective.

Prerequisite: EPH 617 or EPH 620.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 720. Cardiovascular Disease Epidemiology and Prevention. 3 Credit Hours.**

Course aims to teach and train MPH students in the epidemiology and prevention of cardiovascular and cerebrovascular diseases which are the leading causes of morbidity and mortality among the adult U.S. population. Essential knowledge for those working in the area of public health is emphasized.

**Components:** LEC.

**Grading:** GRD.

**EPH 721. Chronic Disease Epidemiology. 3 Credit Hours.**

This course will provide an overview of key concepts in epidemiology of chronic disease both elaborating on previous knowledge and introducing epidemiologic concepts to the understanding of chronic disease. The students will gain knowledge on the most common chronic diseases such as heart disease, cancer, COPD and Asthma, AIDS and stroke. The goal of this course is to introduce students to epidemiology of these common diseases, acquire knowledge on their risk factors and causality, understand their prevention and control, and provide familiarity with epidemiological methods used in Chronic Disease Epidemiology in partial fulfillment of their MS, MPH, MSPH or PhD degrees.

Prerequisite: EPH 621 And EPH 601.

**Components:** LEC.

**Grading:** GRD.

**EPH 722. Infectious Diseases Epidemiology and Control. 3 Credit Hours.**

This course emphasizes surveillance, investigation, and control of infectious diseases that constitute important national and global health problems. Each class will use one or more specific infectious diseases to illustrate core principles of infectious diseases epidemiology. A major organizing principle of the course will be how to determine whether a disease should be controlled, eliminated, or eradicated, and how those determinations can change over time.

Prerequisite: EPH 621.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 723. Epidemiology and Public Health Aspects of Diabetes Mellitus. 3 Credit Hours.**

This course presents an overview of the epidemiology and public health impact of an important chronic disease, diabetes mellitus (DM). Topics include the classification and descriptive epidemiology of DM and associated health complications, disease screening, evaluation of risk factors, methodological issues associated with DM research, DM among special populations, and the public health impact of DM in the U.S.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EPH 724. Molecular and Genetic Epidemiology. 3 Credit Hours.**

This course covers the theoretical concepts and practical issues involved in conducting molecular and genetic epidemiology research involving human populations. Specifically, students will learn about: molecular and genetic technology; evaluating disease-associated genes, and their interaction with environmental factors; clinical research; and data mining techniques. Ultimately, students will develop a framework for study design, statistical power and sample consideration, assay evaluation and validation, and data interpretation using molecular and genetic epidemiology tools in their research.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 727. Climate, Environment, and Health: Data Integration and Management. 3 Credit Hours.**

The course will introduce: a) different research designs needed to understand the linkages between climate/weather and health, and b) sources and types of data needed for different research designs. The course will train students in: a) the integration and management of weather/climate, environment and health data sets that have different spatiotemporal scales, b) assessment of errors and uncertainty in the collocation of these data sets, and c) visualization, interpretation and presentation of these data sets, including covariance structure in these data sets.

Prerequisite: EPH 601.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 728. Social Epidemiology. 3 Credit Hours.**

This course provides an overview and understanding of key concepts and theoretical frameworks relevant to the study of social determinants of population health and health disparities. The interdisciplinary course will cover methodological considerations and methods relevant to the field of social epidemiology, such as lifecourse epidemiology and multilevel determinants of health. A major emphasis will be on biological pathways by which social factors “get under the skin”, and the role of social policies in improving population health. The course will involve lectures, presentation of epidemiologic research by faculty researchers, class discussions, and class projects.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 729. Analysis of the Health Effects of Climate. 3 Credit Hours.**

The course will train students in analytical skills needed to quantify the health risks associated with climate, weather and weather anomalies (or extreme weather) adjusting for confounding factors and time-space hierarchical structures. The course will include quantification of time-space lagged exposure estimation, spatial, temporal and spatiotemporal analyses, exposure and risk uncertainty analyses.

Prerequisite: EPH 727.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 731. Developing, Adapting and Evaluating Interventions. 3 Credit Hours.**

This course builds on the substantive and methodological competencies acquired in preceding prevention science courses by preparing students to develop and adapt preventive interventions.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 732. Introduction to Dissemination and Implementation Science. 3 Credit Hours.**

This course provides an introduction to the theory and practice of Dissemination and Implementation (D&I) Sciences. Topics include the importance and language of D&I science; designs, methods and measures; differences and similarities across clinical, public health, and policy settings; selected tools for D&I research and practice; and future issues. The focus of this course will be on implementing prevention programs, strategies and policies that are ready for application, testing and scale up, rather than developing interventions from scratch.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 740. Basic Pathology and Patho-physiology. 3 Credit Hours.**

The course emphasizes basic patho-physiological mechanisms and diseases of particular interest to students of public health. Students obtain an understanding of basic pathological processes, nomenclature of pathological findings, and common natural and unnatural diseases affecting various body systems. Observations of autopsies and the gross pathology of selected organs are also incorporated in the course.

**Components:** LEC.

**Grading:** GRD.

**EPH 751. Survival Analysis in Clinical Trials. 3 Credit Hours.**

This course covers statistical methods for analysis and interpretation of survival data arising from clinical trials. However, the statistical methods for survival analysis included in the course can be used in applications dealing with the analysis of time-to-event data in other research fields (e.g., in epidemiology, public health, medicine, and sociology). Topics to be covered include: survival function and other related functions; estimation of the survival function by the Kaplan-Meier and life-table nonparametric methods, and by commonly applied parametric models (such as, under exponential and Weibull distributions); comparison of survival curves by the log-rank test; Cox proportional hazards model (interpretation of parameters, derivation and interpretation of the hazard ratio, model selection, test of interactions, assessment of model fit and diagnostics for the proportional hazards assumption); estimation of sample size for survival studies; and introduction to competing risk analysis.

Prerequisite: EPH 602 or equivalent course work, or permission of instructor.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 752. Advanced Research Methods. 3 Credit Hours.**

This is a survey course in advanced quantitative methods for research and evaluation in prevention science. The course will provide students with an introduction to research methodology, matching research questions to specific methods, applying methods to real world data, and presenting the application of a method to a broader audience.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 772. Design & Implementation of Epidemiologic Studies. 3 Credit Hours.**

This is the second epidemiology course after completion of the Fundamentals of Epidemiology. This course will assume knowledge of basic study designs and the basic principles of internal validity (random error, systematic error, and confounding). The concepts, principles, and methods of epidemiologic study designs (beyond basic designs) and the practical issues in the design and conduct of epidemiologic studies will be discussed. The emphasis will also include the application of the epidemiologic methods in the forms of journal article critique of epidemiologic study designs, study design project and/or research proposal development. The course has two intended audiences. PhD students or early career researchers and advanced master's students who wish to add depth to their understanding of some of the fundamental issues in epidemiology. Doctoral students in epidemiology may take this course to fulfill one of the "research method courses" for the PhD in Epidemiology degree. Students who are not in the PhD in Epidemiology program and who wish to take this course require instructor's evaluations (pre-test) and permission.

Prerequisite: EPH 621 and must have already taken or be currently enrolled in EPH 601.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 774. Epidemiologic Methods and Reasoning. 3 Credit Hours.**

This course will discuss epidemiological methods (e.g., study designs) and concepts (e.g., confounding, bias, interaction, random error) required to evaluate the totality of evidence in etiologic research. It will also discuss theoretical models of etiologic research and techniques for quantifying the magnitude of disease or other health indicators as well as the magnitude of study errors specific to study designs.

Prerequisite: EPH 601 and 621. And pre or corequisite: EPH 602.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EPH 776. Methods in Epidemiology. 3 Credit Hours.**

This course will discuss principles of epidemiologic methods. Introduction to causal inference and advanced epidemiologic topics will be covered. This course will be theoretical and quantitative and will include, when applicable, illustrative data examples using various statistical softwares.

Prerequisite: EPH 601 and 621. And pre or corequisite: EPH 602.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EPH 782. Advanced Individual Study. 1-3 Credit Hours.**

Individual work on a special project under faculty guidance.

**Components:** THI.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 825. Continuous Registration--Master's Study. 1 Credit Hour.**

To establish residence for MPH students who are preparing for project presentation. Credit not granted. Regarded as full time residence.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 830. Doctoral Dissertation. 1-12 Credit Hours.**

Required of all candidates for the PhD. The student will enroll for credit as determined by his/her advisor.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 840. Doctoral Dissertation- Post Candidacy. 1-12 Credit Hours.**

Required of all candidates for the PhD. The student will enroll for credit as determined by his/her advisor.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EPH 850. Research in Residence. 1 Credit Hour.**

Used to establish research in residence for the PhD, after the student has been enrolled for the permissible cumulative total in appropriate doctoral research.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.